

The Armagh Observatory and Planetarium

Northern Ireland · Charity number 103948

Details

Status	Received
Registered	2016-04-01
Register	View on the Charity Commission for Northern Ireland register

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Activities

Purposes: The Governors shall, for the purpose of developing and improving the knowledge, appreciation and practice of astronomy and related sciences, maintain and manage the Armagh Observatory and Planetarium and may take such other action as the Governors may think proper for the purpose of acquiring or disseminating knowledge relating to astronomy and related sciences

What the charity does: The advancement of education, The advancement of the arts, culture, heritage or science

How the charity works: Arts, Cultural, Education/training, General charitable purposes, Heritage/historical, Research/evaluation

Who the charity helps: Children (5-13 year olds), General public, Language community, Sensory disabilities, Volunteers

Finances

Period end	Income	Expenditure	Assets	Employees
2025-03-31	£3,546,337	£3,914,671	£392,075	35

Trustees

Name	Role	Appointed
Archbishop Eamon Martin		
Archbishop John McDowell		
Dr Eucharua Meehan Mria		
Mr Eugene Rooney		
Mr Greg Cox		
Mr John Briggs		
Mr Paul Kennedy		
Mr Roger Wilson Obe		
Mr Ronan O'hara		
Ms Grainne Mcveigh		
Ms Samantha Leslie		
Ms Shaaron Leverment		
Professor Garret Cotter		
Professor Margaret Topping		
Professor Matt Darnley		
Professor Michail Mathioudakis		
Rev Canon Colin Darling		
Revd Canon Andrew Totten		
Revd Canon David Hilliard B.Th.		
Revd Canon Gary McMurray		
Revd Canon William Adair Bem		
The Venerable Dr P Thompson		
The Venerable Elizabeth Cairns		
The Very Revd Shane Forster		

Accounts

Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2025

Laid before the Northern Ireland Assembly

*under clause 8 of The Armagh Observatory and Planetarium (Northern Ireland) Order 1995,
as amended by Schedule 1, clause 6 of the Audit and Accountability (Northern Ireland)*

Order 2003, by the Department for Communities

on

XX XXX XXXX

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Any enquiries regarding this publication should be sent to
info@armagh.ac.uk or telephone 028 3752 3689.

Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2025

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The Trustees' Annual Report for the year ended 31 March 2025

The Board of Governors and Management Committee, who are the Trustees for Armagh Observatory and Planetarium (AOP) have pleasure in presenting the annual report and financial statements for this charity for the year ended 31 March 2025. These financial statements have been prepared in accordance with the accounting policies set out in note 1 to the accounts, with the guidance issued by the Department of Finance on the form and contents of the Annual Reports and Accounts of Executive Non-Departmental Public Bodies, *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* and Accounting and Reporting by Charities: Statement of Recommended Practice (SORP) applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102). The Remuneration and Staff report is prepared in accordance with the direction set out in The Government Financial Reporting Manual (FRM) 2024-25.

The sponsor Department for Armagh Observatory and Planetarium is the Department for Communities (DfC) (the Department).

Objectives and Activities

The organisation's statutory functions are set out at Article 4 of *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* (the Order). The Order requires that '*the Governors shall, for the purpose of developing and improving the knowledge, appreciation and practice of astronomy and related sciences, maintain and manage the Armagh Observatory and Planetarium and may take such other action as the Governors may think proper for the purpose of acquiring or disseminating knowledge relating to astronomy and related sciences*'.

In accordance with Paragraph 8(1) of Schedule 1 of the Order, the Armagh Observatory and Planetarium (AOP) Board of Governors has delegated the primary responsibility for the governance and management of AOP to a Management Committee with the statutory purpose of 'developing and improving the knowledge, appreciation and practice of astronomy and related sciences'.

AOP's Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department for Communities (the sponsor Department) and approved by the Minister and for promoting the efficient, economic and effective use of resources.

As the primary responsibility for the governance and management of AOP has been delegated to a Management Committee, the Governors considered that the role of Charity Trustees would more appropriately align with their remit. The Board of Governors agreed in principle to this. The Charity Commission of Northern Ireland recommended that the Members of the Management Committee be appointed as Trustees for the Charity alongside the Members of the Board of Governors. Accordingly, both the Members of the Board of Governors and the Members of the Management Committee are Charity Trustees.

Armagh Observatory is the oldest scientific institution in Northern Ireland, and the longest continuously operating astronomical research institute in the UK and Ireland. Armagh Planetarium is also the oldest operating planetarium in the UK and Ireland.

A Strategic Plan for 2021-26 was launched in September 2021 and this is now being implemented. The strategy is built around four strategic themes –



These strategic themes support the delivery of a number of Programme for Government Outcomes and have potential for synergies with multiple departmental strategies and objectives.

Our Mission:

"Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all."

Our Vision:

"Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of."

The organisation operates on the international stage and receives core funding from the Department and the receipt of external grants from the UK Science and Technology Facilities Council (STFC), and other grant-awarding bodies.

Our strategic objectives:

- To be a must-visit tourist destination
- To provide a vibrant community hub valued by and accessible to all
- Recognition as a significant Astronomical Heritage site
- To be recognised as a key player in international research and a centre for the public dissemination of science for national and international observatories
- To provide a valued resource used by a range of professional organisations for STE(A)M education
- To have a reputation that attracts high-profile international scientific conferences and events
- To be a leading-edge cultural and educational destination; a prestigious research institution and a regional hub for a shared state of the art data visualisation facilities and immersive visitor experience
- To develop an Integrated Masterplan and Capital Development Plan for collaborative development of the AOP site and surrounding area as a centre of Research, Education and Leisure – enhancing opportunities for local people and contributing to the renaissance of the city.

Specifically for 2024-25, our objectives were:

1. To retain the current baseline complement of research staff necessary to ensure the minimum level of critical mass for a research organisation is maintained
2. To maintain the vitality of the PhD programme by enrolling a minimum of 3 new Astronomy PhD students each year to maintain a minimum student population of 12 over the 4-year study period
3. To retain a baseline level of staff that will ensure AOP can continue to provide a vibrant programme of activities and events throughout the year to maintain/increase 2023-24 visitor numbers and customer satisfaction levels
4. Continue to safeguard and maintain our built and natural heritage and historic instruments and collections
5. To retain baseline levels of staff that will ensure AOP can continue to maintain a governance framework which reflects best practice and provides the necessary assurances to stakeholders as set out in the Partnership Agreement between AOP and DfC
6. Maximise AOP's admission income through investment in an increased event programme
7. Maximise AOP's trading income through continual review of stock and pricing
8. Make applications for additional funding to supplement the ability to provide a range of educational programmes and outreach activities
9. Maximise income from private hire of AOP facilities for conferences and events
10. Implement Governance arrangements and staffing support structure for the AOP Redevelopment Project
11. Maximise the use of internal resources and grant funding to deliver in accordance with the Redevelopment Project Plan and funders terms of offer
12. To participate within the Astronomical Observatories of Ireland Partnership (AOI) work-streams based on the agreed areas of co-operation (Research, Heritage, Education/Outreach and Placemaking)
13. To participate in the AOI Governance and Oversight structures agreed by the partnership.

Achievements against specific key performance indicators are also listed on page 19.

Public Benefits

The Trustees confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under Section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2025. This is demonstrated in the following summary of Principal Activities which provides detail on how the organisation has delivered against its objectives and the public benefit which has flowed from this.

Principal Activities

Impact of Brexit

With the full implementation of the UK's EU withdrawal agreement, AOP has encountered several visa issues for non-UK or Irish citizens when crossing between the two jurisdictions on the island of Ireland. One of our PhD students was unable to obtain a visa in time to travel to Galway to give a presentation at INAM (the Irish National Astronomy Meeting) in August 2024 and had to present remotely from Armagh. We are also encountering issues with the planned relocation of the Lindsay Scholar from Dublin to Armagh for their second year of study as they are an EU citizen enrolled in Trinity College Dublin.

The requirement to pay, in full and in advance, NHS costs in addition to visa costs for the full contract term is also adding considerable pressure to new non-resident students and Post Doctoral Research Assistants (PDRA's). Charges have nearly doubled over the last year. A PDRA, who has joined AOP on a prestigious Leverhulme grant that will help allow AOP to develop its data-visualisation ambitions, was faced with a total visa and NHS costs of more than £11,000 for himself and his family. AOP needs to find ways to alleviate these initial hurdles, as some HEI institutions already do for PDRAs through loans and in some cases full reimbursements (e.g. in several UK universities); if not AOP will otherwise risk being unable to attract talent, fill critical skill gaps, and live up to its ambition of being an equal-opportunities workplace.

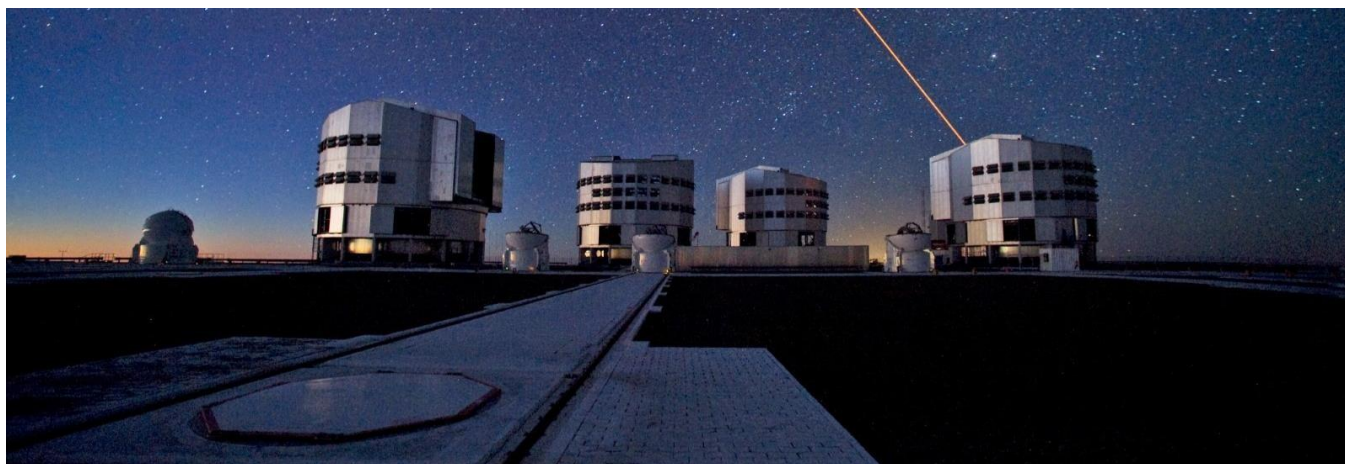
Dublin Institute for Advanced Studies (DIAS), AOP's partner in the Astronomical Observatories of Ireland, had to cancel a planned away-day for all staff to Armagh scheduled for 17 October 2024. DIAS intended to take their entire staff to AOP for the day (about 50 were expected) as part of an internal staff engagement activity. However, several members of DIAS are no longer able to travel across the NI-RoI border due to the nature of their visas. DIAS could not discriminate against some members for what was a staff engagement event and so regrettably had to cancel their trip to Armagh.

AOP Research and its International Standing

AOP is one of the oldest scientific research institutes in the UK and Ireland with a long-established reputation of research excellence. It is also one of very few astronomical institutions in the world to have a modern planetarium where its research can be effectively communicated and where a research-informed outreach and public engagement activity can be sustained. AOP is strategically engaged in front-line research in several key areas of astrophysics. These range from the study of our Solar System to that of distant galaxies, in keeping with the long and varied history of scientific achievements of the Armagh Observatory and with the desire to be perceived by the public as leaders in the strands of astronomical research that are communicated through the Planetarium.

Typically, around a third of AOP's research is funded by the award of project-specific external grants mainly from the UK Science and Technology Facilities Council (STFC), together with several ad hoc grants. These grants support projects led by individual research astronomers with the provision of PhD scholarships, post-doctoral research assistant salaries, computing equipment and observation/conference travel funding. In 2025, AOP researchers contributed to secure €700,000 from the European Space Agency for funding across different EU institutions for a monitoring campaign of potentially hazardous Near-Earth Asteroids. This will fund one PhD student at AOP. AOP researchers also submitted four applications for STFC grants providing funding for one Post-Doctoral Research Assistant (PDRA) each, plus salary staff contribution and estate costs. This is in addition to an EU-Horizon Advance Grant application to establish a premier research group of students and PDRAs working on massive stars in Armagh. While these efforts underscore AOP's ability to seek research funding, it is important to stress that its permanent staff numbers are nonetheless close to the minimum critical value to ensure its sustainability in the UK funding landscape. For instance, both the number of UKRI PhD studentships and the availability of UKRI grants to publish research in open access format depend critically on staff numbers, which for AOP translate in considerable fluctuations for these research income streams.

AOP research requires the use of state-of-the-art observing and computing facilities internationally in order to obtain new astronomical data and allow its analysis. STFC and UK government support provides access to world-class international facilities, and AOP research staff regularly are awarded telescope time on some of the most sought-after telescopes in the world such as the European Southern Observatory (ESO) Very Large Telescope (VLT) and Atacama Large Millimetre Array (ALMA) or the Hubble Space Telescope (HST). In addition, through AOP's membership of the UK SALT Consortium, its research staff have access to the 11-metre diameter Southern African Large Telescope (SALT). AOP is also a founder member of the international Gravitational-wave Optical Transient Observer (GOTO) project; a member of the UK consortia involved in building the detectors for Inouye Solar Telescope (IST); LOFAR (Low Frequency Array) radio telescope project and a consortium member of the Cherenkov Telescope Array (CTA) gamma-ray observatory and the BlackGem project which conducts optical surveys from Chile. Finally, AOP is in a leadership position for nearly a quarter of all the observing time dedicated to Large Programs run by the 15-meter diameter James Clerk Maxwell Telescope (JCMT) in Hawaii.



The European Southern Observatory Very Large Telescope, with its array of 8-metre diameter telescopes in Chile.

These facilities can be extremely expensive to run so that, through the award of their use, the international astronomical community essentially entrusts astronomers at Armagh to make effective use of the data. For instance, the running cost of one observing night at VLT is about £50,000 whereas the cost of one HST orbit worth of observing time is around \$75,000. This year alone, AOP researchers secured 12 nights at VLT and over 50 HST orbits. Furthermore, by leveraging on South African collaborations AOP researchers secured over 50 hours of SALT telescope time, or ten times the guaranteed time that AOP secures through its yearly contribution to SALT.

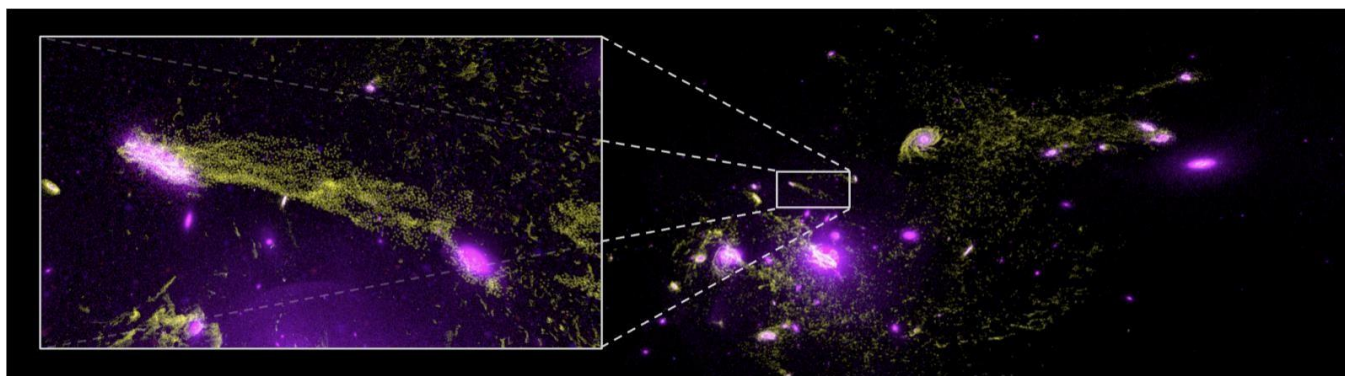
AOP research staff also play a full role in the international astronomical community. For instance, they serve on committees of bodies such as the Royal Astronomical Society (RAS), STFC, the International Astronomical Union (IAU), ESO time allocation panels, assess grant and research proposals on behalf of external funding agencies, review scientific papers and edit international academic journals, and act as external PhD examiners in the UK and beyond. AOP researchers also sit on scientific advisory panels or lead specific projects with future ground-based observing facilities (Vera Rubin Observatory, ELT-METIS, VLT-BlueMUSE), space satellites and missions (European Space Agency's future Plato and Comet Interceptor missions) and large-scale surveys (MOONs).

At the XXXII General Assembly of the International Astronomical Union, held in Cape Town in August 2024, three AOP astronomers were elected as Presidents of IAU Commissions. They were (i) Stefano Bagnulo, President of Commission B6 – Astronomical Photometry and Polarimetry – part of Division B (Facilities, Technologies & Data Science), (ii) Michael Burton, President of Commission C4 – World Heritage and Astronomy – part of Division C (Education, Outreach & Heritage and (iii) Simon Jeffery, President of Commission G5 – Stellar and Planetary Atmospheres – part of Division G (Stars and Stellar Physics).

The international reputation of AOP research staff is also underscored by their ability to attract their international peers to Armagh either on research visits or organising international conferences and workshops at the Planetarium. For instance, in September 2024 AOP welcomed over 44 delegates for the UK Star Formation Conference, thanks to the initiative and coordination of AOP's staff and student's efforts by AOP's Öpik fellow and to funding from the RAS. A well-attended public talk was part of the itinerary, given by Professor Derek Ward-Thompson of the University of Central Lancashire. As another example of AOP's reputation, this year has been the second in a row when AOP has been able to secure all its top candidates for the appointment of PhD students and research fellows, including the recruitment of AOP's new Öpik fellow starting in October 2025.

AOP research staff are also involved in the training of PhD students who also play a key part in AOP outreach and public engagement activity. AOP students are usually registered at Queen University Belfast (QUB), through an advantageous student fee arrangement that over time has allowed AOP to attract students from all over the world and achieve a vibrant diversity in our cohort that in turn prepares our students to be STEM champions, promoting equal opportunities in physics when they help at the Planetarium. In this respect, AOP's students will now play an important role as STEM ambassadors in Northern Ireland, with AOP now being the coordinating organisation for this initiative.

In this last respect, we note that this year saw several research-led public sessions at the Planetarium in AOP's data visualisation laboratory, where staff and students use its large screen as well as immersive technologies such as the Cobra panoramic, curved screen and VR sets to instigate discussion around astronomy data and research. The arrival at AOP of a Leverhulme-funded PDRA previously based at Inter-university Institute for Data Intensive Astronomy in South Africa has allowed AOP to further investigate the use of immersive technologies not only in outreach but also in research. For instance, a particularly promising avenue concerns the agile exploration of the result of complex cosmological simulations for galaxy formation.



Immersive visualisation for both stars (purple) and gas (yellow) particles (several millions) for a simulated galaxy cluster, showing an array of gravitational and hydrodynamical processes affecting galaxy formation.

Finally, AOP continues to be committed to promoting the career development of its researchers, the integrity of its research as well as inclusion, diversity and equal opportunities in research. For this AOP has followed up on several actions for the Concordat to Support the Career Development of Researchers (see 2023-24 Annual Report), including reaching out to QUB to receive the latest training in research integrity, continuing to offer AOP's Öpik fellowship as an opportunity for progression towards independent research, supporting students and researchers development through travel funding to conferences and workshops and promoting their research with contributions to AOP's Management Committee. Besides the aforementioned QUB training opportunities, in terms Research Integrity Concordat AOP has also updated its own policies on research integrity and misconduct to the standard needed by UKRI, had internal student training on plagiarism and discussion on personal experiences of research misconduct. Finally, AOP research staff and students continue to be involved in the organisation wide Equality Diversity & Inclusion working group, and already participated in the Institute of Physics (IoP) meetings outlining the path for AOP in the new Physics Inclusion Award run by the IoP.

Research Highlights

To provide a practical understanding of how the work of AOP research contributes to the region's international reputation and understanding of the cosmos, the following provides some highlights of the research undertaken at AOP in the financial year. This draws from international collaborations and the award of observing time on highly competitive facilities, as well as direct support from the Department allowing AOP to participate in several key international projects (such as SALT, GOTO, IST, I-LOFAR, Comet Interceptor, CTA and BlackGem). Full bibliographic references can be found in the publication list appended to this report.

Stellar and Galaxy Evolution

Introduction

When we look up on a dark night, we may think that stars are immutable and isolated. Yet, although stars can live for as long as the age of the Universe, they can also undergo dramatic changes in a matter of seconds. They are also not isolated from other stars. Some are found in pairs or tight groups and more generally stars are related to each other through the very way in which they form and evolve. Stars are born from giant clouds of gas and return matter to those clouds, seeding the birth of new stars as they fade away or sometimes explode in dramatic events. Furthermore, stars produce the heavy elements necessary for the formation of rocky planets and of life as we know it.

In turn, the formation history of stars relates to the formation and evolution of the galaxies that contain them. Some galaxies no longer appear to form stars, unlike the case of the Milky Way. This may depend on whether fresh gas is available around them, on whether they have collided with other galaxies in the past or possibly also on whether their central supermassive black hole suddenly becomes active and pours out tremendous amounts of energy capable of clearing its host galaxy of any star-forming gas material. Finally, galaxies are carried by the general expansion of the Universe and the evolution of the dominant, yet unknown dark-matter material in which they themselves are embedded. Understanding the formation and evolutions of stars and galaxies therefore ultimately means understanding our origin in relation to the very fabric of the Universe.

Recent results

AOP stellar studies range from the most massive and brightest young stars to the faintest and ageing stars or stellar remnants such as white dwarfs and black holes.

The research led by Professor Jorick Vink is both theoretical and observational in nature and is supported by grants from STFC. The theoretical work is focused on understanding the formation and evolution of the most massive stars

and stellar black holes in the Universe - objects that can shine up to ten million times brighter than our Sun. A key area of investigation concerns pair-instability supernovae, a rare type of stellar explosion in which the entire star is disrupted. These events play a crucial role in enriching galaxies with heavy elements, potentially contributing more to galactic chemical evolution than all lower-mass stars combined. Recent work led by Professor Vink, together with PhD student Ethan Winch and postdoctoral researcher Gautham Sabhahit, has revealed that the most massive stars in our Milky Way undergo significant mass loss through strong stellar winds, effectively "evaporating" over time (Vink et al. 2024). However, in more pristine, metal-poor galaxies - such as those probed via gravitational wave detections - these stars retain far more of their mass (Winch et al. 2024), with important implications for the formation of massive black holes. On the observational front, Professor Vink is the Principal Investigator of the ESO-VLT Large Programme *X-Shooting ULLYSES (XShootU)*. This international collaboration brings together around 100 experts in massive star astrophysics to study the stellar properties of massive stars in the low-metallicity environments of the Large and Small Magellanic Clouds. These galaxies serve as nearby analogues to the early Universe, offering critical insights into the nature of the very first stars, which are thought to have been extremely massive. In the past year alone, the XShootU programme has produced 10 peer-reviewed publications.

More than 90% of stars will end their lives as white dwarfs - stellar remnants with a mass comparable to the Sun but compressed to the size of Earth. These objects are incredibly dense (imagine compressing a car down to the size of a coin) and they exert an intense gravitational force. We know that remnants of planetary systems once orbiting these stars eventually fall onto the white dwarf's surface. Many white dwarfs also have strong magnetic fields. A team led by staff astronomer Stefano Bagnulo previously discovered a case in which the magnetic field was channelling the accreting planetary debris onto specific regions of the white dwarf. Building on that work, the same team led by Bagnulo has now shown that this magnetically guided accretion is common in the universe. Bagnulo, together with visiting astronomer John Landstreet, also studied the magnetic field properties of white dwarfs and made another important finding: as magnetic white dwarfs age, their magnetic fields tend to align with their rotational axis. While unexpected, this result confirms a theoretical prediction from the early 1970s that had never been observed before.



An artistic impression of a magnetic white dwarf surrounded by the remnants of a planetary system.

Stars may pass through several stages after leaving the long-lived hydrogen-burning phase and becoming white dwarfs. Many become red giants, and a few become hot subdwarfs. Professor Simon Jeffery and his team study the latter, including stars that are in transition from one to another. Some hot subdwarfs evolve to become white dwarfs and show large-amplitude pulsations; AOP is at the forefront of theoretical studies of these stars; including hydrodynamical simulation of their oscillations (Jeffery 2025). An AOP survey using SALT to study peculiar hot subdwarfs has discovered stars with surfaces which are excessively rich in unusual elements such as lead, extremely deficient in hydrogen and most metals (Jeffery et al. 2024), or show extremely strong magnetic fields of a few hundred kiloGauss (Dorsch et al. 2024) (30 times that of an MRI scanner). The team is working to discover whether the chemical excesses are of nuclear origin or due to the formation of thin clouds in their atmospheres (Scott et al. 2024).

Looking further in the Milky Way, the Carina Nebula complex is a spectacular star-forming region located at 2.3 kpc, which is close enough to observe different size scales in detail. With more than 65 O-stars and more than 900 young stellar objects identified it is also the nearest analogue of more extreme star forming regions, such as 30 Doradus. The results of a major effort to study the relationship between the different gas phases in the Carina region

from 100 pc to 0.01 pc using the Australia Telescope Compact Array (ATCA), the Mopra telescope in Australia and the ALMA telescope in Chile were presented at the IAU General Assembly in Cape Town in August 2024. This is a collaboration between Chilean astronomers David Rebolledo and Guido Garay, Australian astronomer Anne Green, and Professor Michael Burton at Armagh. At large scales, CO images combined with far-infrared data from Herschel revealed the overall molecular mass and its distribution across the Carina complex. An extremely detailed map of the HI 21-cm line across the whole nebula revealed a complex filamentary structure in the atomic gas, which allowed the identification of regions where phase transition between atomic and molecular gas is happening. An ATCA 1-3 GHz radio continuum image across the whole Carina region revealed a complete and spectacular view of the ionized gas in the region. At small scales, ALMA high spatial resolution observations of molecular line tracers and dust showed that the level of stellar feedback effectively influences the fragmentation process in clumps, and provides further evidence for a higher level of turbulence in the material with a higher level of massive stellar feedback.

This work is also close to the research of AOP's previous Öpik Fellow, Dr David Eden, who was in post until December 2024. He was utilising data from multiple JCMT Large Programs to investigate the causes of star formation in the Milky Way. These Large Programs investigate multiple stages of the star-formation process from the formation of new molecular clouds (the sites of star formation; *Rani, Li, Moore, Eden et al., 2024*) to the role dense-gas (the gas most closely aligned to star formation) takes in the earliest stages of star formation; (*Eden et al., 2024*). *Eden et al. (2024)* calculated the physical properties cold cores identified by the Planck survey and determined that they were indeed tracing the youngest sites of star formation and are a distinct population of Galactic Plane surveys. *Rani et al. (2024)* investigated the kinematics of molecular clouds in the Galactic Plane and their findings suggested that the Galaxy was not impacting the rotation of these clouds, but instead it was the imprint of the processes that formed these clouds. Further JCMT data was utilised to investigate the star-forming conditions in the Galactic Centre and the amount of star formation was found to be low (*King, Moore, Henshaw, Longmore, Eden, et al., 2024*), with the magnetic fields hinted at as the cause of this (*Yang, Lai, Karoly, Pattle, Lu, Eden, et al., 2025*).

Finally, linking to external galaxies, Professor Marc Sarzi's long standing interest in central supermassive black holes (SMBHs) resulted in several papers within the WISDOM collaboration, which focuses on the study of galactic nuclei using ALMA observations for the molecular gas in these regions. This particularly cold phase of the interstellar medium can indeed lead to accurate black-hole mass measurements as it is often found in relaxed and regularly-rotating gaseous disks, allowing us to follow very well the gravitational pull that stars and supermassive black holes have on such gas clouds near the centre of a galaxy. Taken together with the spectacular angular resolution of ALMA, comparable if not superior to that of HST, these observations allow to trace molecular gas clouds moving around central SMBHs as the planets do around the Sun, leading to relatively straightforward and very precise measurements for their mass. This was further demonstrated in *Zhang et al. (2025)*, which set the current record for the accuracy for the mass measurement of a SMBH in external galaxies, to just 5% and exceeding the gold standard set by measurements based on rare water mega-masers disks. Considering how common nuclear disks of molecular gas are, this is a promising avenue for completing the census of nearby SMBHs and further elucidate their role in galaxy evolution.

The role of SALT

The Southern African Large Telescope (SALT) is the largest telescope in the Southern Hemisphere, providing unparalleled access to the skies for its shareholders. Participation in this major international facility brings visibility throughout the worldwide research community and AOP is presently the only UK research institution to engage in collaborations with other SALT international partners, as the last holder of shares in UK SALT Consortium. Through such partnerships, AOP receives a return in terms of telescope time allocation that is equivalent to roughly 10 times its contribution. For instance, over the years a unique programme led by Professor Simon Jeffery at AOP has obtained over 1000 observations of nearly 700 objects, targeting some of the most exotic stars in the Universe and exploring their abundance in key elements such as hydrogen, helium, carbon, oxygen, and iron, as well as rarer elements such as lead and zirconium. These data contribute to a growing series of discovery papers and to the training of postgraduate research students at AOP. As the last standing organisation in the UK with shares in SALT, AOP has now a unique opportunity to promote both scientific and economic advantages in using this telescope to both the UK and Irish astronomical communities, creating further partnerships opportunities for AOP.



The 10-metre diameter Southern African Large Telescope (SALT), in the semi-desert region of the Karoo, South Africa.

Transient stars and Transiting exoplanets

Astronomers from the ancient world detected new stars, “novae” or “supernovae”, which suddenly appeared in the night sky and then gradually faded from view over weeks or months. We now know that many of these “transient” events occur when one star circling a companion star unloads enough matter through the process of “accretion” to its companion to make it explode. These Supernovae ‘Ia’s have now been used to show the universe is expanding at an accelerating rate. However, astronomers are not sure what kind of star the companion is in these events.

It is now 30 years ago that the first planet was discovered around a regular star – an exoplanet. We now know that most stars host planets. The most common means for discovering new exoplanets is a called the *transit method* where an exoplanet has the right orbit inclination to cause a slight dip in a star’s brightness once every exoplanet year. To determine the mass of the transiting body, high resolution spectroscopy is required to determine its radial velocity since the body could be a very low mass companion star or a brown dwarf whose mass is not quite high enough to start nuclear burning in its core.

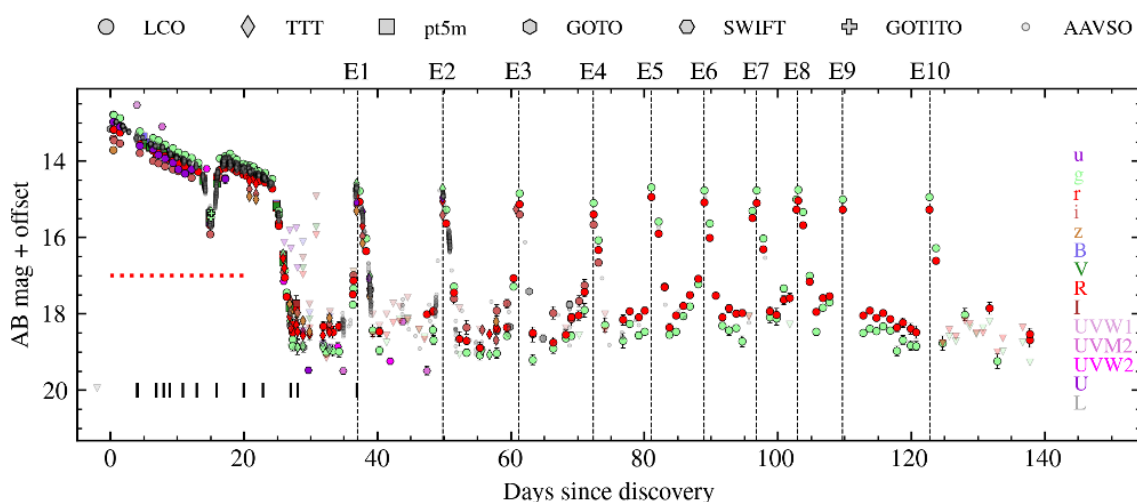
Recent results

AOP is a founding partner of the international project the *Gravitational-wave Optical Transient Observer* (GOTO) whose prime goal is to detect the optical counterpart of gravitational wave events such as the neutron star binary merger GW170817. AOP’s contributions are led by Professor Gavin Ramsay. Since April 2023, the GOTO telescopes have been operating remotely and routinely from the island of La Palma in the Canaries and New South Wales in Australia. GOTO images the whole observable sky every few nights and is ready and waiting for new gravitational wave events made by Ligo and Virgo. In the meantime, GOTO has discovered more than 2000 supernovae in distant galaxies as well as outbursts from Galactic compact binaries and other variable stars. In *Warwick et al (2025)* GOTO reported on SN 2023tsz which is a rare sub-type of stripped-envelope core-collapse supernovae in a very low-mass galaxy; and in *Pursiainen et al (2025)* the discovery of AT 2024wpp which is a very luminous supernova with high velocity outflows.

The GOTO Consortium have also developed an education programme called [Kilonova Seekers](#) where people around the world can gain insight to how science is done but also make contributions to astronomical research. Kilonova Seekers have already discovered several dozen new supernova but have also made a spectacular discovery of an outburst from a previously unknown large amplitude accreting binary, GOTO0650, in our Galaxy. With the help of amateur astronomers, we were able to detect a series of ten echo outbursts after the main outburst had ended. Such observations allow theoretical models of accretion discs to be tested in detail. Other wide field surveys such as ZTF have been used to study the outburst characteristics of another class of accreting binaries called VY Scl stars *Duffy et al (2024)* and X-ray observations have been used to confront the number of accreting binaries with theoretical models *Rodriguez et al (2025)*.

Ramsay also works with colleagues in the New Generation Transient Survey (NGTS located in Chile) project together with data obtained from the TESS satellite to discover and characterise exoplanets. These include NGTS-29b which orbits its Solar analogue star every 69 days *Gill et al (2024)*; NGTS-33b which is a young super-Jupiter planet orbiting every 2.8 days around a rapidly rotating hot star *Alves et al (2024)* and NGTS 31b and 32b which are two hot Jupiter-

like planets orbiting evolved sub-giant stars ([Vines et al 2025](#)). Ramsay is also the ESA Plato Community Scientist and member of the Plato Science Working Team whose main goal is the detection of Earth sized planets around the habitable zone of Solar type stars and is due to be launched towards the end of 2026.



GOTO0650: Showing how the brightness of this newly discovered accreting binary evolved since its discovery in October 2024. These repeat outbursts provide important tests of models which predict how accretion discs change over an outburst.

Stellar Activity

We have known for many years that the number of sunspots varies on an eleven-year timescale. We can also infer the presence of spots on other stars (starspots) because as spots rotate into view, the star appears to dim since these spots are cooler than the rest of the star. The Sun's changing activity can also be traced by other means including measuring the characteristics of specific spectral lines. As timescales are expected to be years, finding evidence for stellar activity cycles on other stars takes time to emerge. Systematic and regular spectroscopic observations of Solar-like stars began during the 1960's with a focus on using the Calcium lines as an activity indicator. Subsequent studies using data such as these showed that other stars exhibit activity cycles on a similar timescale to the Sun. For lower mass stars, an activity cycle of ~7 yr was detected in the star nearest to the Sun, Proxima Centauri using optical, UV and X-ray observations.

Gavin Ramsay, Professor Gerry Doyle and colleagues continue to study activity on low-mass stars and Solar type stars using data from the *TESS* satellite and ground-based telescopes such as the 10.4m Gran Telescopio Canarias on La Palma. Recently they have used data from *TESS* to search for activity cycles on low mass stars (less than half the Sun's mass). In particular, they measured the amplitude of the rotational modulation over time of several thousand stars which were observed in the *TESS* continuous viewing zones and searched for evidence that stars showed a systematic trend in the amplitude of rotation over time. They found 26 low mass stars which showed such a variation making them candidates for exhibiting stellar activity cycles of several to many years ([Ramsay, Hakala & Doyle 2024](#)). In another paper, Ramsay along with colleagues, [King et al \(2025\)](#) used X-ray observations to search for long term variations in the X-ray brightness of the binary DS Tuc which has two active stars.

Solar System Studies

Introduction

Our Solar System is an extraordinary natural laboratory to study the formation and evolution of planetary systems around the Sun and other stars. AOP feeds into fundamental questions about how the Solar System and the Earth formed and the development of life in the Universe. Our study of comets, asteroids and planets impacts on models of solar system formation, the ever-present hazard to civilization if asteroids or comets hit our planet and on the origin of water and organic compounds necessary for life to exist. The space industry benefits from improved detailed knowledge and understanding of the near-Earth and interplanetary environment.

Recent results



The Rubin telescope, seen here under the glittering light of the Milky Way at the Atacama Desert in Chile. The facility is expected to begin commissioning operations in 2025.

Dr Apostolos Christou reported the successful recruitment of a PDRA to work on a project funded by a Leverhulme Trust research grant. The project aims to develop advanced Artificial Intelligence tools that will be used to sift through the huge volume of asteroid data expected from the Rubin telescope. Dr Alexander Sivitilli joined AOP on the 1 January 2025 and has been working to develop software for AOP's Data Visualisation Laboratory facility and to incorporate the latest datasets on asteroid properties into the DVL astrophysical databases suite. Sivitilli has also been working closely with PhD student Andrew Marshall-Lee in developing Artificial Neural Network (ANN) algorithms, with a view to apply them to the problem of finding families of asteroids created by ancient collisions in the main Belt of asteroids between Mars and Jupiter. Collisions are a fundamental driver of planetary system evolution and applying the new algorithms to the Rubin data promises to reveal the 4 billion year history of our solar system in unprecedented detail.

The 15,000 asteroids known to cross the Earth's orbit – known as near-Earth asteroids – are as prone to breaking up as their counterparts between Mars and Jupiter. However, their orbits frequently bring them close to the Earth and the gravity of our planet scatters them onto completely different orbits like a cluster being struck by the cue ball in a pool table, creating an additional challenge to the problem of finding families among near-earth asteroids. In a paper published in *Monthly Notices of the Royal Astronomical Society*, PhD student Alice Humpage and Apostolos Christou carried out numerical simulations on the in-house *Sirius* computer cluster with the aim to quantify the scattering rate for NEAs. An important finding of the work is that this rate varies across the different orbit types, with orbits strongly tilted to the ecliptic plane being the least prone to the scattering and suggesting that a search for families should prioritise asteroids in the less-affected orbits. Another significant outcome of the work is that the scattering growth over time can be approximated by a simple mathematical function, potentially providing a method to date the families.

Shooting stars, also known as meteors, are caused by bits of debris from space burning up high in the atmosphere. Their observation allows astronomers to map out the debris distribution along the Earth's orbit and even determine which comet or asteroid they may have come from, a 'poor man's sample return'. Since the time of Ernst Öpik, Armagh has been a leading centre of meteor research. In a recent study published in the journal [Icarus](#), Apostolos Christou and Maria Gritsevich (University of Helsinki, Finland) ask the question whether meteors could be observed in the atmosphere of the neighbouring planet Venus. In the study, Christou and Gritsevich found that, on average, an observer would see about twice the number of meteors on Venus than on Earth, making our neighbouring planet the better place to do meteor astronomy. In the future, cameras placed in orbit around Venus and looking down on the nightside would allow astronomers to study the space debris populations at two different locations in the solar system. This work also generated a popular article in [Universe Today](#), a space and astronomy news site.

Finally, polarimetry is a special technique that analyses the light and can be used as a powerful remote sensing tool and which, when it comes to Solar system studies, can reveal the size and composition of asteroids. Bagnulo secured funding from the European Space Agency (ESA) to use polarimetry for the monitoring Near-Earth Asteroids (NEAs), a key component of ESA's planetary defence strategy. Understanding the size and trajectory of NEAs is critical, as these objects could potentially impact Earth. Funding was used to recruit a PhD student who will start in October 2025.

Education and Community Outreach

Planetarium

AOP is a unique institution that brings together cutting-edge research and public engagement, all within a heritage-rich environment steeped in scientific legacy. Its public programme is built on four foundational pillars: education, inspiration, entertainment and outreach. Established in 1968, the Planetarium is internationally recognised as a pioneering centre of excellence dedicated to advancing public understanding of science.

At the heart of the Planetarium's mission is the education and dissemination of scientific and astronomical knowledge. It serves a broad and diverse audience – from young children to older adults – through its comprehensive school's programme and dynamic public outreach initiatives. Whether onsite or offsite, AOP is committed to making astronomy and science accessible, engaging and inspiring for all.

AOP offers a comprehensive education programme designed to inspire and inform individuals about astronomy and space science. This includes an onsite school's programme tailored for all educational levels from Nursery through to Third Level, engaging students with interactive workshops and immersive full-dome experiences. These sessions explore Earth, space, and the physical sciences, sparking interest in STEM subjects. For schools in the Republic of Ireland, a Junior Cycle programme provides modular content aligned with the national curriculum, allowing teachers to select topics that best suit their classroom needs.

In recent years, AOP has significantly expanded its outreach efforts, supported by external funding and the establishment of a dedicated Tours and Outreach Officer role. During 2024-25, we delivered a wide-reaching outreach programme across Ireland's border counties, fully funded by Science Foundation Ireland. A parallel initiative, supported by the UK Space Agency, brought science engagement to schools across Northern Ireland. These efforts resulted in our highest-ever offsite engagement figures, reaching approximately 25,000 individuals through school visits, science festivals, and community events including sessions for groups such as Scouts. This represents a marked increase from the 11,000 people reached during 2023-24. We are committed to continuing outreach as a core activity, particularly for schools unable to visit our facilities due to geographical constraints. Outreach will also remain a key part of our involvement in science festivals and special events. Special credit goes to Dr Rok Nežič, AOP's Tours and Outreach Officer, who coordinated and delivered the majority of the programme, travelling across Ireland in our electric van to make science accessible to communities far and wide.

In 2024-25, AOP launched *Space Cadets*, an after-school STEM education programme designed for children aged 7 to 11. Delivered as themed, one-hour weekly sessions, the initiative aims to spark curiosity and build lasting interest in space science. Initially funded by the International Astronomical Union, *Space Cadets* has proven highly successful, and we now aim to sustain and expand it beyond the original funding period. The education team also ran *Little Astronomers*, a monthly club for pre-school children, which consistently sold out, highlighting the strong demand for early years science engagement. AOP also took part in global initiatives such as *One Hundred Hours of Astronomy*, hosting afternoon solar viewing sessions that attracted a wide range of visitors. This experience underscored the untapped potential of afternoon programming for families and special interest groups.

With our education programme at full capacity and bookings consistently high, there is clear scope to grow our afternoon offerings, catering to both after-school audiences and adult learners. However, it is worth noting that while school visitor numbers remained strong overall, we did experience a number of cancellations due to teacher strikes and disruptions in public transport services provided by Translink. Additionally, the education team hosted two placement students from Stranmillis University College. These placements not only support teacher training but also enrich our programme by bringing in fresh ideas and new approaches from future educators. We also had a Tourism and Hospitality placement student from Monaghan Institute with us for two weeks.

Another key funding source in 2024-25 was the ASDC *Bold Futures* programme, through which the Planetarium partnered with local autism support groups to make astronomy more accessible for neurodiverse students. This initiative builds on the success of our 2023-24 project and reinforces our ongoing commitment to inclusive science education. In addition, we offer tailored shows in Makaton, British Sign Language (BSL), Irish Sign Language (ISL), Irish and Ulster Scots, ensuring that diverse linguistic and communication needs are met.

A milestone this year was the hosting of our first fully *Accessible Day* in March 2025 which was an event designed to welcome visitors that need quieter spaces, lower volumes and reduction of people on the premises to ensure queuing is at a minimum. Due to its success, a new series of Accessible Sundays will now take place quarterly as a regular feature of our public programming.

Accessibility remains a core priority at AOP. Our goal is to be as inclusive as possible, ensuring everyone has the opportunity to experience the wonder of the cosmos making us a "space for all." We host monthly dome shows in both BSL and ISL, including our popular *CapCom Go* film. This year, we expanded our interpreted content to include *Perfect Little Planet*, a children's tour of the solar system, offering greater value for both school groups and public audiences. In addition, we provided BSL and ISL interpretation for our live Christmas experience *Mission Santa*, as

well as our festive dome show *The Alien Who Stole Christmas*. Further advancing our accessibility, we added Makaton signing to *Astronaut George*, a dome show that launched in May 2024. Thanks to ASDC funding, Education Officer Mark Grimley also introduced Makaton signage throughout the building, improving communication support for non-verbal visitors.

Monthly relaxed dome show sessions are now a standard part of our programme, alongside relaxed workshop sessions designed to create a welcoming and supportive environment for all visitors, particularly those with sensory sensitivities. We have renewed our JAM (Just A Minute) Card registration, and all front-line staff are now trained to recognise and support JAM Card users. In addition, our team has completed Level One Makaton training, further enhancing our ability to communicate inclusively. Our sensory bags which were developed in collaboration with the *Bold Futures* forum and made possible through funding from the ASDC *Bold Futures* initiative have been very well received. These resources have proven invaluable for schools and families, helping to create a more comfortable and accessible experience for neurodiverse visitors.

Our stargazing nights continued to be a major success in 2024-25, regularly reaching full capacity. Prominent astronomical events such as the planetary alignment, generated high public interest and provided valuable insights into audience demand. While many nights were affected by cloudy weather, we maximised the visitor experience by offering alternative activities, including simulated night sky sessions in the dome.

This year also marked the pilot of corporate dome hire for music and wellness events, with highly positive outcomes. *Mesmerica*, an immersive audiovisual experience, delivered by an external company, has expanded our corporate hire portfolio and attracted return visitors to other AOP programmes. *Sound Journey Under the Stars*, a relaxation and sound therapy session hosted by another external provider, has further showcased the Planetarium as a distinctive venue for alternative experiences. These external events are scheduled in addition to AOP's core programming and represent a growing area of opportunity. While we receive support via an events tender, it is important to acknowledge that coordination of both public events and corporate hire which is overseen by Senior Education Officer Ria McDonnell. Ria plays a vital role in maintaining communication, overseeing existing plans, and proactively seeking innovative new event opportunities to enhance the Planetarium's offerings.

To enrich the visitor experience and make greater use of our outdoor space, we launched a new children's Eco Trail featuring a workbook, sculptures, interactive clues, and an augmented reality (AR) app. In addition, an adult-focused AR app offers a guided tour of the grounds and Observatory, providing a more in-depth educational experience. This new initiative was a cross-departmental effort developed over the past year, and it has already proven successful in increasing visitor dwell time and engagement particularly on sunny days with positive feedback from both locals and tourists and the grounds are highly active! We also arranged a successful series of public events centred around the Calver Dome, which was opened to visitors for the first time in this format. These fully booked sessions included presentations and Q&A opportunities led by our PhD students, offering the public a rare chance to engage directly with current astronomical research and the people behind it.

Although our summer season did not meet projected targets or match the figures from the previous year, it remains encouraging when compared to pre-Covid benchmarks. Visitor numbers were 20% higher than those recorded in 2019, demonstrating sustained long-term growth. In contrast, many other visitor centres across the UK and Ireland reported an average decline of around 8% compared to 2019 levels. Insights shared at recent Tourism Northern Ireland (TNI) and ASDC conferences confirmed that this dip in summer 2024 attendance was part of a broader trend affecting the wider visitor attraction sector throughout 2024-25. In this context, our performance remains strong and resilient.

We are pleased to report the successful outcome of a funding application for the Northern Ireland STEM Ambassadors programme, securing a two-year contract to establish AOP as the official STEM Ambassador Hub for Northern Ireland. This funding, which totals approximately £200,000 over two years, has enabled the recruitment of a dedicated Project Manager and Admin Officer, both now in post to support effective programme delivery. As the regional hub, AOP will play a central role in connecting schools and community groups with STEM Ambassadors, offering pupils opportunities to engage with real-world professionals and explore the diverse range of STEM careers available. This initiative will significantly enhance our links with industry and raise AOP's profile within the STEM education and outreach sector across Northern Ireland. Over the course of the two-year programme, we aim to strengthen and support a growing network of thousands of volunteers, who will help bring STEM to life in classrooms, colleges, and universities. Through inspiring careers events, hands-on activities and inclusive outreach, we will work to challenge stereotypes and open young minds to the endless possibilities of a future in STEM.

This year, the Education Team experienced the temporary and permanent departure of three senior staff members due to maternity leave, a career break, and relocation for new employment opportunities. In response, we successfully completed recruitment for two key roles: Operations Manager and Education Assistant. Additionally, we introduced a new post of Theatre Producer and Astronomy Communicator to support the development of innovative programming and storytelling within the dome. We are delighted to welcome Jessica Moon as our new Operations Manager, Emma-Jayne Malcolmson as Education Assistant, and Kerem Çubuk to the newly created role of Theatre

Producer and Astronomy Communicator. Their appointments bring fresh energy, ideas, and expertise to the team, and we look forward to the contributions they will make to AOP's continued growth and success.

The addition of a dedicated Digital Theatre role with expertise in dome content creation and collaboration with external partners has already proven to be a significant asset to AOP. In his new role, Kerem Çubuk has actively contributed to revenue generation through external dome show production, most notably with the development and sale of the *Sound Journey Under the Stars* dome experience. AOP was also commissioned by the European Space Science Committee (ESSC) to produce a bespoke planetarium show celebrating 50 years of European space exploration. This commemorative show marks the anniversary of the formation of the European Provisional Space Science Advisory Board in April 1974, which ultimately led to the creation of the European Space Agency (ESA). The show premiered at the Strasbourg Planetarium on 16 April 2024 as part of a high-profile gala event.

In addition to external productions, Kerem has significantly enhanced AOP's internal offerings. He reimaged our flagship presenter-led show, *Look Up: Our Night Sky*, by designing a new user interface featuring custom control panel pages. This innovation offers greater flexibility for presenters and allows for a more tailored, dynamic delivery of content. Furthermore, Kerem collaborated with Lovisa Redpath to create a brand-new toddler dome show titled *Our Wee Planets*, which has quickly become a favourite with our pre-school audiences. This charming and engaging programme is now a staple of our weekend and school holiday schedule and proudly a home-grown AOP original.

One of the standout moments of the year was the visit of NASA astronaut Cady Coleman on 19th September, made possible through our valued connection with the US Consulate in Belfast. A distinguished chemist and engineer, Dr. Coleman has flown on two Space Shuttle missions in 1995 and 1999 and spent 159 days aboard the International Space Station during her 2011 mission. Notably, she played a key role in deploying the Chandra X-ray Observatory during her 1999 flight. We were honoured to welcome students from four local schools to attend her inspiring talk, delivered under the Planetarium dome. Her first-hand accounts of life in space and the future of exploration captivated the audience and left a lasting impression on all who attended. Dr. Coleman also made a surprise appearance at the UK Star Formation Workshop taking place at AOP that same day, where she gave a brief but impactful presentation. Remarkably, several of the visiting scientists at the workshop had used data from the Chandra X-ray Observatory in their own research, creating a special moment of connection between astronaut and astronomers.

A range of other inspiring events took place throughout the year with highlights including the Engineers Open House Weekend, featuring hands-on rocket-making activities, and the Our World from Space Saturday Club, a monthly programme engaging young people with space science and environmental themes. We collaborated with Armagh City, Banbridge and Craigavon Borough Council for events as part of the Food and Cider Festival, and welcomed families to take part in orienteering in the Astropark during February Half-Term. Special public events such as *First Light: 230 Years of Observations from Armagh* and the European Open Heritage Day, which gave visitors a chance to experience the historic Calver Telescope, were particularly well received. We also hosted *Our Planet and the Universe*, an event held as part of the IAU's 100 Hours of Astronomy global celebration, and continued our Data Visualisation Laboratory (DVL) sessions with the astronomers interacting with visitors to the Planetarium, bringing data-driven learning to life. Other standout events included a full-day Scouts Takeover, during which the organisation booked the Planetarium exclusively and delivered a bespoke programme of shows and workshops for its members.

Finally, our staff proudly participated in the ASDC Annual Meeting, delivering presentations that showcased the innovative and impactful work being carried out at AOP and reinforcing our position as a leading science communication centre.

History and Heritage

History and Heritage Policy

AOP boasts a collection of over 34,000 historic documents, rare and antiquarian books, scientific instruments and photographs, up from 33,000 entries at the start of the financial year. This collection is unique on the Island of Ireland and one of the best-preserved observatory collections in the United Kingdom. The heritage policies implemented ensure that the collection is cared for in accordance with best practice and has allowed ongoing historical research. AOP remains represented on the Board of Directors of the Northern Ireland Museums Council by the Museum Collections Officer who began their three-year term in September 2023.

The eMuseum has 16,406 objects available for public viewing on the armagh.space website and also on the newly launched Museum Data Service. The Planetarium display cases have hosted one loaned in exhibition 'The Drawings of the 3rd Earl of Rosse', which launched on 30 January 2025, and was made possible by collaboration within the Astronomical Observatories of Ireland. Two additional exhibitions based on the AOP Historical Collection, 'Cabinet of Curiosities' (curated by students from QUB History after workshops with AOP Museum Staff) and 'From the Library' ran during the year. AOP accepted three donations in 2024-25 including the return of the 1912 Ellison Reflector, made possible by a grant from the Esme Mitchell Trust.

In accordance with AOP's policy of making our collection available for the public and researchers to use we have continued to facilitate public information requests. The 2024-25 financial year brought 31 requests facilitated by the Museum Collections Officer. This included a three week stay by a MA Student at QUB, and several visits by academics from around the world to access the Historical Collection for their own research. AOP has continued to work with the Geography Department of QUB and was awarded funding for a third Northern Bridge Collaborative Doctoral Award PhD to begin in October 2025.

2024-25 saw the final year of the National Lottery Heritage Fund project 'Wisdom Begins with Wonder'. This project was funded to run from May 2022 and it was extended to run until the end of December 2024 and has seen the successful implementation of a volunteer program. Since launching, the volunteer program facilitated over 1,234 hours of voluntary work in AOP, with more volunteers awaiting projects. The position of Museum Collections Officer, which was funded from June 2022 – December 2024 by the project, has been retained on temporary contract to continue the volunteer program, provide access to researchers and maintain the collection. At present the five active volunteers are working on varied projects including academic research, archival work, and preventative conservation. In total volunteers have accessioned 1,148 new objects to the AOP Historical Collection in 2024-25.

AOP continues to publish history related research throughout the 2024-2025 period. This has included the publication of a book commissioned by the International Planetarium Society, '100 Years of Planetaria' (2025). This book featured contributions from four AOP staff members and one AOP PhD Student, as well as one retired staff member. In addition, one academic article and one non-peer reviewed article featured in publications.

Library and Archives

AOP's suite of technical equipment and historic collection is complemented by the finest astronomical study library on the Island of Ireland. The library provides an essential reference resource for AOP research, and especially for its student and young researcher cohort. It contains approximately 3,400 textbooks, monographs, special reports, and conference proceedings covering nearly all disciplines in astronomy. Some 17,000 volumes from nearly two hundred scientific journal titles including nearly complete runs of all the major astronomy journals, as well as journals of significant historical interest.

During 2024-25 the collection has been supplemented by 41 new books on topics relevant to AOP research. Some 20 texts and conference proceedings were purchased with end-of-year funds. Acquisitions also include student theses completed in recent years, and donations by staff and associates of AOP.

The AOP library is a reference library, with materials primarily consulted *in situ*, for which records are not currently maintained. Longer term loans are managed using a digital loan form; such materials are still expected to remain on AOP premises. There were 30 recorded loans in 2024-25. Library returns are maintained by the Museum Collections Officer. No journal binding was undertaken. 12 books have featured in 3 temporary exhibitions.

Whilst still under enormous pressure for space, the AOP library remains an attractive space and a more effective research tool, with potential for further development and revenue generation. It is increasingly demonstrating its potential for historical discovery as well as astronomical research. It has been used for the weekly Student Discussion and for the weekly Research Seminar. It has been used monthly by the Armagh and District History group for their meetings.

Meteorological Record

As part of AOP's primary research role, staff and students take daily readings of a wide range of meteorological parameters at Armagh and maintain the Observatory's unique 230-year meteorological record and databank. This is believed to be the longest daily climate series in the UK and Ireland from a single site (though the log book for the period June 1825 to December 1832 appears to have been lost), as well as being one of the longest in the world. The climate station has been continuously maintained since July 1795 with readings currently taken every day at 09:00 (GMT). The World Meteorological Organisation (WMO) has recognised Armagh with Centennial Station status for its longevity and importance in contributing to the climate record.

The automated weather station (AWS) was installed by the Met Office in 2019, sampling the weather every minute. This now provides the primary source of weather data in the Met Office records (e.g., temperature, pressure, rain fall, windspeed) since it is automatically uploaded to the Met Office. The instruments are inside a second Stevenson Screen within an expanded meteorological enclosure to ensure that the AWS enclosure is identical to those used by the Met Office in their UK-wide network. Manual collection still continues and provides the only source for some of the data collected (e.g. sunshine) at Armagh.

Calibration of these data has enabled researchers and government agencies to use the Armagh series for reports and research into global warming. The data contributes to the UK Meteorological Office's main climate database and are released to the general public on a monthly basis through press releases and on our climate website (<https://weather.armagh.space>) whilst also contributing to the UK Meteorological Office's main climate database.

Climate change is a subject of strategic importance for Northern Ireland in this era of climate variability. Armagh's unique climate record provides an exceptionally long historical baseline, enabling better informed judgements to be made as to how Northern Ireland's climate has responded and is responding to climate change world-wide. AOP has a movable exhibition on the climate change in the Copernicus Hall, centred around an interactive Puffersphere presentation, together with supporting exhibits which expand on local impacts.

A series of python scripts store, analyse and provide access to the weather data base via the weather webpage listed above. This includes both the manual data as well as the automated weather station data. This takes the monthly observers log, provides a means of entering the information via an online log, and in addition automatically downloads the data received from the automated station, to ingest these data sets into a new database. Analysis scripts then allow this database to be interrogated, e.g. to find climate extrema over any date range of interest. This includes enquiring about weather on any single day (as might be used in a visitor display in the Planetarium), as well as examining the data set over any period of interest and searching for climate records (extrema) over a period of interest. The automated weather station data is available to inspect online, in addition to the manual data. Plotting tools allow the user to see the weather over any time period, as well as to find when extrema in the various measured parameters occurred.

The two new PhD students (Michael Stroet and Ciarán Furey) were trained in October 2024 on undertaking weather observations, and then accredited as Level 1 Met Observers by the Director. This forms part of their PhD training in the techniques of scientific data measurement and analysis. A list of qualified Meteorological Observers, as well as those observers who participated in the daily weather measurements each year, has been added to AOP's weather webpages (see <https://www.armagh.space/weather/weather-observers-acknowledgements>).

The highest and lowest dry bulb air temperatures recorded from 01/04/24 to 31/03/25 were 25.0°C on 07/09/24 and -5.3°C on 10/01/25, respectively, with the warmest and coldest days (derived from the average of the daily max & min temperatures) being 24/06/24 (19.3°C) and 08/01/25 (-2.6°C). The lowest grass minimum temperature, of -9.9°C, was also recorded on 08/01/25. The wettest day for the year was on 22/11/24 when 35.8mm of rain fell, whereas the sunniest day was 10/05/24 when 13.0 hours of sunshine were recorded.

Armagh experienced two severe winter storms, Storm Darragh on 06/12/2024 - 07/12/2024 and Storm Éowyn on 24/01/2025. While we were spared some of the damage experience elsewhere on the island, nevertheless it had significant impact at AOP, especially in our woodland. A magnificent three-stemmed beech tree lost one of its stems in Storm Darragh and then further major branches in Storm Éowyn, necessitating the need to remove the tree as the remaining trunk was rotten and presented a safety hazard. We estimate that this beech tree was about 300 years old, so pre-dating the foundation on the Observatory.

During Storm Éowyn the maximum wind speed recorded by AOP's Automated Weather Station was 35 m/s, which occurred at both 08:08 and 08:28 on 24/01/2025. Winds speeds in excess of 15 m/s were recorded virtually continuously from 03:45 in the morning to 15:15 in the afternoon. These are measured using the station's Robinson Cup anemometer. The pressure fell to 969.6 hPa that day, the second lowest recorded during the year (with the lowest reading of 965.9 hPa recorded 2 days later on 27/01/2025).

A meteorological event of a quite different nature was recorded in February 2025 with a near absence of sunshine over an extended period. From 08/02/2025 to 18/02/2025 less than 0.2 hours/day of sunshine was recorded each day by the Campbell-Stokes sunshine recorder, with a grand total of just 30 minutes sunshine measured over this entire 11 day period.

Support

AOP is committed to ensuring fit for purpose governance and support services to support the delivery of organisational objectives.

Information and Communications Technology (ICT)

ICT is fundamental to the delivery of AOP's mission as a leading scientific organisation and its operational and strategic goals. ICT operates in a fast-changing environment and it will always be the aim to provide the best service and equipment within the resources available.

An ICT Strategy 2024-2028 was approved in March 2025. Progress against the targets will be reported to Audit and Risk Assurance Committee (ARAC) each quarter.

At an organisational level, the ICT Strategy will pursue the following outcomes to support this delivery:

- Protect the users, systems, data and reputation of AOP;
- Facilitate in-office and remote working;
- Facilitate cloud computing where practical and economic;
- Provide backup to recover from critical data loss;

- Provide cyber security compatible with supporting operational needs;
- Provide ICT training, support and assistance to users;
- Manage the ICT network across AOP;
- Renewal and/or repair of ICT equipment at AOP.

ICT is required to provide an overarching support structure to ensure fit for purpose technology and systems that facilitate the needs of research, education, heritage and corporate services, planning for the future, whilst at the same time protecting against risk.

AOP continues to modernise and improve its centralised ICT hub. All devices are now managed using Intune and are secured using multi-factor authentication and device registration. Auto patching of all Linux, Windows and Mac devices has reduced our exposure to cyber-attack. The focus now moves to software run on the devices as the next level of risk develops.

The biggest risk to AOP still remains user error through clicking on malicious links in emails. AOP mitigates this through regular reinforcement of messaging and a focus on continuing to educate users in best practice and system etiquette.

Finance

AOP has a well-established finance function. Financial policies and procedures are continually being enhanced to ensure that AOP meets the governance standards required. This includes the application of public sector procurement controls, meeting prompt payment targets and providing regular and ad hoc financial information within AOP and to DfC.

AOP continues to experience significant cost pressures within a core budget that has remained relatively static for 7 years.

Human Resources

A Human Resources Strategy 2022-26 has been developed and approved and is supported by an annual Human Resources Action Plan. The 2024/25 plan has been implemented to include:

- Maintaining a Fit for Purpose Organisation Structure – review of the skills-gap paper and workforce planning papers in light of available budget and future needs; completion of necessary recruitment and training in a timely matter and identifying short term opportunities to plug skills gaps with short term projects or engagements;
- Continual review of Operating Models – supporting the Head of Education & Outreach in recruitment and retention of staff and reviewing staffing needs in the context of budgets and affordability.
- Employing and Investing in Motivated and Engaged Staff – supporting the annual appraisal process; completing/revising a rolling training plan; reviewing implementation of training plans in the context of available budget; preparing a case for award of a special bonus scheme; preparing for engagement events and supporting the health and wellbeing of PhD students; and
- Fair and Equitable Employment Policies and Procedures – completion of the annual Fair Employment return, retention of Bronze Diversity Mark Award, review of policies, and induction and refresher training as required.

Diversity and Inclusion

AOP has an obligation under Section 75 of the Northern Ireland Act to ensure that equality of opportunity and good relations are central to policy making, policy implementation and review as well as service delivery. AOP monitors the composition of its workforce in terms of community background and sex and uses an equal opportunities monitoring form questionnaire. AOP submits an annual Fair Employment Monitoring return to the Equality Commission detailing staff composition and that of job applicants to AOP posts.

In the AOP Strategic Plan 2021-26 we state that having Fair and Equitable Employment Policies and Procedures is one of our key elements in delivering high standards. AOP has a number of policies in place including an Equal Opportunities Policy. We have also agreed a new ED&I Strategy & Action Plan 2025-2028 which incorporates a number of actions including reviewing, monitoring and training in policies and practices.

AOP currently holds the Diversity Mark NI Bronze Award and we continue to work through our targets as follows:

- To develop an Equality, Diversity and Inclusion Strategy;
- To increase the number of female research staff at AOP from 2 to 4; and
- To increase female representation on the AOP Management Committee from 3 to 5.

AOP retained Juno Practitioner status in August 2023. This is an award scheme that recognises and rewards university physics departments, schools of physics, and related institutes and organisations that can demonstrate

they have taken action to address gender equality at all levels and to foster a more inclusive working environment. In June 2024 AOP became a signatory to the new Institute of Physics Inclusion Award that is currently being developed.

Governance

Governance and accountability continue to be strengthened and improved and risks reduced as demonstrated by external and internal audit reviews. Actions arising from effectiveness reviews undertaken by both ARAC and the Management Committee have also resulted in enhanced arrangements.

Future Redevelopment Project

AOP manages an extensive property estate which includes nine separate buildings, including the Grade A listed Observatory and a circa 20-acre historic estate. There are also several leases associated with land and property.

An Outline Business Case (OBC) for the AOP Estate Redevelopment Project, as approved by the Management Committee at its 125th meeting, was approved by the Board of Governors at the 2023 Annual Visitation and submitted to DfC in July 2023. To support the project a funding bid was made to the Heritage Lottery, "*Wisdom Begins with Wonder at the Armagh Observatory and Planetarium: where the past meets the future*" for c£6m. This was successful and AOP were awarded the funding in March 2024, to come in two stages, a Development and a Delivery phase. However it has proved not possible for DfC to provide the necessary match component for AOP to be able to accept these funds. AOP was asked to update and re-submit the OBC. This was done with the help of the Strategic Investment Board who were engaged to assist, and the updated case (now known as OBC1) was approved by the Management Committee at a special meeting on 3 March 2025, endorsed by Archbishop McDowell on behalf of the Board of Governors, and re-submitted to DfC. This will be progressed in the 2025-26 financial year.

Funding required for the Outline Business Case (OBC1), which relates to the redevelopment of the AOP site, was approved by the Minister of Communities on 30 June 2025. In terms of the funding application, a total amount of £3,973k has been approved for the three years ending 31 March 2028.

Previously, The National Lottery Heritage Fund (NLHF) had allocated funding in the amount of £ 1,324k which was dependent on funding procured from other sources amounting to three-fold the funding allocated by NLHF.

The funding grant from DfC is therefore 75% of the total funding grant of £5,297k, with the balance of 25% being funded by NLHF.

The redevelopment project is imperative to future proof AOP's role into the next generation. The case for change is predicated by an estate that is outdated and misaligned to the expectations of modern day visitors; a restricted footprint on challenging topography that limits incremental or add-on extensions to increasing its capacity; and a dome technology that is on the precipice of transformational change that will render the existing visitor experience technically unsustainable within the next decade.

The case made in the OBC is centred around five spending objectives:

- 1) To create a world-renowned centre of astronomical research excellence that attracts international conferences and research visitors.
- 2) To create a state-of-the-art facility to educate the public and future generations of young people in science and astronomy across the island of Ireland.
- 3) To create a relevant, inspiring and dynamic visitor experience for the domestic and international tourist visitor market.
- 4) To preserve the heritage of the scientific instruments and the Observatory, while maximising the public's enjoyment of, and access to, the heritage site and collections held by AOP.
- 5) To improve the long-term viability and sustainability of AOP; having an attraction that is unique within NI and Ireland; and encouraging economic development through promoting it as a state-of-the-art facility.

NetZero

AOP's international research standing, and unique record of uninterrupted meteorological observations has allowed it to effectively communicate on the issue of climate change (CC) to the public, thanks also to the design and installation of a temporary CC exhibition in the Planetarium and of a CC Puffersphere display demonstrating AOP's own commitment to reducing its carbon footprint.

Moving in this direction, AOP are now using more efficient LED lights, following the standards of the International Dark Sky Association, and installed two new green energy power generation stations based on wind and solar power, the Smartflower and Windtree, with a respective nominal peak power of 2.5 and 16 kW (see figure below). Whereas the Windtree still needs to be connected to the main grid as AOP awaits NIE grid permission to do so, the Smartflower has produced 1.25 mega Watts since its installation in June 2024. Furthermore, an analysis of its energy production demonstrates its high efficiency, showing how it can reach its peak power even early in the morning when the Sun is still low in the sky. While these installations do not generate sufficient power to cover all the needs of the Planetarium, they will serve to illustrate the role that renewable energy technologies can play in harnessing energy from wind and the Sun, also adding to AOP's education offering.



AOP's Smartflower and Windtree. The Smartflower follows the movement of the Sun in the sky thus always maximising the flux of solar energy received. The WindTree can harness the power from even a light breeze of wind and unlike standard wind turbines it is silent and visually appealing.

Despite these efforts, AOP remains aware of its significant challenges in decarbonising its research and education activities, both internal and external, and as informed from AOP's 2022 carbon baseline review and decarbonization strategy. Reducing energy consumption in the planetarium remains complicated due to technical difficulties in monitoring electricity consumption, while installing solar panels on its roof would not make financial sense while AOP awaits confirmation of possible redevelopment plans for the Planetarium. In the Observatory, better insulation or more sustainable forms of heating clash with the need to retain the Georgian character of this building. Finally, reducing indirect, scope 3 emissions due to our own visitor travel to Armagh and due to our own international, mostly research-related travel also proves very difficult. In this respect, AOP is aware that other visitor centres in the UK are adopting more realistic, albeit still ambitious and transparent decarbonisation plans, and will engage with them to better understand our own NetZero direction of travel.

Achievements and Performance

The targets set for AOP in the 2024-25 Business Plan are shown in the following table. Actual performance achieved is shown along with the corresponding achievement in the previous financial year, where applicable.

Targets were achieved or exceeded in many areas; however, three out of four targets were not met. Whilst the total visitors target was exceeded the target in respect of school visitors was not achieved due to a number of school cancellations as a result of education and bus strikes and also snow. Failure to meet the remaining two targets is beyond AOP's control in that they are reliant upon external factors.

KPI	Description	Target	As at 31 March 2025	As at 31 March 2024 (where applicable)	Comments
1	Maintain overall on-site visitor numbers: Public Schools	72,000 60,000 12,000	Public 52,245	60,097	Total 63,903 visitors
			School 11,658	11,808	There were a number of school cancellations due to teacher and bus strikes and disruptions due to snowfalls.
2	5% uplift in off-site engagement numbers	11,500	24,484	n/a	
3	Achieve a 90% overall customer satisfaction rating of 4 or above out of 5	90%+ evaluation ratings $\geq$ 4	90.92%	90.83%	
4	Achieve £644,550 income from admissions and sales	£644,550	£528,671	£592,494	

Progress Key: Complete, Not Achieved

Financial Review

Operating Results

In the financial year to 31 March 2025, the value of charity funds decreased by £0.041m, summarised below:

	2025 £	2024 £
Total incoming resources	3,546,337	3,354,210
Total outgoing resources	(3,914,671)	(3,978,546)
Net deficit	(368,334)	(624,336)
Gains on the revaluation of fixed and heritage assets	283,841	500,740
Actuarial gains on defined benefit pension scheme	43,000	(121,000)
Net movement in funds for the year	(41,493)	(244,596)
Movement in Unusable Funds		
Capital financing		
Capital grants received	140,000	435,000
Government grant fund	(788,014)	(826,567)
Revaluation reserve	46,935	271,372
Pension reserve	-	(158,000)
Movement in Usable Funds		
Restricted	72,681	(100,091)
Unrestricted	486,905	133,690
	(41,493)	(244,596)

The total income for the year was £3.546m, an increase of £0.192m from 2023-24, mainly due to an increase in DfC resource of £0.420m less a reduction in capital grant income of £0.295m, together with an increase in other grants of £0.149m, offset by an decrease in operating income of £0.071m.

Expenditure was £3.915m, a decrease of £0.064m from the previous year. Staff costs continue to be the largest component of operational expenditure, comprising 61% of all direct costs.

Unrestricted operating costs are funded primarily by DfC grant-in-aid. The balance of such unrestricted operating costs is funded by contributions from external grants, operating income, trading activities and miscellaneous income. We continue to seek other funding streams to maintain this important source of funds. In 2024-25 the Department provided 70% of the total income through recurrent and capital grant allocations (2023-24: 71%).

Net Assets

Net assets at 31 March 2025 were £12.434m (31 March 2024: £12.476m).

Reserves

The AOP reserves policy is included in note 1 of the accounts. Total accumulated funds are as follows:

Funds at 31 March	2025	2024
	£	£
Restricted funds	120,618	47,937
Unrestricted funds	4,591,583	4,752,692
Revaluation Reserve	7,722,181	7,675,246
Total Charity Funds	12,434,382	12,475,875

Going Concern

The Trustees are satisfied that the organisation is a going concern on the basis that it has a reasonable expectation that it will continue in operation for the foreseeable future. The financial statements are therefore prepared on a going concern basis.

Pension Reserve

AOP is a member of Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) which manages Local Government Pension Scheme (LGPS) Northern Ireland, which in turn provides a defined benefits pension to employees. At 31 March 2025 the surplus was calculated by independent actuaries at £2,888,000 (2024: surplus £1,175,000). The assets, defined benefit obligation and current service cost shown in note 19 to the accounts have been calculated based on the data and results of the 2022 triennial actuarial valuation. AOP has applied the principles of IFRIC14 in relation to pension surplus restriction. IFRIC14 requires allowances to be made for a minimum funding requirement, which limits the amount of economic benefit available to the excess of the value of prospective current service costs above the funding requirement.

Key Risks and Uncertainties

At year end, the key risks were identified as:

- Reputation – loss of confidence in AOP's ability to deliver acceptable level of research of international value due to significantly limited resources;
- Engagement:
 - Visitors – limitations to provide experiences that attract new and returning visitors and/or failure to engage local pride in AOP as a cherished asset;
 - Partners and collaborators – inadequate support and commitment from key stakeholders to be able to deliver future vision;
- Resources:
 - Staff – limited resources to recruit and retain an appropriately skilled, highly motivated and engaged workforce of sufficient capacity to satisfactorily deliver AOP objectives;
 - Financial – insufficient or poor management of allocated funds could result in sustainability objectives not being met and/or 'value for money (VfM)' objectives not being achieved;
- Asset Management:
 - Buildings and Heritage – lack of adequate planning for the long-term development needs of the estate and assets resulting in increasing reliance on remedial intervention and inadequate resources to protect and preserve heritage assets from irreparable decline;
 - Other physical assets including ICT – lack of adequate planning for the upkeep and renewal of plant and equipment resulting in reduced service delivery; and
- Governance and Planning:
 - Inadequate implementation or maintenance of best practice approaches to corporate governance and risk management resulting in loss of confidence and reputational damage and/or legal challenges;
 - Inadequate information/data security measures resulting in information breaches and/or cyber security breaches.

Integral to AOP's Risk Management Strategy of AOP, management regularly review the inherent level of risk for each of the above aspects and how the risk is currently managed. An Action Plan is documented to reduce the level of risk, mindful of the risk appetite or risk aversion of the organisation. This Risk Register is reviewed on a quarterly basis by the Audit and Risk Assurance Committee and approved by the Management Committee. A separate Risk Register is also used to identify and track risks associated with ICT. Many of the above risks derive from the uncertainty relating to funding. Until AOP has adequate funding appropriate to its needs and long-term security of funding, this situation is likely to continue. In managing these funding risks, the organisation has developed and maintained close communication links with the Department of Communities and submitted in-year monitoring bids for additional funding while carefully monitoring spend and financial resources. For many of the above risks all reasonable steps within AOP's control are being taken to mitigate the risk.

The above risks also take account of recommendations from internal and external audit reports. Significant progress has been made in addressing the weaknesses identified in previous years and considerable effort has been put into the management of these risks going forward.

Plans for Future Periods

In 2021, AOP published a Strategy for 2021-26 with the four key themes of Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

Leading on from this AOP has prepared a Business Plan for 2025-26 for consideration by the Department. The business plan has been developed in the context of an unclear and uncertain financial environment, however AOP remains focused and optimistic towards continued achievements within its key priority areas. The Business Plan also emphasises the importance of furthering the redevelopment project while also maintaining the active research, education and outreach programmes conducted by AOP.

The Astronomical Observatories of Ireland Partnership

Drawing upon the deep links between the historic observatories of Armagh, Birr and Dunsink, AOP has formed a strategic partnership to strengthen our relationship – the Astronomical Observatories of Ireland (or AOI).

Three broad thematic areas are covered by the partnership:

1. Research: collaborative approaches to research which draw on the strengths of the partners to add value to our contributions to scientific knowledge.
2. Education, Heritage and Cultural Programming: building capacity across our three sites, including local and national relationships, to progress a UNESCO World Heritage application as a transnational property.
3. Impact and Place Making: developing complementary approaches that leverage the impact of our institutions in the areas of environment, community engagement, economy and tourism.

The first meeting of the AOI Oversight Board took place in the Armagh Observatory Boardroom on 9 September 2024. Representing AOP were Archbishops John McDowell and Eamon Martin, for Birr Scientific Heritage Foundation Maria McGovern and Councillor John Carroll and for Dublin Institute for Advanced Studies Professors Mary Fowler and Janet Drew.

AOI also received €250k through Shared Island funding from the RoI Government, distributed via Fingal Council, for projects at each of the three observatories.

Following feedback received from a preliminary application made in 2023, a full application was made in 2024 for the AOI to join the UNESCO World Heritage Tentative List for Ireland. The Director, along with the Registrar of DIAS (Eucharía Meehan) and the Director of Dunsink Observatory & Chair of the Birr Scientific and Heritage Foundation (Peter Gallagher), were then interviewed on 23 January 2025 by the Expert Advisory Group appointed by the Irish Government to consider our application.

Structure, Governance and Management

Armagh Observatory and Planetarium is a single statutory corporation and arms-length body (ALB). 'The Governors of The Armagh Observatory and Planetarium' are as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*.

This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled '*An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever*', and an Amendment of the 1938 Act ('The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938').

AOP is a registered charity under the title "The Armagh Observatory and Planetarium".

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one Department nominee;
- one Queen's University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

The Order places a statutory duty on "the Governors of Armagh Observatory and Planetarium" to maintain and manage AOP with the purpose of "developing and improving the knowledge, appreciation and practice of astronomy and related sciences."

The Board of Governors (the Board) has retained a role to ensure that the culture and character, history and patrimony embodied in AOP are protected and preserved and that the institution is managed in line with the statutory purpose outlined in the Order. This role will normally be fulfilled through an Annual Review meeting (visitation) where the Board will receive assurance as to the management and performance of AOP from the Management Committee.

Management Committee of Armagh Observatory and Planetarium

The Board has delegated primary responsibility for the governance and management of AOP to a Management Committee. The Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department and approved by the Minister and for promoting the efficient, economic and effective use of resources. The Management Committee provides leadership, challenge, oversight, support and encouragement to the Director and staff.

The Management Committee comprises:

- three nominees from the Board of Governors;
- six nominees from the Department appointed through open competition;
- one nominee of Queen's University, Belfast;
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS);
- a Chair appointed through open competition; and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

The following committees are established as sub-committees of the Management Committee.

Audit and Risk Assurance Committee (ARAC)

The ARAC is a sub-committee of the Management Committee established in accordance with DAO (DoF) 02/25 Corporate governance in central government departments: Code of good practice NI (2025) and NIAO Effective Audit and Risk Assurance Committees Good Practice Guide (2025) (superseding DAO (DFP) 06/13 - Corporate governance in central government departments: Code of Good Practice NI 2013, and in line with the HM Treasury

Audit and Risk Assurance Committee Handbook (DoF 03/18)) to advise the Board of Governors, the Management Committee and the Director of AOP as Accounting Officer and to support them in their responsibilities for issues of organisational risks, internal control, governance and their associated assurances and in reviewing the reliability and integrity of these assurances.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is a sub-committee of the Management Committee and provides advice and recommendations to the Management Committee on employment issues.

Research and Education Advisory Committee

The Research and Education Advisory Committee is a sub-committee of the Management Committee and advises it on research and education issues.

Redevelopment Committee

The Redevelopment Committee is a sub-committee of the Management Committee and was established to develop an Outline Business Case for redevelopment proposals.

Strategic Oversight Committee

The Strategic Oversight Committee is a sub-committee of the Management Committee, to oversee the work of the Project Board for AOP development (yet to be established). It has delegated authority to make decisions in relation to operations issues.

Further details on the membership of these Committees are set out in the Governance Statement on pages 32 to 42.

Reference and Administrative Details

Name of the Charity

The charity is registered and operates under the title of The Armagh Observatory and Planetarium.

Charity number

Registered with the Charity Commission for Northern Ireland 103948.

Principal Office

College Hill, Armagh, BT61 9DG

Trustees

Archbishop J McDowell, (Board Chair)
The Very Revd S Forster
The Venerable E Cairns
The Venerable Dr P Thompson
Revd Canon W M Adair BEM
Revd Canon M Hagan MBE
Revd Canon D Hilliard
Revd Canon B Paine (to 31 July 2024)
Revd Canon R J N Porteus (to 31 March 2025)
Revd Canon A Totten OBE (from 20 October 2024)
Revd Canon G McMurray (from 20 October 2024)
Mr G Cox
Professor A Fitzsimmons (to 1 May 2025)
Mr R Wilson OBE
Archbishop E Martin
Ms S Leslie
Mr J Briggs (Management Committee Chair)
Professor L Harra (to 30 April 2024)
Mr S Brown (to 30 April 2024)
Professor M Mathioudakis

Professor C Jackman
Professor M Darnley
Mr P Kennedy
Dr K Lemon
Mr E Rooney
Professor R Hunter (from 1 June 2024)
Ms G McVeigh (from 1 June 2024)
Mr R O'Hara (from 1 June 2024)
Professor G Cotter (from 1 October 2024)
Ms S Leverment (from 1 October 2024)

Director and Accounting Officer

Professor Michael Burton

Auditors

Northern Ireland Audit Office, 106 University Street, BELFAST, BT7 1EU

Internal Auditors

Cavanagh Kelly, 36-38 Northland Row, Dungannon, BT71 6AP

Bankers

Danske Bank, Donegal Square West, Belfast, BT1 6JS

Register of Interests

A Register of Interests is maintained for Board and Committee Members and Senior Management and is available for inspection at the Principal Address. Declared Interests by Board and Committee Members and the Director are available on the AOP website – www.armagh.space.

Related party transactions are shown in note 23 of the accounts.

Gifts

AOP adheres to the limits and rules laid out in its Partnership Agreement approved by the Department and the guidance in Managing Public Money Northern Ireland (MPMNI). There were no gifts made or accepted during the 2024-25 financial year that exceeded these limits.

Personal Data Related Incidents

AOP has considered the requirement to report personal data related incidents. It is content that there were no such incidents in the year ended 31 March 2025.

Disclosure of Audit Information

So far as the Accounting Officer is aware, there is no relevant audit information of which AOP's auditors are unaware. The Accounting Officer has taken all necessary steps to make himself aware of any relevant audit information and to establish that AOP's auditors are aware of that information.

Events after the end of the reporting period

There have been no events since the end of the financial year requiring disclosure.



Mr John Briggs Trustee
Date: 12 November 2025



Professor Michael Burton
Director / Accounting Officer
Date: 12 November 2025

Remuneration and Staff Report

The remuneration and staff report sets out AOP's remuneration policy for Board members and senior managers, reports on how that policy has been implemented and sets out the amounts awarded to the Director. In addition, the report provides details on remuneration and staff that users see as key to accountability.

Remuneration Policy

Annual NICS pay awards are made in the context of the wider public sector pay policy. On 26 March 2025, NICS People and Organisational Development division confirmed that trade unions had accepted a pay which sees the majority of staff receiving a 9% increase on salaries over the 20 months from 1 August 2024 to 31 March 2026; this is made up of a 3% consolidated increase with effect from 1 August 2024 and a 6% consolidated increase with effect from 1 August 2025. Those who are eligible for progression will also receive that increase.

AOP staff remuneration is aligned with NICS pay scales. The Accounting Officer is authorised by DfC to approve its pay remit and business case, notifying same to DfC, prior to implementation of the pay award. Staff received the pay award, including backpay, in May 2025.

Trustees

Trustees do not receive any remuneration. They receive travel and subsistence allowances at rates and on conditions determined by AOP, subject to Departmental approval. No Trustee receives pension benefits or makes pension contributions in their capacity as a Board member. Management Committee members who were not trustees during the financial year received travel and subsistence expenses of £Nil (2024: £2,287).

Service Contracts

The Director of AOP, Professor Michael G. Burton, is the person in a senior position having authority and responsibility for directing and controlling the activities of the organisation. The service contract of the Director commenced on 1 August 2016.

Current terms and conditions for staff are those set out in various policies and individual employment contracts. Senior staff are permanent employees of AOP. The notice period for senior staff is three months. Termination payments are in accordance with contractual terms and those of the principal Civil Service Pension Scheme (NI).

Director's Remuneration (including Salary and Pension Entitlements) (Audited Information)

The following tables provide details of the remuneration and pension entitlements of the Director of the organisation.

Single Total Figure of Remuneration of Director							
	Salary (£'000)		Pension Benefits* (£'000)		Total (£'000)		Percentage Change
Official	2024-25	2023-24	2024-25	2023-24	2024-25	2023-24	
M.G. Burton	90-95	85-90	44	35	135-140	120-125	(9.7%)

* The value of pension benefits accrued during the year is calculated as (the real increase in pension multiplied by 20) plus (the real increase in any lump sum) less (the contributions made by the individual). The real increases exclude increases due to inflation and any increase or decrease due to a transfer of pension rights.

** Accrued pension benefits included in this table for any individual affected by the Public Service Pensions Remedy have been calculated based on their inclusion in the legacy scheme for the period between 1 April 2015 and 31 March 2022, following the McCloud judgment. The Public Service Pensions Remedy applies to individuals that were members, or eligible to be members, of a public service pension scheme on 31 March 2012 and were members of a public service pension scheme between 1 April 2015 and 31 March 2022. The basis for the calculation reflects the legal position that impacted members have been rolled back into the relevant legacy scheme for the Remedy Period and that this will apply unless the member actively exercises their entitlement on retirement to decide instead to receive benefits calculated under the terms of the alpha scheme for the period from 1 April 2015 to 31 March 2022.

'Salary' includes gross salary (on an accruals basis) to the extent that it is subject to UK taxation. There was no overtime, benefit-in-kind, bonus or other allowances. The salary of the Director shown above is based on the Northern Ireland Senior Civil Service Grade 5 pay scale.

Compensation on early retirement or for loss of office

No payment for compensation on early retirement or for loss of office has been made (2023-24: £nil).

AOP Fair Pay Disclosures (Audited Information)

AOP is required to disclose the relationship between the remuneration of the Director and the lower quartile, median and upper quartile remuneration of the organisation's workforce. The banded remuneration of the Director in the financial year 2024-25 was £90,000 - £95,000 (2023-24: £85,000 - £90,000). The relationship between the mid-point of this band and the remuneration of AOP's workforce is disclosed below.

2024-25	25th percentile	Median	75th percentile
Total remuneration	£23,177	£33,791	£41,998
Pay ratio	4:1	2.7:1	2.2:1

2023-24	25th percentile	Median	75th percentile
Total remuneration	£21,053	£27,913	£33,780
Pay ratio	4.2:1	3.1:1	2.6:1

Total remuneration includes salary, overtime and performance-related bonuses. It does not include severance payments, employer pension contributions and the cash equivalent transfer value of pensions. Remuneration ranged from £23,177 to £92,500. The 25th percentile remuneration increased following a 10% increase in the NICS AA pay scale. The 75th percentile remuneration increased following backpay attributable to a remuneration increment. Because overall employment numbers are low, small changes in the staffing structure can appear disproportionate.

The percentage changes in respect of AOP are shown in the following table. It should be noted that the calculation for the Director is based on the mid-point of the band within which their remuneration fell in each year.

Percentage change for:	2024-25 v 2023-24	2023-24 v 2022-23
Average employee salary and allowances	-1.2%	8.6%
Director's salary and allowances	5.7%	6.1%
Average employee performance pay and bonuses	100.0%	-7.2%

No performance pay or bonus was payable to the Director in these years.

Pension Entitlements (Audited Information)

Official	Accrued pension at pension age as at 31/03/25	Real increase in pension at pension age	Accrued Lump Sum at 31/03/25	Real Increase in Lump Sum	CETV at 31/03/25	CETV at 31/03/24	Real Increase in CETV
	£'000	£'000	£'000	£'000	£'000	£'000	£'000
M.G. Burton	17	3	-	-	301	247	42

The figures enclosed are based on the previous year's guidance from the Department of Finance on the pension information that should be disclosed in accounts for 2024-25. Please note, that the CETV figures now incorporate the McCloud Underpin into calculations for eligible members, where possible. Where relevant, any additions to a CETV because of an underpin will be included. The real increase in CETVs are based on the factors in force from 30 June 2023. There have been no changes to CETV factors between 31 March 2024 and 31 March 2025. When calculating the real increase in CETV and the pension benefits accrued during the year 2024-2025 for the single total figure of remuneration, NILGOSC takes account of inflation. The CPI increase for September 2024 was 1.7%. The in-service revaluation rate for the Career Average Revalued Earnings Scheme was also 1.7%.

Pension Scheme

Pension benefits are provided through the Northern Ireland Local Government Officers' Superannuation Committee Pension Scheme (NILGOSC). For members, 1/49th of pensionable pay will be added to their pension account each year and retirement pension is based on career average earnings. Details can be obtained at <http://www.nilgosc.org.uk>.

Active members of the pension scheme will receive an Annual Benefit Statement. The accrued pension quoted is the pension the member is entitled to receive when they reach their scheme pension age, or immediately on ceasing to be an active member of the scheme if they are at or over pension age.

Employee contribution rates for all members for the period covering 1 April 2024 to 31 March 2025 are as follows:

Pensionable Pay	Contribution Rate
£0 to £18,000	5.5%
£18,001 to £27,700	5.8%
£27,701 to £46,300	6.5%
£46,301 to £56,300	6.8%
£56,301 to £111,700	8.5%
More than £111,700	10.5%

Employer contribution rates are determined by the Scheme's actuary every three years. Following the results of the 2022 actuarial valuation, the Committee agreed with its actuary the employer contributions of 19% for the following three years, effective from 1 April 2023. The next triennial valuation will take place as at 31 March 2025 with revised employers contribution rates set from 1 April 2026.

Cash Equivalent Transfer Values

A Cash Equivalent Transfer Value (CETV) is the actuarially assessed capitalised value of the pension scheme benefits accrued by a member at a particular point in time. The benefits valued are the member's accrued benefits and any contingent spouse's pension payable from the scheme. A CETV is a payment made by a pension scheme or arrangement to secure pension benefits in another pension scheme or arrangement when the member leaves a scheme and chooses to transfer the benefits accrued in their former scheme. The pension figures shown relate to the benefits that the individual has accrued as a consequence of their total membership of the pension scheme, not just their service in a senior capacity to which disclosure applies. The CETV figures include the value of any pension benefit in another scheme or arrangement which the individual has transferred to the NICS pension arrangements. They also include any additional pension benefit accrued to the member as a result of their purchasing additional years of pension service in the scheme at their own cost. CETVs are calculated in accordance with The Occupational Pension Schemes (Transfer Values) (Amendment) Regulations 2015 and do not take account of any actual or potential benefits resulting from Lifetime Allowance Tax which may be due when pension benefits are taken.

Real increase in CETV

This reflects the increase in CETV effectively funded by the employer. It does not include the increase in accrued pension due to inflation, contributions paid by the employee (including the value of any benefits transferred from another pension scheme or arrangement) and uses common market valuation factors for the start and end of the period. However, the real increase calculation uses common actuarial factors at the start and end of the period so that it disregards the effect of any changes in factors and focuses only on the increase that is funded by the employer.

Total Permanently Employed Staff Costs (Audited Information)

	Permanent staff £	Others ¹ £	2024-25 £	2023-24 £
Wages and salaries	1,253,979	147,921	1,401,900	1,446,683
Social security costs	141,026	12,702	153,728	150,822
Employer's pension contributions	236,879	23,821	260,700	259,240
Defined benefit pension additional service cost	50,000	-	50,000	51,000
	1,681,884	184,444	1,866,328	1,907,745

¹ "Others" includes £31,158 for agency staff

Average staff numbers (Audited Information)

	Permanent staff	Others ²	2024-25 Total Number	2023-24 Total Number
Average staff numbers	27.9	6.4	34.3	35.2

² "Others" includes 3.59 fixed term, 2.43 casuals and 0.37 agency staff

Staff Composition – permanent employees (full time equivalent)

	Male	Female
Directors/senior managers	2.6	2.0
Other employees	11.5	11.8

Staff Turnover

	2024-25	2023-24
Leavers as a percentage of average staff in post	17.3%	1.5%

Sickness Absence (Audited Information)

Staff sickness for the period 1 April 2024 to 31 March 2025 totalled 41 days (2024: 94 days) which equates to an average per FTE of 0.56% (2024: 1.24%).

Expenditure on External Consultancy (Audited Information)

Expenditure on external consultancy during the year was £nil (2023-24: £nil).

Off-payroll Engagements (Audited Information)

There were no “off-payroll” engagements in place as at 31 March 2025, nor were any arrangements entered into between 1 April 2024 and 31 March 2025.

Exit Packages (Audited Information)

Exit package cost band	No of compulsory redundancies	No of other departures agreed	Total no. of exit packages by cost band	Total no. of exit packages by cost band
	2024-25	2024-25	2024-25	2023-24
Total no. of exit packages	-	-	-	-
Total resource cost	Nil	Nil	Nil	Nil

Statement of the Responsibilities of the Governors and Accounting Officer

In accordance with The Armagh Observatory and Planetarium (Northern Ireland) Order 1995, The Governors shall prepare and submit to the Department a statement of accounts in respect of each financial year, and that statement shall be in such form and contain such information as the Department may direct and shall give a true and fair view of the state of the Governors' affairs at the end of the financial year and of the income and expenditure of the Governors in the financial year.

In preparing the accounts, the Accounting Officer is required to comply with the requirements of the Government Financial Reporting Manual and in particular to:

- observe the accounts direction issued by the Department of Finance, including the relevant accounting and disclosure requirements, and apply suitable accounting policies on a consistent basis;
- make judgements and estimates on a reasonable basis;
- state whether applicable accounting standards as set out in the Government Financial Reporting Manual have been followed, and disclose and explain any material departures in the accounts;
- prepare the accounts on a going concern basis; and
- confirm that the Annual Report and Accounts as a whole is fair, balanced and understandable and take personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

The Department for Communities has appointed Professor M.G. Burton as Accounting Officer of AOP. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding AOP's assets, are set out in Managing Public Money Northern Ireland.

Statement of Disclosure of Information to the Auditors

As the Accounting Officer, I have taken all the steps that I ought to have taken to make myself aware of any relevant audit information and to establish that Armagh Observatory and Planetarium's auditors are aware of that information. So far as I am aware, there is no relevant audit information of which the auditors are unaware.

Signed:



Professor Michael Burton
Accounting Officer for Armagh Observatory and Planetarium

Date: 12 November 2025

Governance Statement

AOP is a Non-Departmental Public Body established under The Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

1. Compliance with Corporate Governance Code

In 2013 the Department of Finance and Personnel published Corporate Governance in Central Government Departments: Code of Good Practice NI. The Code draws on best practice in the public, private and charity sectors by: reinforcing the importance of corporate governance as a pre-requisite to achieving good financial management; reflecting changes in governance best practice, including increased emphasis on good leadership; and promoting better governance arrangements within departmental families.

The Code is written for departments, concentrating throughout on key principles which will have wider application for other parts of the public sector. Such bodies (including arms-length bodies (ALBs)) are encouraged to consider and adopt the practices set out in the Code wherever it is relevant, practical and suits their business needs.

AOP in so far as they are relevant for an arms-length body, complies with the principles of good practice in the Corporate Governance Code.

2. Governance Framework

Accounting Officer

Name	Accounting Officer
Professor Michael Burton – Director and Chief Executive	From 1 September 2016 onwards

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one DfC nominee;
- one Queen's University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

During 2024-25, two new Members were appointed to the Chapter of the Church of Ireland Cathedral of Armagh and two Members retired; Professor Fitzsimmons' term of office was extended for a year to facilitate discussions regarding succession planning and Mr Wilson's term was extended for a 5-year term. There are currently two vacant positions.

BOARD OF GOVERNORS			
GOVERNOR	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 1)
Archbishop J McDowell (Chair)	28 April 2020	None	1
The Very Revd S Forster Dean of Armagh	14 February 2021	None	1
The Ven E Cairns Archdeacon of Ardboe	13 December 2020	None	0
The Ven Dr P Thompson Archdeacon of Armagh	13 January 2019	None	1
Revd Canon W M Adair BEM	10 September 2008	None	0
Revd Canon D Hilliard	13 March 2016	None	1
Revd Canon W B Paine	7 May 2017	31 July 2024 (Retired)	0
Revd Canon R J N Porteus	1998	31 March 2025 (Retired)	0
Revd Canon M Hagan MBE	23 April 2023	None	1
Revd Canon A Totten OBE (from 20 October 2024)	20 October 2024	None	0 from 0

Revd Canon Gary McMurray (from 20 October 2024)	20 October 2024	None	0 from 0
VACANT (from 31 July 2024)			
VACANT (from 1 April 2025)			
Professor A Fitzsimmons	18 April 2019	1 May 2025	1
Mr R Wilson OBE	1 December 2019	30 November 2029	1
Archbishop E Martin	1 January 2021	31 December 2025	1
Ms S Leslie	1 June 2021	31 May 2026	1
Mr G Cox	1 March 2021	28 February 2026	1

During the Annual Visitation on 7 May 2024 the Board of Governors:

- approved the Partnership Agreement between the Department for Communities and AOP;
- endorsed the continuing membership of Revd Canon Hagan and Messrs Cox and Wilson as its nominees on the Management Committee;
- approved the appointment of three co-optees to the Management Committee;
- approved changes to the Terms of Reference for the Board and Management Committee;
- considered a new Committee and delegation process and delegated authority to the Management Committee to take forward;
- appointed two Members to the Oversight Board of the Astronomical Observatories of Ireland;
- approved an updated draft Outline Business Case for AOP Redevelopment Project for submission to DfC.

The Chairs of the Management Committee and Audit and Risk Assurance Committees provided verbal reports to the Board and the minutes of both meetings between June 2023 and April 2024 (draft) were provided.

The Board retrospectively approved the Annual Report and Accounts 2022-23 and approved the draft Annual Report and Accounts 2023-24, delegating authority to the Management Committee to sign them off.

The Board noted the Management Report for 2023-24 which included the Director's Report and a presentation on Research Highlights; Corporate Plan Objectives; Key Performance Indicators; Corporate Risk Register as at 26 March 2024 and ICT Risk Register as at 26 March 2024.

The Board considered the Mid-Term Review of the Strategic Business Plan 2021-24 and delegated authority to the Management Committee to take forward and approve the Business Plan 2024-25.

The Board noted the Code of Conduct for Board Members which had been reviewed, with no changes.

The Board confirmed that it was satisfied that comprehensive arrangements were in place to ensure that high-quality information was received to enable it to make informed decisions. Internal controls were in place to validate the accuracy and completeness of information presented to the Board.

Minutes of the meeting record the business carried out and actions agreed.

Management Committee of Armagh Observatory and Planetarium

The Management Committee comprises:

- a Chair appointed through open competition;
- three nominees from the Board of Governors;
- six nominees from DfC;
- one nominee of the Queen's University Belfast (QUB);
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS); and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

During 2024-25, there were eight changes to the Membership of the Management Committee. Professor Harra and Mr Brown retired on 30 April 2024; Professor Hunter, Ms McVeigh and Mr O'Hara were appointed as DfC nominees to the Management Committee from 1 June 2024; Professor Cotter and Ms Leverment were appointed as Board of Governors' co-optees to the Management Committee on 1 October 2024 and Revd Canon Totten replaced Revd Canon Hagan as one of the Board of Governors' nominees to the Management Committee. During the year Mr Wilson appointment to the Management Committee was extended for a further 5 year term.

There are currently no vacancies on the Management Committee.

MANAGEMENT COMMITTEE			
MEMBER	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 6)
Mr J Briggs (Chair)	1 January 2018	31 December 2027	5
Professor L Harra	1 November 2014	30 April 2024	0 from 1
Mr S Brown	1 November 2014	30 April 2024	1 from 1
Professor M Mathioudakis	11 November 2016	10 November 2026	2
Mr R Wilson OBE	1 December 2019	30 November 2029	4
Dr C Jackman	1 January 2021	31 December 2025	3
Dr M Darnley	1 January 2021	31 December 2025	6
Mr P Kennedy	1 March 2021	28 February 2026	4
Dr K Lemon	1 March 2021	28 February 2026	5
Mr E Rooney	1 March 2021	28 February 2026	6
Mr G Cox	19 May 2021	28 February 2026	6
Revd Canon M Hagan MBE	17 May 2023	18 November 2024	2 from 3
Professor R Hunter	1 June 2024	31 May 2029	1 from 5
Ms G McVeigh	1 June 2024	31 May 2029	5 from 5
Mr R O'Hara	1 June 2024	31 May 2029	4 from 5
Professor G Cotter	1 October 2024	30 September 2027	3 from 3
Ms S Leverment	1 October 2024	30 September 2027	1 from 3
Revd Canon A Totten OBE	18 November 2024	NONE	2 from 3

In April 2024, the Management Committee approved a revised draft Partnership Agreement between DfC and AOP, signed by DfC Accounting Officer on 22 May 2024 and the draft 2024-25 Business Plan, which was subsequently approved by the Minister on 16 September 2024.

The Management Committee reviewed the Terms of Reference for both the Board of Governors and the Management Committee and approved their presentation to the Board of Governors. It also agreed that the ability to enable delegation to Sub-Committees be sought at the Board of Governors.

A two-day meeting took place in June 2024. In addition to routine business over the two days the Management Committee; held a session with staff; received presentations from PhD students; and undertook Boardroom training.

The Committee considered and was content with the summary of its annual Effectiveness Review in September 2023.

In September 2024, the Management Committee considered revised Committee Structure proposals and the draft Programme for Government.

At each of its meetings throughout the year the Committee received a report from the Director, a presentation from Research or Education, updates from each of its standing sub-committees and approved relevant reports. Regular governance reports such as the Bi-Annual Assurance Statement, the Corporate Risk Register, ICT Risk Register, Key Performance Indicators and Finance reports were reviewed and approved. The Committee considered and noted amendments to policies that had been reviewed in line with the policy review process and approved new policies as appropriate.

Throughout the year, the Management Committee also considered progress on AOP's Vision and redevelopment which included updates from the Redevelopment Sub-Committee / Strategic Oversight Committee.

Internal controls are in place to validate the accuracy and completeness of information presented to the Management Committee.

Minutes of the meetings record the business carried out and actions agreed.

Audit and Risk Assurance Committee

The Audit and Risk Assurance Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

During 2024-25 there were four changes to membership. Professor Harra and Mr Brown retired on 30 April 2024; Ms McVeigh was appointed from 24 June 2024 and Professor Darnley was appointed from 16 December 2024. Mr Kennedy was appointed Chair from June 2024.

AUDIT AND RISK ASSURANCE COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 5)
Mr S Brown Chair (to 30 April 2024)	1 from 1
Professor L Harra (to 30 April 2024)	0 from 1
Mr P Kennedy Chair (from June 2024)	4
Mr E Rooney	5
Dr K Lemon	1
Ms G McVeigh (from 24 June 2024)	3 from 3
Professor M Darnley (from 16 December 2024)	0 from 1

During 2024-25 the Audit and Risk Assurance Committee considered the Internal Audit Report 2023-24; Internal Audit Plan 2024-25; reports from Internal Audit on progress against the audit plan and on outstanding recommendations; ICT Strategy Action Plan Progress Reports; ICT Risk Register; Accounting Officer's Assurance Statements; Finance Reports; updated policies; Business Continuity; Annual Report and Accounts 2023-24 and the Report to Those Charged With Governance in respect of the 2023-24 Accounts.

A dedicated Risk Management Workshop was held on 21 October 2024.

The Committee is satisfied that the integrated approach, the frequency of meetings, the breadth of the business undertaken, the skills of Members and the range of attendees at meetings of the Committee has allowed the Committee to meet the governance requirements of the organisation and assisted the Management Committee to demonstrate its stewardship of the public resources with which it is charged.

The Committee is satisfied that the organisation has robust risk management arrangements in place which are in line with the good practice in the HM Treasury 'Orange Book' and are reviewed regularly by the Management Committee.

There were five Internal Audit recommendations outstanding from prior years, three of which have been completed during 2024-25. The Committee is satisfied that progress is being made to complete the remaining outstanding recommendations. There were 15 new internal audit recommendations identified during 2024-25, 11 of which have been implemented.

Minutes of the meetings record the business carried out and actions agreed.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members. A Special Meeting took place in September 2024 to consider SPRC's effectiveness.

During 2024-25 there were two changes to membership. Mr Brown retired on 30 April 2024 and Mr O'Hara was appointed from 24 June 2024.

STAFFING POLICY AND REMUNERATION COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 6)
Mr E Rooney (Chair)	6
Mr S Brown (to 30 April 2024)	1 from 1
Mr J Briggs	5
Dr K Lemon	4
Mr P Kennedy	4
Mr R O'Hara (from 24 June 2024)	3 from 4

In 2024-25, amongst other matters, the Committee considered:

- staffing and recruitment, including Skills Gaps Analysis and Strategic Workforce Planning;

- a range of Human Resources issues including progress against the Human Resources Strategy and Action Plan;
- staff and students surveys;
- updates to staff related policies, including Employers Pension Discretions Policy, Volunteer Policy, Attendance Management Policy and Performance Appraisal Policy; and
- updates against Diversity Mark actions, which included a commitment to develop an Equality, Diversity and Inclusion Strategy and the identification of a Diversity Champion.

Research and Education Advisory Committee

The Research and Education Advisory Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

During 2024-25 there were four changes to membership. Professor Harra (Chair) retired on 30 April 2024, Professor Hunter was appointed from 24 June 2024 and Professor G Cotter and Ms S Leverment were appointed to the Committee from 31 March 2025. Dr Lemon was appointed Chair from 1 May 2024.

RESEARCH AND EDUCATION ADVISORY COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 4)
Professor L Harra (Chair to 30 April 2024)	0 from 0
Professor M Darnley	4
Dr K Lemon (Chair from 1 May 2024)	4
Professor M Mathioudakis	3
Professor R Hunter (from 24 June 2024)	1 from 3
Professor G Cotter (from 31 March 2025)	0 from 0
Ms S Leverment (from 31 March 2025)	0 from 0

In 2024-25, amongst other matters, the Committee considered:

- education and outreach activities, including visitor reports and development of an Education Programme Strategy;
- research activities, including changes to the publication environment; PDRA Salaries; AOP Research Strategy; Intellectual Property matters; Concordat to Support the Career Development of Researchers; Policy on Academic Integrity in Research Code of Practice and Procedure; Research Excellence Framework (REF) updates;
- ICT needs; and
- funding opportunities.

A Local Organising Committee (LOC) comprising members from across AOP ensured the smooth delivery of one Conference held at the Planetarium in September 2024.

Redevelopment Sub-Committee

The Redevelopment Sub-Committee's membership is drawn from the Management Committee and comprises of six members.

REDEVELOPMENT SUB-COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 2)
Mr S Brown (Chair)	2
Mr J Briggs	1
Mr G Cox	0
Mr P Kennedy	2
Dr K Lemon	0
Mr E Rooney	2

The primary purpose of the Sub-Committee was to drive the AOP's Redevelopment Project and oversee the delivery of the outcomes and benefits, most notably initially an Outline Business Case (OBC), which was submitted to DfC on 1 June 2023.

The Redevelopment Sub-Committee met twice and considered a range of issues associated with project governance including the funding applications; planning / design issues; stakeholder engagement; risks and opportunities; programme / key milestones; project board structures and procurement of design team options.

All members of the Management Committee were invited to attend its last meeting which took place on Wednesday 11 September 2024 and Revd Canon Hagan, Mr Wilson, Professor Darnley, Professor Mathioudakis, Mr O'Hara and Professor Hunter did so.

The 'task and finish' Sub-Committee was intended to continue until the OBC was approved, however, it was replaced by a Strategic Oversight Committee which first met in June 2024.

Strategic Oversight Committee

The Strategic Oversight Committee's membership is drawn from the Management Committee and comprises 9 members.

STRATEGIC OVERSIGHT COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 6)
Mr J Briggs	4
Professor M Burton	6
Mr G Cox	4
Mr P Kennedy	5
Dr K Lemon	3
Mr R O'Hara	5
Mr E Rooney	6
Mr R Wilson	5
Ms G McVeigh (from 10 December 2024)	3 from 3

As outlined in the draft Terms of Reference, the purpose of the Strategic Oversight Committee (SOC) is to oversee all strands of AOP activity during the development phase of the redevelopment project to ensure there is a focus and consistency of approach towards achieving the organisation's objectives. It is intended to be more agile than the quarterly Management Committee meetings, with delegated authority to make decisions in relation to operations issues consistent with the shared vision. The Committee will also oversee the work of the Project Board for AOP development.

In 2024-25, amongst other matters, the Committee considered:

- governance matters including draft Terms of Reference; programme of meetings; core agenda items and staffing structure changes;
- redevelopment project matters including - proposals for establishment of a Project Board and design team procurement; funding matters;
- stakeholder engagement;
- draft Programme for Government (PfG) Consultation response;
- updates relating to Astronomical Observatories of Ireland;
- organisational review; and
- 2025-26 budget.

Finance Sub-Committee

An interim **task and finish** Finance Sub-Committee was established in December 2023 to consider the potential budget constraints faced for 2024-25 and possible actions to be taken. It last met in May 2024, culminating in a letter from the Accounting Officer to the DfC Permanent Secretary setting out identified savings and inescapable costs.

Conflicts of Interest

The organisation maintains a register of interests to ensure that potential conflicts of interest can be identified and addressed in advance of Board, Management Committee and other Committee discussions. The register is formally revisited on an annual basis. Where conflicts exist, they are recorded in the Committee minutes and the Chair of the meeting decides the most appropriate way of managing the conflict. This may include that member not taking part in discussions or making decisions on certain matters or being excluded for part or all of that meeting.

The Register of Interests for Board of Governors, Management Committee and senior staff is published on the AOP website in accordance with central government guidance.

Directors and Secretary

Professor Michael Burton is Director and Chief Executive of AOP.

The Corporate Manager provides a range of secretarial support services to the Board of Governors, Management Committee, Audit and Risk Assurance Committee and Strategic Oversight Committee; the HR and Policy Officer provides secretarial support to the Staffing Policy and Remuneration Committee and Executive Officers to the Research and Education Advisory Committee and Redevelopment Sub-Committee.

3. Business Planning and Risk Management

Business Planning

'Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.'

'Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.'

The pillars that support us are – Knowledge, Legacy, People and Engagement.

The five-year strategy is built around four strategic themes - Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

The Strategic Plan aligns closely with the aims and objectives of the Observatory and Planetarium's sponsor - the Department for Communities (DfC) – and with the broader aims and objectives of the Northern Ireland Executive's Programme for Government. The organisation's Strategic Plan 2021-26 received Departmental approval on 17 August 2021.

The work of the Observatory encompasses both internationally acclaimed research and a unique cultural heritage — scientific, historical, architectural — as well as maintaining the unique daily climate series (the longest daily series from a single site in the UK and Ireland) and undertaking a world-class programme of science in the community, which complements the Planetarium's main business of education.

The Planetarium's main business is education, and all age and social groups are welcome to visit. The educational programmes and demonstrations are designed to include participation by children of pre-nursery age up to senior citizens and all age groups in between. The primary educational aim of the Planetarium is to endorse and promote the Science, Technology, Engineering, Arts and Mathematics (STEAM) agenda which promotes scientific careers to young people. All of the ancillary activities support the primary aim, with the additional target of offering excellent value for money, both to the visitors taking part and to the public purse. The Planetarium maintains a focus on being inclusive so that all children can enjoy the Planetarium experience.

Full details of all the Observatory and Planetarium's activities are provided in comprehensive Annual Reports which are available online at: www.armagh.space.

No Ministerial Directions have been given regarding the work of AOP during 2024-25.

Risk Management

Risk Management is an essential element of AOP's corporate governance framework and is closely linked to the system of internal control and business planning process. HM Treasury Orange Book establishes the concept of risk management and provides a basic introduction to its concepts, development and implementation of risk management process in government organisations. A robust risk management process assists AOP in identifying and managing issues which may hinder the achievement of objectives. The arrangements are regularly reviewed.

As well as ensuring that there is an effective system in place to deal with threats to AOP's aims and objectives, the organisation encourages a proactive approach to innovation and well-managed risk taking where there is potential to realise sustainable improvements in the organisation's research and educational services. For this reason, the organisation's Risk Appetite is 'Open'.

The Management Committee sets the risk appetite for AOP. The Accounting Officer, Senior Management Team and other staff are responsible for ensuring that residual risks are reduced to a level as low as reasonably practicable and wherever possible consistent with the level of risk appetite established by the Management Committee.

Updates are provided to the Audit and Risk Assurance Committee on the development and implementation of the risk management process across AOP. The Audit and Risk Assurance Committee provides the Accounting Officer with objective advice on issues concerning the risk, control and governance of the organisation and the associated assurances. An update on the main points considered by the Audit and Risk Assurance Committee is provided to the Management Committee following each meeting and the Management Committee has access to all papers for the Audit and Risk Assurance Committee.

4. Fraud and Information Risk

The Accounting Officer has overall responsibility for managing the risk of fraud including:

- developing a fraud risk profile and undertaking a regular review of the fraud risks associated with each of the key organisational objectives in order to keep the profile current;
- establishing an effective fraud prevention policy and fraud response plan, commensurate with the level of fraud risk identified in the fraud risk profile;
- designing an effective control environment to prevent fraud commensurate with the fraud risk profile;
- operating appropriate pre-employment screening measures;
- establishing appropriate mechanisms for reporting fraud risk issues, reporting significant incidents of fraud, and coordinating assurances about the effectiveness of fraud prevention policies to support the Governance Statement;
- liaising with the Audit and Risk Assurance Committee;
- ensuring that all staff are aware of the organisation's fraud prevention policy and know what their responsibilities are in relation to combating fraud;
- ensuring fraud awareness training is provided as appropriate and, if necessary, more specific fraud prevention training and development is provided to relevant staff;
- ensuring that vigorous and prompt investigations are carried out if fraud occurs, is attempted or is suspected by the establishment of a Fraud Investigation Oversight Group;
- ensuring, where appropriate, legal and/or disciplinary action against perpetrators of fraud;
- ensuring, where appropriate, disciplinary action against supervisors where supervisory failures have contributed to the commission of fraud;
- ensuring, where appropriate, disciplinary action against staff who fail to report fraud;
- taking appropriate action to recover assets and losses;
- ensuring that appropriate action is taken to minimise the risk of similar frauds occurring in future; and
- ensuring that an anti-fraud culture is promoted throughout the organisation in line with the seven Nolan Principles of Public Life.

Risks to data and information held by the organisation are owned and managed by individuals designated as information asset owners. The Corporate Policy and HR Officer responds to requests for information under the Data Protection and Freedom of Information Acts following consultation with the Accounting Officer and the organisation's governing Committees, as appropriate.

AOP operates a Whistleblowing Policy which informs all members of the organisation of the standards of behaviour expected of them in carrying out their duties, and to provide information on the procedures to follow if a situation arises in which they are required to act in a way which is believed by them to be illegal, improper, or in breach of the Nolan Principles.

5. Governance and Accountability

AOP seeks to achieve excellence in good governance, in particular the precepts: (1) leadership; (2) effectiveness; (3) accountability and (4) sustainability.

The Chair of the Board of Governors has a particular leadership responsibility for securing the sustainability and vitality of the organisation in the long term; giving advice and direction in formulating AOP's forward look and overall strategy; ensuring that account is taken of guidance provided by the Minister or the Department; promoting the efficient and effective use of staff and other resources; encouraging high standards of probity amongst staff and Board and Committee members alike; and ensuring that the Board and its Committees meet at regular intervals throughout the year and that the Minutes of meetings accurately record the decisions taken and, where appropriate, the views of individual Board members.

Within AOP, the Director, supported by his Senior Management team, has responsibility for the management and effective operation of their organisation. Their operational responsibilities include:

- developing, implementing and monitoring the strategic and operational plans;

- undertaking financial management and Accounting Officer responsibilities;
- managing and developing a team of highly qualified professional and administrative staff;
- identifying and attracting sources of external income;
- promoting their respective organisations in relevant local, national and international arenas; and
- promoting Public Understanding of Science with the objective of improving the level of scientific literacy in the community and to ensure a strong link with government policy and the STEM agenda.

Members of the Board of Governors and of the Management Committee and their various Sub Committees exercise an effective challenge function on the leadership team in accordance with their respective roles in the organisation. They also provide guidance and advice on strategic and operational matters such as Human Resource issues, accountability and relationships with stakeholders.

The members of these Committees are drawn from a very wide community background within, and beyond, Northern Ireland, and provide the organisation with a correspondingly wide range of expert knowledge and advice. All the Committees of AOP operate with full transparency and accountability, and over the last year have proved effective in the discharge of their duties and responsibilities.

It was agreed by the Board of Governors and the Management Committee that the governance arrangements in place removed the need for the current Board of Governors to complete an internal self-assessment of its effectiveness.

The Board of Governors and supporting Committees receive assurances from the Director and his Senior Management Team and Internal Audit that the governance and accountability processes are being managed effectively.

During 2024-25 two members of the Senior Management Team – the Head of Corporate Services and the Head of Finance and Income Generation – tendered their resignations with effect from 30 April 2025 and 31 May 2025 respectively. The two positions have temporarily been combined into the post of Interim Head of Finance and Corporate Services pending a permanent appointment in due course.

6. Sources of Independent Assurance

Internal Audit

CavanaghKelly was reappointed as Internal Auditors for the 3 years 2023-24 – 2025-26 using CPD as the Centre of Procurement Expertise. Their work was carried out in accordance with the Public Sector Internal Audit Standards.

The three year Audit Strategy was approved by the Audit and Risk Assurance Committee in June 2023.

During 2024-25 the Audit and Risk Assurance Committee considered reports on the following areas:

Audit Assignment	Assurance Rating
IT Systems and Security	Satisfactory
Human Resource Management	Satisfactory
Financial – Income & Procurement	Satisfactory
Internal Audit Follow Up 2024-25	N/A

An overall satisfactory internal audit assurance opinion has been provided.

External Audit

The Comptroller and Auditor General (C&AG) is required to audit the financial statements under *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. The C&AG is responsible for reporting whether in her opinion the financial statements give a true and fair view and whether they and the part of the Remuneration Report to be audited have been properly prepared in accordance with the Order and DfC directions made thereunder and applicable law and United Kingdom accounting standards. The C&AG is required to report whether, in her opinion, in light of the knowledge and understanding of AOP and its environment obtained in the course of the audit, she has identified any material misstatements in the Trustees' Annual Report and whether the information which comprises the Statement of the Responsibilities of the Governors and Accounting Officers and Governance Statement, as included within the Annual Report, is consistent with the financial statements. She also reports on whether, in her opinion, in all material respects, the expenditure and income presented in the financial statements have been applied

to the purposes intended by the Assembly and whether the financial transactions conform to the authorities which govern them.

A representative from the Northern Ireland Audit Office is invited to all Audit and Risk Assurance Committee meetings.

7. Review of the Effectiveness of the System of Internal Governance

The system of internal governance is designed to manage risk to a reasonable level, rather than to eliminate all risk of failure to achieve certain policies, aims and objectives; it can therefore only provide reasonable and not absolute assurance of effectiveness. The system of internal governance is based on an ongoing process designed to identify and prioritise risks to the achievement of the AOP policies, aims and objectives; to assess the likelihood of the events occurring and the impact should they be realised; and to manage the risks effectively, efficiently and economically. The system of internal governance has been in place in AOP for the year ended 31 March 2025 and up to the date of approval of the annual accounts, and accords with Department of Finance guidance.

As previously detailed in Section 2, the responsibilities of the Accounting Officer include the need to maintain a sound system of internal control which supports the achievement of the organisation's policies, aims and objectives. The review of the effectiveness of the system of internal governance has been informed by the assurances provided by relevant parties such as: Internal Audit and the Senior Management Team. Where weaknesses have been identified these have been promptly drawn, through normal reporting mechanisms, to the attention of the Audit and Risk Assurance Committee, Management Committee and/or Board of Governors, as appropriate.

The main procedures in place to monitor the effectiveness of the system of internal governance are as follows:

- ongoing independent assessment of the Observatory's research outputs;
- regular reports by financial staff on progress against principal financial targets and the projected financial outcome for the year and progress reports by staff responsible for major projects;
- detailed progress reports to the Management Committee and Board of Governors at their regular meetings and inclusion of performance measures and results against targets in the annual operating plan;
- annual reports on the system of internal control from internal auditors to the Audit and Risk Assurance Committee;
- regular Partnership meetings with officials from the Sponsor Department to consider operational and strategic issues and matters relating to the system of internal control;
- Bi-Annual Assurance Statements submitted to the Sponsor Department;
- periodic review of the AOP Risk Register by the Audit and Risk Assurance Committee, the Management Committee, the Accounting Officer and Senior Management Team and the Sponsor Department;
- continuous assessment of the quality of research through peer review of grant applications, applications for telescope time, and the submission of scientific papers to academic journals of international standing by AOP staff and students;
- peer review of the research quality, capability and output of the Observatory, and through participation in an objective external Assurance Committee, which provide an opinion on the adequacy and effectiveness of the system and contain recommendations for improvement; and
- annual reports from Northern Ireland Audit Office to the Audit and Risk Assurance Committee, the Management Committee and the Board of Governors on the Annual Report and Accounts, providing an opinion on the state of affairs of the organisation and its total incoming resources and expenditure of resources.

All reports based on the internal and external audits include opinions on the adequacy and effectiveness of risk management and the control framework in place. These matters are considered by the Audit and Risk Assurance Committee and are reported by the Audit and Risk Assurance Committee Chair to the Management Committee and the Board of Governors.

Weaknesses identified in AOP's control systems and internal governance are set out within the next section. Upon identification, plans were immediately put into place to address these issues.

8. Internal Governance Divergences

Update on Prior Years:

There are currently two outstanding internal audit recommendations from prior years, which are still being implemented, namely Education and Outreach activities - educational programme, a new target date set of December 2025; and Health and Safety where the risk management policy was to be updated to include the new risk assessment template – this has now been completed.

Identification of New Issues:

Of the new issues identified by internal audit during 2024/25 there remain four outstanding recommendations – two that are being implemented and two that have not yet reached the implementation date.

During its audit for 2024-25, NIAO identified no priority 1 issues to be addressed by management in their areas of responsibility. Only 1 priority 3 issue was raised.

Recommendation	Priority	Status
Our testing identified one declaration of interest which had not been completed by a member of the Management Committee. We understand that AOP remind members of the Board of Governors and Management Committee of the policy in respect of Conflicts of Interest and follow up on declarations which are not returned by members. This matter was also raised as a finding in the prior year Report to Those Charged with Governance. We recommend that AOP remind members of the Board of Governors and Management Committee of the importance of completing declarations of interest forms on an annual basis and submitting these for records.	3	Requests for members of the Board of Governors and members of the Management Committee to declare conflicts of interest were sent on 09 April 2025, and reminders again on 12 June 2025 and 27 June 2025. Declarations were not received from three members of the Board of Governors or Management Committee during the period ended 31 March 2025, but who had all resigned by 15 August 2025.

9. Conclusion

AOP has an effective governance structure and is operating to a high standard of integrity and probity. In signing this report, I have taken assurances, where available, from the Audit and Risk Assurance Committee and I will continue to monitor the Internal Audit and Northern Ireland Audit Office recommendations to ensure that all issues are appropriately addressed.

To the best of my knowledge this report provides a fair and accurate reflection of the business of AOP and of the status of the controls and checks that have been put in place to regulate and inform the organisation's committees.


Signed:

Date: 12 November 2025

Professor Michael Burton
Accounting Officer
Armagh Observatory and Planetarium

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Zhang H., et al., inc. **Sarzi M.**, 2025, WISDOM Project - XXII. A 5 per cent precision CO-dynamical supermassive black hole mass measurement in the galaxy NGC 383, Monthly Notices Royal Astronomical Society, 537, 520, doi:10.1093/mnras/staf055, <https://ui.adsabs.harvard.edu/abs/2025MNRAS.537..520Z>

Armagh Observatory and Planetarium

Non Refereed Journal Publications: April 2024 – March 2025

Burton, M & Mackle, S., 2024, Teaching Secondary School Physics in the Planetarium Dome, in The International Planetarium Society 2024 Conference Proceedings, Stiftung Planetarium Berlin, 18-25 July 2024, Editor S Mitchell. URL <https://www.ips-planetarium.org/page/proceedings>

Christou A., Gritsevich M., 2024, in European Planetary Science Congress. Characterising the meteoroid environment at 0.7 au from the sun with a Venus-orbiting meteor camera: a feasibility study. pp EPSC2024–204, doi:10.5194/epsc2024-204

Dyer M. J., et al., inc. **Ramsay G.**, 2024, in Marshall H. K., Spyromilio J., Usuda T., eds, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series Vol. 13094, Ground-based and Airborne Telescopes X. The Gravitational-wave Optical Transient Observer (GOTO). p. 130941X (arXiv:2407.17176), doi:10.1117/12.3018305

Gray Z., 2024, in European Planetary Science Congress. Double Trouble: Polarimetric Insights into the Didymos-Dimorphos post-DART Evolution. pp EPSC2024–458, doi:10.5194/epsc2024-458

Humpage A., Christou A., 2024, in European Planetary Science Congress. A Numerical Study of Near-Earth Asteroid Family Orbital Dispersion. pp EPSC2024–910, doi:10.5194/epsc2024-910

Joo A. P., **Eden D.**, Tóth L. V., 2024, in IAU General Assembly. Pre- and protostellar cores in the 200 brightest Planck compact sources. p. 2397

Khamrat S., et al., inc. **Ramsay G.**, 2024, in Lee H. W., Chang S. J., Leung K. C., eds, Astronomical Society of the Pacific Conference Series Vol. 536, The Twelfth Pacific Rim Conference on Stellar Astrophysics. Galactic Novae in the GOTO Database. p. 35

Kolokolova L., Markkanen J., Ludet Q., Ivanova O., **Gray Z.**, Opitom C., 2024, in European Planetary Science Congress. Characterizing the dust in active asteroids by modeling their photometric and polarimetric images. pp EPSC2024–567, doi:10.5194/epsc2024-567

Mandl L., **Christou A.**, Windisch A., 2024, in EGU General Assembly Conference Abstracts. A machine learning approach to meteor light curve analysis, EGU General Assembly Conference Abstracts. p. 21463, doi:10.5194/egusphere-egu24-21463

Marshall-Lee A., Delbo M., **Christou A.**, Deienno R., Walsh K., 2024, in European Planetary Science Congress. The Efficiency of the Hierarchical Clustering Method. pp EPSC2024–980, doi:10.5194/epsc2024-980

McMahon M., 2025, The Imagined Planetarium, History Armagh, 5(4)

Mugrauer M., Michel K.-U., **Schlagenhauf S.**, Ginski C., 2024, in EAS2024, European Astronomical Society Annual Meeting. The impact of stellar multiplicity on the formation and evolution of planets. p. 715

O'Neill D., et al., inc. **Ramsay G.**, 2024, in Benn C. R., Chrysostomou A., Storrie-Lombardi L. J., eds, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series Vol. 13098, Observatory Operations: Strategies, Processes, and Systems X. GERry: A code to optimise the hunt for the electromagnetic counter-parts to gravitational wave events. p. 1309818 (arXiv:2407.18642), doi:10.1117/12.3018319

Penttilä A., Muinonen K., Granvik M., **Gray Z.**, **Bagnulo S.**, Kolokolova L., Moreno F., 2024, in European Planetary Science Congress. Modeling linear polarization of the Didymos-Dimorphos system before and after the DART impact. pp EPSC2024–301, doi:10.5194/epsc2024-301

Rebolledo D., Green A., **Burton M.**, Garay G., 2024, in IAU General Assembly. A resolved view of the impact of massive star formation in the atomic, molecular and ionized gas in the Carina Nebula. p. 1878

Schipani P., et al., inc. **Bagnulo S.**, 2024, in Bryant J. J., Motohara K., Vernet J. R. D., eds, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series Vol. 13096, Ground-based and Airborne Instrumentation for Astronomy X. VSTPOL: making the VST a large survey telescope for optical polarimetry. p. 130967L, doi:10.1117/12.3019695

Winch E., Vink J., Higgins E., Sabhahit G., 2024, in IAU General Assembly. Predictions for the Maximum Masses of Black Holes below the PI Boundary. p. 1014

During the reporting year, G Ramsay published many reports related to the discovery of transients, and is directly related to his work on the GOTO and BlackGem projects. The Transient Name Server (TNS) is an IAU supported service which reports newly discovered extragalactic transients. He led or was co-I on 1093 TNS Discovery Reports and 8 TNS AstroNotes. In addition, he led or was co-I on 34 GRB Coordinates Network Circular Service (GCNs), which report the results of optical followup of Gravitational Wave and Gamma-ray Burst events.

Books and Other Publications Not Listed Above: April 2024 – March 2025

McMahon M., Raposo P.M.P., Smail M., Boyce-Jacino K., (eds), 2025, 100 Years of Planetaria: 100 Stories of People, Places, and Devices. Springer.

Features contributions from Michael Burton, Heather Alexander, Terence Murtagh, Arjun Chawla and Kerem Çubuk

Armagh Observatory and Planetarium Presentations: April 2024 – March 2025

Date	AOP Speaker	Title	Location/Mode	Category
04 Apr 2024	J. Landstreet	Magnetic White Dwarfs — An Unfinished Story	Colloquium, Department of Physics and Astronomy, University of Western Ontario, London, Ontario, Canada	Research
08 Apr 2024	S. Bagnulo	Night Time Astronomy with Sunglasses	Northern Ireland Amateur Astronomy Society, Ballyclare, Co. Antrim	Outreach
17 Apr 2024	A. Christou	Mercury vs the Taurids: A Continuing Saga	Department Seminar, Meteor Physics Group, University of Western Ontario, London ON, Canada	Research
24 Apr 2024	M. McMahon	PhD at a Museum	QUB/Ulster Museum Meeting, Belfast, Co. Antrim	Outreach
25 Apr 2024	D. Eden	MAJORS: First Results from W49	Raising the Veil on Star Formation: Near and Far Conference, Cambridge, England	Research
30 Apr 2024	K. Trakakis	Determining the Physical Conditions of the Interstellar Medium and the Structure of the Milky Way Galaxy	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Co. Armagh	Research
07 May 2024	A. Chawla	Astrophysical Data Visualisation	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Co. Armagh	Research
07 May 2024	K. Çubuk	Our Wee Planet and the Size of the Universe	Slemish College, Ballymena, Co. Antrim	Outreach
07 May 2024	K. Çubuk	Our Wee Planet and the Size of the Universe	St. Patrick's College, Ballymena, Co. Antrim	Outreach
07 May 2024	K. Çubuk	Our Wee Planet and the Size of the Universe	Castle Tower School, Ballymena, Co. Antrim	Outreach
07 May 2024	A. Philip Monai	Groups in SALT Data	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Co. Armagh	Research
18 May 2024	S. Bagnulo	Auroral Phenomena and Metal Scars at the Surface of White Dwarfs	Irish Astronomical Association 50th Anniversary Event at the Armagh Planetarium, Co. Armagh	Outreach
22 May 2024	M. Burton	A Short History of Armagh Observatory	Glasgow Philosophical Society Visit, Armagh Planetarium, Co. Armagh	Internal Outreach
22 May 2024	D. Eden	What Causes Stars to Form?	Seminar, University of Hertfordshire, Hatfield, England	Research
23 May 2024	C.S. Jeffery	The SALT / GAIA Survey of Hydrogen-Deficient Hot Subdwarfs.	The 3rd LAMOST-Kepler/TESS Workshop, Beijing Normal University, Beijing, China	Research
23 May 2024	A. Philip Monai	Unsupervised Approach to Spectral Classification of Hot Subdwarfs	The 3rd LAMOST-Kepler/TESS Workshop, Beijing Normal University, Beijing, China	Research
24 May 2024	C.S. Jeffery	Synergies Between Ground-based Spectroscopic Surveys and Space-based Photometric Missions	The 3rd LAMOST-Kepler/TESS Workshop, Beijing Normal University, Beijing, China	Research
24 May 2024	C.S. Jeffery	Theoretical Models for Blue Large Amplitude Pulsators	Stellar Physics Group, Beijing Normal University, Beijing, China	Research
29 May 2024	K. Trakakis	Where Could the Aliens Be?	PhD Day at Armagh Planetarium, Co. Armagh	Outreach
07 Jun 2024	K. Çubuk	Our Wee Planet and the Size of the Universe	ASE Conference, Teacher CPD Session, W5, Belfast, Co. Antrim	Outreach
10 Jun 2024	S. Schlagenhauf	S-PLUS MUSE - STARLIGHT and Revelations on Star Formation History of NGC 1436	S-PLUS Collaboration Meeting, Instituto de Astronomia, Geofísica e Ciências Atmosféricas, University of São Paulo, Rio de Janeiro, Brazil (online)	Research
12 Jun 2024	D. Eden	MAJORS: First Results from W40	JCMT Users' Meeting 2024, Kuala Lumpur, Malaysia	Research
19 Jun 2024	A. Marshall-Lee	Re-writing the HCM as a Neural Network	British Planetary Science Conference, Leicester, England	Research

Date	AOP Speaker	Title	Location/Mode	Category
21 Jun 2024	J.S. Vink	What is New with Black Holes	Astrobytes, Armagh Observatory and Planetarium, Co. Armagh	Internal Outreach
24 Jun 2024	M. Burton	Armagh 2031 – 250 Years Since the Discovery of Uranus	AOP Board Dinner, Armagh Planetarium, Co. Armagh	Internal Outreach
03 Jul 2024	J.S. Vink	XShootU Science Goals	XShootU III Collaboration Meeting, KU Leuven, Belgium	Research
08 Jul 2024	J.S. Vink	50 Years of CAK	Stanfest, Fundamentals of Stellar Outflows: Celebrating and Amplifying the Scientific Life of Stan Owocki, Leuven, Belgium	Research
16 Jul 2024	D. Eden	Galactic Plane Star Formation with the JCMT	National Astronomical Meeting 2024, Hull, England	Research
17 Jul 2024	A. Philip Monai	Unsupervised Approach to Spectral Classification of Hot Subdwarfs	Poster Presentation, STFC School on Data Intensive Science 2024, University of Liverpool/Liverpool John Moores University, Liverpool, England	Research
18 Jul 2024	K. Trakakis	How to be a Star - Everything You Need to Know	Space to Learn Summer Camp, Armagh Observatory and Planetarium, Co. Armagh	Outreach
23 Jul 2024	S. Schlagenhauf	Update on S-PLUS MUSE - STARLIGHT and Revelations on Star Formation History	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Co. Armagh	Internal Outreach
25 Jul 2024	M. Burton with S. Mackle	Teaching Secondary School Physics in the Planetarium Dome	International Planetarium Society Conference, Grosse-Planetarium Berlin, Germany	Teaching/Research
08 Aug 2024	J.S. Vink	Very Massive Stars and N-emitting Galaxies	International Astronomical Union General Assembly, Cape Town, South Africa (online)	Research
09 Aug 2024	M. Burton	World Heritage and Astronomy	International Astronomical Union General Assembly, Cape Town, South Africa	Research
09 Aug 2024	J.S. Vink	X-Shooting Ulysses: Massive Stars at Low Z	International Astronomical Union General Assembly, DIV G, Cape Town, South Africa (online)	Research
23 Aug 2024	C.S. Jeffery	The Analysis of Stellar Spectra (3 Lectures)	ICESUN Summer School 2024: Stellar Explosions and Related Objects, Yunnan Observatory, Kunming, China	Teaching
27 Aug 2024	C.J. Bulter	Trends and Cycles in the Armagh Observatory Meteorological Series	Session Historical Climatology, 35th International Geographical Congress, 2024, Dublin, Co. Dublin, Ireland	Research
27 Aug 2024	C.S. Jeffery	The Populations and Products of Merging Double White Dwarfs	The Progenitors of Supernovae and their Explosions Conference, Dali, China	Research
28 Aug 2024	K. Trakakis	Determining the Physical Conditions of the Interstellar Medium and the Structure of the Milky Way Galaxy	Poster Presentation, Irish National Astronomy Meeting (INAM), University of Galway, Co. Galway, Ireland	Research
29 Aug 2024	A. Philip Monai	Unsupervised Approach to Spectral Classification of Hot Subdwarfs	Poster Presentation, Irish National Astronomy Meeting (INAM), University of Galway, Co. Galway, Ireland	Research
30 Aug 2024	A. Chawla	Astrophysical Data Visualisation	Online Talk at Irish National Astronomy Meeting (INAM), University of Galway, Co. Galway, Ireland	Research
30 Aug 2024	S. Schlagenhauf	S-PLUS MUSE - STARLIGHT and Revelations on Star Formation History	Irish National Astronomy Meeting (INAM), University of Galway, Co. Galway, Ireland	Research
02 Sep 2024	J.S. Vink	Carbon from Massive Star Winds	Carbon in Universe Workshop, Tokyo, Japan (online)	Research
04 Sep 2024	M. Burton	A Celebration of the Career of Tom Ray	After Dinner Speech, Jets and Beyond Conference, Knockranny House Hotel, Westport, Co. Mayo, Ireland	Outreach

Date	AOP Speaker	Title	Location/Mode	Category
09 Sep 2024	A. Marshall-Lee	Characterising the Efficiency of the Hierarchical Clustering Method	European Planetary Science Congress, Freie Universität Berlin, Germany	Research
10 Sep 2024	M.E. Bailey	Armagh Observatory - Societal Impacts and Longterm Climate Archive	Aughnacloy Historical Society, Aughnacloy, Co. Tyrone	Outreach
13 Sep 2024	A. Christou	Characterising the Meteoroid Environment at 0.7 au from the Sun with a Venus-orbiting Meteor Camera: A Feasibility Study	Europlanet Science Congress 2024, Berlin, Germany (virtual)	Research
17 Sep 2024	D. Eden	MAJORS: First Results from W40	UK Galactic Star Formation Workshop 2024, Armagh Observatory and Planetarium, Armagh, Co. Armagh	Research
18 Sep 2024	M. Sarzi	The Scientific Power of IFS Observations	Irish Astronomical Association Seminar, Queen's University Belfast, Co. Antrim	Outreach
18 Sep 2024	K. Trakakis	Determining the Physical Conditions of the Interstellar Medium and the Structure of the Milky Way Galaxy	UK Galactic Star Formation Workshop 2024, Armagh Observatory and Planetarium, Co. Armagh	Research
20 Sep 2024	A. Marshall-Lee	Protecting Ireland's Dark Skies for Future Generations	Culture Night, Wild Nephin National Park, Ballycroy Visitor Centre, Ballycroy, Co. Mayo, Ireland	Outreach
20 Sep 2024	S. Schlagenhauf	Showcase on the Importance of Dark Skies with a Mobile Planetarium	Culture Night, Wild Nephin National Park, Ballycroy Visitor Centre, Ballycroy, Co. Mayo, Ireland	Outreach
24 Sep 2024	M. Burton with M. McMahon	A History of the Armagh Planetarium	Designing a Planetarium Workshop, Armagh Planetarium, Co. Armagh	Education
25 Sep 2024	G. Ramsay	Stellar Activity and the Digital Telescope	Royal Astronomical Society, London, England	Research
25 Sep 2024	G. Ramsay	Galactic Transients and the Digital Telescope	Royal Astronomical Society, London, England	Research
02 Oct 2024	J.S. Vink	The Heaviest Black Holes in the Universe	Irish Astronomical Association Seminar, Queen's University Belfast, Co. Antrim	Outreach
04 Oct 2024	M. Burton	Armagh Observatory	Alliance of Historic Observatories, Specola Vaticana, Vatican	Research/ Education/ Outreach
04 Oct 2024	K. Trakakis	The Universe - A Journey Through Time	Stargazing Evening, Armagh Planetarium, Co. Armagh	Outreach
07 Oct 2024	M.E. Bailey	Giant Comets and Their Impacts Through Time: The Most Recent Giant Comet and its Impact on Civilization	Causeway U3A, Portstewart, Co. Antrim	Outreach
08 Oct 2024	A. Chawla	HI for a Simulated Galaxy Using TNG-50	Seminar, Meerkat Fornax Group, INAF, Osservatorio Astronomico di Capodimonte, Naples, Italy	Research
08 Oct 2024	M. McMahon	The History of Astronomical Observatories in Ireland	Craigavon Historical Society, Co. Armagh	Outreach
10 Oct 2024	J.S. Vink	How Massive is the Most Massive Star	Seminar, Armagh Observatory and Planetarium, Co. Armagh	Research
05 Oct 2024	J.S. Vink	The B Supergiant Problem and the Main Sequence Width	Hot Stars with Dust Conference, Almaty, Kazakhstan	Research
17 Oct 2024	S. Bagnulo	Strong Magnetic Fields of Old White Dwarfs are Symmetric about the Stellar Rotation Axes	Seminar, Armagh Observatory and Planetarium, Co. Armagh	Research
26 Oct 2024	S. Bagnulo	The Magnetic Field of Isolated White Dwarfs	ESO, Santiago, Chile	Research

Date	AOP Speaker	Title	Location/Mode	Category
30 Oct 2024	G. Ramsay	Hunting for the Optical Counterparts of GW Events Using GOTO and BlackGem	Irish Astronomical Association Seminar, Queen's University Belfast, Co. Antrim	Outreach
31 Oct 2024	G. Ramsay	Searching for the Optical Counterpart of Gravitational Wave Events Using GOTO and BlackGem	Seminar, Armagh Observatory and Planetarium, Co. Armagh	Research
01 Nov 2024	A. Philip Monai	Visualising the Universe	DVL, Armagh Planetarium, Co. Armagh	Outreach
13 Nov 2024	J.S. Vink	How Massive is the Most Massive Star	Seminar, Liverpool John Moores University, Liverpool, England	Research
21 Nov 2024	M. Burton	From the Discovery of Uranus to the Astronomical Observatories of Ireland: An Astronomical Adventure Story	Herschel Society, Bath Royal Literary and Scientific Institution, Bath, England	Outreach
11 Dec 2024	M. McMahon	The Exhibited Planetarium	Seminar, Science and Culture Research Group, Queen's University Belfast, Co. Antrim	Research
16 Dec 2024	K. Çubuk	Unlocking New Opportunities for Visibility and Growth	Management Committee Meeting, Armagh Observatory and Planetarium, Co. Armagh	Internal Outreach
16 Dec 2024	J.S. Vink	The Search for the First Stars	Management Committee Meeting, Armagh Observatory and Planetarium, Co. Armagh	Internal Outreach
14 Jan 2025	J.S. Vink	The Heaviest Stars and Black Holes in the Universe	Seminar, Institut de Ciències del Cosmos, Universitat de Barcelona, Spain	Research
16 Jan 2025	J.S. Vink	The Heaviest Black Holes Below PI	Lisa Meeting, University College Dublin, Co Dublin, Ireland	Research
20 Jan 2025	S. Schlagenhauf	S-PLUS MUSE - STARLIGHT and Revelations on Star Formation History	ING Journal Club, Isaac Newton Group, Santa Cruz de La Palma, La Palma, Canaries, Spain	Research/ Outreach
23 Jan 2025	M. Burton	The Historic Astronomical Observatories of Ireland	Presentation to the Expert Review Panel for the Irish World Heritage Unit, Dublin, Co Dublin	Outreach
28 Jan 2025	M. Burton	AOP, AOI & QUB – History and Collaboration	Queen's University Belfast, Co. Antrim	Research/ Education
03 Feb 2025	C.S. Jeffery	SALT, Stellar Mergers and the Super-Hot Zombie Stars	Northern Ireland Amateur Astronomical Society, Ballyclare, Co. Antrim	Outreach
20 Feb 2025	C.S. Jeffery	Highlights from the SALT Survey of Hydrogen-Deficient Hot Subdwarfs	School of Physics, Trinity College Dublin, Co. Dublin, Ireland	Research
11 Feb 2025	A. Philip Monai	PCA + Neural Networks for Identification and Classification of Hot Subdwarfs in LAMOST Sample	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Co. Armagh	Research
27 Feb 2025	M. Burton	Molecular Clouds and Star Formation in the Milky Way	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Co. Armagh	Teaching
06 Mar 2025	M. Burton	The Historic Astronomical Observatories of Ireland – An Update on our UNESCO World Heritage Application	Seminar, Armagh Observatory and Planetarium, Co. Armagh	Research
06 Mar 2025	G. Ramsay	Superflares on the Sun and Other Stars	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Co. Armagh	Teaching
06 Mar 2025	G. Ramsay	Multi-Messenger Astronomy and Wide Field Surveys	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Co. Armagh	Teaching
07 Mar 2025	A. Marshall-Lee	The History of Our Solar System	Stargazer Evening, Armagh Planetarium, Co. Armagh	Outreach
13 Mar 2025	J.S. Vink	The Most Massive Stars	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Co. Armagh	Research/ Outreach
17 Mar 2025	G. Ramsay	High Amplitude Galactic Transients	BlackGem Consortium Meeting — University of Barcelona, Spain	Research

Date	AOP Speaker	Title	Location/Mode	Category
20 Mar 2025	C.S. Jeffery	Stellar Pulsation — Theory and Applications	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Co. Armagh	Teaching
27 Mar 2025	A. Christou	How to Travel from A to B in the Solar System: A Brief Introduction to Interplanetary Flight	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Co. Armagh	Teaching

Armagh Observatory and Planetarium Education and Outreach: April 2024 – March 2025

Date	Event Description
Apr 2024 – Mar 2025	Outreach at various locations with the portable dome through AOP bookings or RI bookings
Apr 2024 – Mar 2025	The Legendary Telescope Tours at Armagh Observatory
Apr 2024 – Mar 2025	DVL sessions seasonally
Apr 2024 – Mar 2025	Little Astronomers (Monthly)
Apr 2024 – Mar 2025	Our World from Space Club (Monthly)
April 2024 – Mar 2025	STEM Cadets Afterschools Club (Weekly)
8-10 Apr 2025	Meet the Buyer (outreach) Belfast
20 Apr – 12 May 2024	ec(h)o, A Digital Film Poem by Csilla Toldy
27 Apr 2024	ec(h)o, A Digital Film Poem by Csilla Toldy. Artist's Talk
4 May 2024	International Star Wars Day: May The 4 th Be With You
7 May 2024	Day of the Planetaria: 100 Years of Eternity Dome show
11 May 2024	Action Deaf Youth Event for Launch of PLP in BSL
27 May 2024	Meet our PhD Students: Learn More About Aliens and Exo-Planets
29-30 June 2024	Makaton Dome Shpw Launch
Jul – Aug 2024	Robot Exhibition – An Exhibition of Robots, Cyborgs and Androids
12 Jul-23 Aug 2024	Pink Floyd's Dark Side of the Moon (50 th Anniversary Dome Show), Planets 360, Queen Mercury with Love – Music Show Fridays
21 Aug 2024	BBC Conor Phillips Show at AOP
7 Sep 2024	Armagh Food and Cider Weekend 2024 Event: Edible Experiments Workshop
14 Sep 2024	European Heritage Open Day Experience the Calver Telescope
14 Sep 2024	International Observe The Moon Day
19 Sep 2024	Public Lecture and Pink Floyd Dome Show How to Take a Picture of a Black Hole by Professor Derek Ward Thompson UK Galactic Star Formation Workshop
2 Oct 2024	100 Hours of Astronomy, 100 Years of the Planetarium 2 – 5 October 2024 – Stargazing Evening
4 Oct 2024	Stargazing Evening
29 – 30 Oct 2024	Halloween at Armagh Planetarium – Spooky Activities and Varied Meet and Greet with Popular Characters.
1 Nov 2024	Stargazing Evening
23 Nov – 23 Dec 2024	Mission Santa: An Immersive Christmas Experience
30 Nov 2024	Georgian Day Legendary Telescopes Tour
6 Dec 2024	Stargazing Evening
10 Jan 2024	Exhibit at Holiday World
24 Jan 2025	Stargazing Evening – Cancelled due to Storm Éowyn
Jan – Apr 2025	Historic Rosse Drawings Exhibition
13 – 15 Feb 2025	NI Science Festival 2025 Event: The Ultimate Bubble Show
14 Feb 2025	Stargazing Evening
16, 22 – 23 Feb 2025	NI Science Festival 2025 Event: Orienteering at the AOP
18 – 28 Feb 2025	1pm dome show Mysteries of your Brain
18 Feb 2025	NI Science Festival 2025 Event: NI Engineering Goes Into Space
21 Feb 2025	NI Science Festival 2025 Event: Little Astronomers

Date	Event Description
22 Feb 2025	NI Science Festival 2025 Event: Life Beyond Earth Talk
23 Feb 2025	NI Science Festival Event – The Magical Sounds – Sound Spa for Families
7 Mar 2025	Stargazing Evening
8 Mar 2025	Experience the Calver Telescope: Irish Astronomy Week
13 Mar 2025	Outreach with ABC Council: Dublin
15 – 23 Mar 2025	National Lottery Open Week Event
30 Mar 2025	Accessible Sunday – For a Relaxed Day of Exploring the Cosmos

THE ARMAGH OBSERVATORY AND PLANETARIUM

**THE CERTIFICATE AND REPORT OF THE COMPTROLLER AND AUDITOR GENERAL TO
THE NORTHERN IRELAND ASSEMBLY to be inserted here**

Statement of Financial Activities for the year ended 31 March 2025

	Note	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Unrestricted Funds 2024 £	Restricted Funds 2024 £	Total Funds 2024 £
Income from:							
Charitable activities	2	2,726,531	635,118	3,361,649	2,348,511	810,084	3,158,595
Other trading activities	4	184,688	-	184,688	195,615	-	195,615
Total incoming resources		2,911,219	635,118	3,546,337	2,544,126	810,084	3,354,210
Expenditure on:							
Charitable activities	5	3,641,021	186,411	3,827,432	3,670,849	200,797	3,871,646
Other trading activities	7	87,239	-	87,239	106,900	-	106,900
Total outgoing expenditure		3,728,260	186,411	3,914,671	3,777,749	200,797	3,978,546
Net income / (expenditure)		)817,041(	448,707	)368,334(	)1,233,623(	609,287	)624,336(
Transfers between funds	15	376,026	)376,026(	-	709,378	)709,378(	-
Other recognised gains/(losses):							
Gains/(losses) on the revaluation of fixed assets and heritage assets	10 & 11	283,841	-	283,841	500,740	-	500,740
Actuarial gains less provisions on defined benefit pension scheme	15 & 19	43,000	-	43,000	)121,000(	-	)121,000(
Net Movement in Funds		)114,174(	72,681	)41,493(	)144,505(	)100,091(	)244,596(
Reconciliation of funds							
Total funds brought forward at 1 April 2024		12,427,938	47,937	12,475,875	12,572,443	148,028	12,720,471
Total funds carried forward at 31 March 2025		12,313,764	120,618	12,434,382	12,427,938	47,937	12,475,875

All amounts above relate to continuing operations of the organisation.
The notes on pages 64 to 76 form part of the financial statements.

Armagh Observatory and Planetarium

Balance Sheet as at 31 March 2025

	Note	2025 £	2024 £
Fixed Assets			
Intangible assets	9	125,047	206,627
Tangible assets	10	9,356,826	9,607,418
Heritage Assets	11	2,996,570	2,995,970
Total fixed assets		12,478,443	12,810,015
Current assets			
Stocks	12	17,469	25,152
Debtors	13	104,982	113,140
Cash at bank and in hand	18	225,563	290,949
Total current assets		348,014	429,241
Creditors: amounts falling due within one year	14	(392,075)	(763,381)
Net current liabilities		(44,061)	(334,140)
Total assets less current liabilities		12,434,382	12,475,875
Creditors: amounts falling due after more than one year		-	-
Net assets excluding pension asset		12,434,382	12,475,875
Defined benefit pension scheme asset	19	-	-
Net assets		12,434,382	12,475,875
Funds			
Restricted funds	15	120,618	47,937
Unrestricted funds	15	4,591,583	4,752,692
Revaluation Reserves	15	7,722,181	7,675,246
Pension Reserve	15	-	-
Total Charity Funds		12,434,382	12,475,875

The financial statements on pages 61 to 76 were approved by the Board of Trustees of Armagh Observatory and Planetarium on 12 November 2025 and were signed on its behalf by:


Trustee
Mr John Briggs


Accounting Officer
Professor Michael Burton

Statement of cash flows for the year ended 31 March 2025

	Note	2025 £	2024 £
Net cash provided by operating activities	17	172,824	242,341
Cash flows from investing activities:			
Interest received		1,556	4,831
Purchase of tangible fixed assets		)239,766(	)335,434(
Sale of tangible fixed assets		-	-
		)238,210(	)330,603(
Increase / (decrease) in cash and cash equivalents		)65,386(	)88,262(

Further detail is reported in Notes 17 and 18.

Reconciliation of net cashflow to movement in net cash funds

		2025 £	2024 £
Increase / (decrease) in cash and cash equivalents in the year		)65,386(	)88,262(
Cash and cash equivalents at 1 April 2024		290,949	379,211
Cash and cash equivalents at 31 March 2025	18	225,563	290,949

The notes on pages 64 to 76 form part of the financial statements.

Notes to the financial statements for the year ended 31 March 2025

1 Summary of significant accounting policies

(a) Basis of accounting

These financial statements have been prepared in accordance with the historical cost convention as modified by the revaluation of certain assets. The accounts comply with relevant accounting standards and disclosure requirements issued by the Department of Finance. In all other aspects the financial statements comply with the Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS102) (Charities SORP (FRS102)).

The Trustees of Armagh Observatory and Planetarium (AOP) confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2025.

The Trustees are satisfied that there are no material uncertainties related to events or conditions which cast significant doubt on the ability of Armagh Observatory and Planetarium to continue as a going concern.

(b) Incoming resources

Grant income from Department for Communities (DfC) is shown in the Statement of Financial Activities (SOFA) in the year in which it is received. Grants that relate to specific capital expenditure are initially recognised in the SOFA and transferred to a restricted fund, Government Grant for Fixed Assets. Where no restriction on the use of the assets exists the value is transferred to an unrestricted fund. Grants that relate to specific research projects are recognised in the Statement of Financial Activities and transferred to a restricted fund. Once the relevant conditions for recognition (entitlement and certainty of value) have been met, they are transferred to funds to match the relevant expenditure. Other grants are credited to the Statement of Financial Activities when receivable.

(c) Resources expended

Resources expended are accounted for on an accruals basis. Expenditure is classified under the principal charitable activities of Research, Education and Governance & Support.

(d) Pension scheme

The organisation provides pension benefits to its employees by participating in the Local Government Pension Scheme for Northern Ireland, administered by Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC), which is a defined benefit scheme. Annual contributions to the NILGOSC scheme are determined by the scheme and based on actuarial advice. The operating costs of providing retirement benefits to the organisation's employees are recognised in accounting periods in which the benefits are earned by employees, and the related finance costs and other changes in value of the assets and liabilities are recognised in the period in which they arise. AOP applies the principles of IFRIC 14 in relation to pension surplus restriction. IFRIC 14 requires allowances to be made for a minimum funding requirement, which limits the amount of economic benefit available to the excess of the value of prospective current service costs above the funding requirement.

(e) Intangible fixed assets

Intangible fixed assets represent contributions to international astronomical research projects, financed by capital grant. They are identifiable, for example, as part of a major telescope installation. The organisation benefits in the form of research participation or collaboration, which in turn contributes to the research outputs. Intangible fixed assets are stated at cost and amortised over the expected life of the project.

(f) Tangible fixed assets

The cost of tangible fixed assets is their purchase cost or valuation together with any incidental costs of acquisition. Depreciation is calculated so as to write off the cost or valuation of tangible fixed assets, less their estimated residual values, on a straight-line basis over the expected useful economic lives of the assets concerned. Land is not depreciated.

The principal annual depreciation rates used are as follows:

Buildings	Remaining asset life as valued
Digistar	20%
Fixtures and fittings	20 - 25%
Office equipment	20 - 25%
Scientific equipment	10 - 25%
Exhibits	10 - 50%
Motor Vehicles	20%

Land and buildings are included in the balance sheet at depreciated replacement cost, estimated value in use or market value. Land and buildings are professionally revalued at least every 5 years in accordance with accounting guidance. Land and buildings were last revalued as at the 31 March 2025 by Lynsey Allen MRICS on behalf of Land and Property Services. Revaluation gains (losses) are transferred to a revaluation reserve.

The valuations of Land and Buildings have been undertaken having regard to International Financial Reporting Standards (IFRS) as applied to the United Kingdom public sector and in accordance with HM Treasury guidance, International Valuation Standards and the requirements of the Royal Institution of Chartered Surveyors Valuation Global Standards 2025.

Other fixed assets (non Land & Buildings) with a life estimated over 5 years have a net book value of £45,274 at 31 March 2025. This accounts for 0.5% of the net book value of fixed assets. The Trustees do not consider it appropriate to carry out an annual indexation of such assets on grounds of immateriality.

Armagh Observatory and Planetarium

Notes to the financial statements for the year ended 31 March 2025 (continued)

(g) Heritage Assets

Armagh Observatory was founded in 1789 and from this date the Observatory has collected through its operations scientific items, books, furniture and other artefacts which would be considered heritage assets. It is not the policy of Armagh Observatory and Planetarium to acquire heritage assets but has collected such assets through donations and operations. As at 31 March 2024, heritage assets were re-valued for insurance purposes with reference to auction estimates for replacement. Antique books were valued by Doerr Dallas Valuations Limited. Meteorites were valued by Ulster Museum. Coram James Limited carried out a desktop valuation of clocks, scientific instruments, fine art, furniture and sculptures. The remainder were valued by experienced members of management. It is policy to regularly review the valuation of heritage assets. The heritage assets are being documented on the Collections Database and environmental controls were further improved in 2023/24.

Heritage assets are summarised in these accounts in four categories: Books; Clocks and watches; Scientific instruments; and Furniture, Artworks, etc, and are recorded in catalogues and on databases. Historic buildings which have heritage value are included within operational assets. These were included within the recent property revaluation as operational assets and continue to be used for operational purposes.

(h) Stocks

Stocks are stated at the lower of cost and net realisable value. In general, cost is determined on a first in first out basis. Provision is made where necessary for obsolete, slow moving and defective stocks.

(i) Debtors

Debtors comprise amounts due from customers, grants due, prepaid expenses and value added tax refunds.

(j) Cash at bank and in hand

Cash held in bank accounts payable on demand and cash floats.

(k) Creditors

Creditors comprise payments due to suppliers and accruals for other amounts due but not invoiced at the year end.

(l) Fund accounting

The organisation has various types of funds for which it is responsible, and which require separate disclosure, totalling £12,434,382 at 31 March 2025 (£12,475,875 at 31 March 2024).

Restricted funds

Grants or donations received which are earmarked by the donor for specific purposes. Such purposes are within the overall aims of the organisation.

Unrestricted funds

Unrestricted funds, comprising designated funds and undesignated funds, are those which are expendable at the discretion of the trustees in furtherance of the objectives of the organisation. In addition to expenditure on the provision of services, such funds may be held in order to finance capital investment and working capital.

Designated funds include the donated assets fund, the government grants fund and the general fund. The general fund is the day to day operating fund.

Donated assets are the buildings and grounds donated to the organisation in 1790 by its founder Archbishop Richard Robinson. The value is adjusted annually by any revaluation of the underlying assets.

The government grant fund represents the capital financing of the Charity's tangible fixed assets. The fund is reduced annually by a value equivalent to depreciation charged on the related assets.

Undesignated funds - These represent the revaluation reserve which records the movement from the revaluation of the Charity's assets and a pension reserve which matches the long term liability of an underfunded defined benefits pension scheme.

(m) Reserves policy

Armagh Observatory and Planetarium adopts a risk-based approach to establishing a sound system of control covering all types of risks to the aims and objectives of the organisation. There is a need to retain a sufficient level of unrestricted cash reserves to meet the risks associated with short term financial contingencies, uncertainties and demands. The Trustees do not believe there are any key assumptions or key sources of estimation uncertainty which could cause a material adjustment to the carrying amounts of assets and liabilities within the next reporting period. Armagh Observatory and Planetarium budgets to operate on an annual basis within a balanced funding formula of grant-in-aid and self-generated income.

Notes to the financial statements for the year ended 31 March 2025 (continued)

2 Income from charitable activities

	Note	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Total Funds 2024 £
Grant Income					
DfC Recurrent grant-in-aid		2,352,000	-	2,352,000	1,932,000
DfC In-year capital grant-in-aid		-	140,000	140,000	435,000
Total grant-in-aid from the DfC		2,352,000	140,000	2,492,000	2,367,000
Income from other grants and receipts	3	-	489,548	489,548	340,637
Total Grant Income		2,352,000	629,548	2,981,548	2,707,637
Operating Income					
Admissions		355,797	-	355,797	408,680
Profit/(loss) on disposal of fixed assets		-	-	-	-
Miscellaneous income		18,734	5,570	24,304	42,278
Total Operating Income		374,531	5,570	380,101	450,958
Total Income from Charitable Activities		2,726,531	635,118	3,361,649	3,158,595

3 Income from other grants and receipts

	Note	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Total Funds 2024 £
STFC Research and Studentship grants		-	225,202	225,202	270,259
Europlanet 2024 RI grant		-	-	-	8,895
UKRI Open Access block grant		-	5,848	5,848	5,668
Science Foundation Ireland grant		-	46,166	46,166	4,576
ASDC grants		-	9,167	9,167	9,583
IAU grant		-	-	-	4,270
Tourism NI grants		-	2,413	2,413	15,872
Royal Astronomical society grant		-	2,500	2,500	5,000
National Lottery Heritage Fund		-	39,995	39,995	-
DfC Sign Language Partnership grant		-	-	-	3,450
Museums Association		-	-	-	9,500
JobStart scheme		-	-	-	3,364
STEM Ambassadors grant		-	27,774	27,774	-
UKSA Space For All grant		-	10,601	10,601	-
Leverhulme grant		-	41,753	41,753	-
Shared Island grant		-	75,782	75,782	-
Sundry grants and donations		-	2,347	2,347	200
Total other grants and receipts	2	-	489,548	489,548	340,637

4 Income from other trading activities

	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Total Funds 2024 £
Shop income	154,050	-	154,050	174,419
Rental income	30,638	-	30,638	21,196
Total Income from other trading	184,688	-	184,688	195,615

Notes to the financial statements for the year ended 31 March 2025 (continued)

5 Expenditure on charitable activities

	Note	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Total Funds 2024 £
Research	6	1,103,090	186,411	1,289,501	1,299,196
Education	6	1,446,180	-	1,446,180	1,509,701
Governance and Support	6	1,091,751	-	1,091,751	1,062,749
		3,641,021	186,411	3,827,432	3,871,646

6 Expenditure on charitable activities

	Note	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Total Funds 2024 £
Research					
Staff costs		536,876	96,894	633,770	666,291
Direct costs		191,219	89,517	280,736	253,359
Support costs		140,399	-	140,399	144,004
Depreciation		234,596	-	234,596	235,542
	5	1,103,090	186,411	1,289,501	1,299,196
Education					
Staff costs		500,831	-	500,831	513,774
Direct costs		162,583	-	162,583	129,890
Support costs		260,259	-	260,259	304,978
Depreciation		522,507	-	522,507	561,059
	5	1,446,180	-	1,446,180	1,509,701
Governance and Support					
Staff costs		731,727	-	731,727	727,680
Direct costs		21,987	-	21,987	8,166
Support costs		307,126	-	307,126	296,935
Depreciation		30,911	-	30,911	29,968
	5	1,091,751	-	1,091,751	1,062,749

Included within Governance and Support costs are the following governance costs:

	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Total Funds 2024 £
Management Committee expenses	6,911	-	6,911	3,613
Internal Audit	14,743	-	14,743	15,254
External Audit	27,400	-	27,400	26,700
	49,054	-	49,054	45,567

The cost of audit shown above includes £26,700 fees payable to Northern Ireland Audit Office for statutory audit. NIAO does not provide any other service.

7 Expenditure on trading activities

	Unrestricted Funds 2025 £	Restricted Funds 2025 £	Total Funds 2025 £	Total Funds 2024 £
Trading				
Direct costs	87,239	-	87,239	106,900
	87,239	-	87,239	106,900

Notes to the financial statements for the year ended 31 March 2025 (continued)

8 Average staff numbers and related costs

	Permanent staff	Others	2025 Number	2024 Number
Average staff numbers	27.9	6.4	34.3	35.2

Staff costs comprise:

	Permanent staff £	Others £	2025 £	2024 £
Wages and salaries	1,253,979	147,921	1,401,900	1,446,683
Social security costs	141,026	12,702	153,728	150,822
Employer's pension contributions	236,879	23,821	260,700	259,240
Defined benefit pension additional service cost	50,000	-	50,000	51,000
	1,681,884	184,444	1,866,328	1,907,745

The number of employees whose employee benefits (excluding employer pension costs) exceeded £60,000 was:

	2025 Number	2024 Number
£60,001 - £70,000	6	1
£70,001 - £80,000	1	-
£80,001 - £90,000	-	1
£90,001 - £100,000	1	-

The key management personnel of the organisation comprise the trustees and the Executive Director.

The total amount of employee benefits (including employer pension contributions) received by the Executive Director for his services to the organisation was £107,893 (2024: £105,154).

There was no remuneration paid to trustees during the year (2024: Nil). Travel and subsistence expenses reimbursed to trustees amounted to £3,293 (2024: Nil).

Average student numbers and related costs (not included above)

	2025 Number	2024 Number
PhD students	8.4	7.0

	2025 £	2024 £
Student maintenance grants & stipends	186,776	135,617

Notes to the financial statements for the year ended 31 March 2025 (continued)

9 Intangible fixed assets

	2025 £	2024 £
Cost		
At 1 April	622,018	622,018
Additions	-	-
Disposals	-	-
At 31 March	622,018	622,018
Depreciation		
At 1 April	415,391	333,811
Charge for year	81,580	81,580
Disposals	-	-
At 31 March	496,971	415,391
Net book value		
At 31 March 2025	125,047	206,627
At 31 March 2024	206,627	288,207

10 Tangible fixed assets

	Freehold Land & buildings £	Exhibits £	Assets Under Construction £	Digistar Projection System £	Scientific Equipment £	Other Equipment & Vehicles £	Total £
Cost or valuation							
At 1 April 2024	8,717,982	1,194,456	6,000	500,351	723,698	1,316,484	12,458,971
Asset revaluation	46,935	-	-	-	-	-	46,935
Additions	70,015	4,626	-	-	-	97,360	172,001
Transfers	6,000	-	6,000(	-	-	-	-
Disposals	-	2,624(	-	4,192(	51,073(	44,548(	102,437(
At 31 March 2025	8,840,932	1,196,458	-	496,159	672,625	1,369,296	12,575,470
Depreciation							
At 1 April 2024	-	719,115	-	401,119	653,020	1,078,299	2,851,553
Adjustment for asset revaluation	236,906(	-	-	-	-	-	236,906(
Charge for year	236,906	184,749	-	99,232	41,637	143,910	706,434
Disposals	-	2,624(	-	4,192(	51,073(	44,548(	102,437(
At 31 March 2025	-	901,240	-	496,159	643,584	1,177,661	3,218,644
Net book value							
At 31 March 2025	8,840,932	295,218	-	-	29,041	191,635	9,356,826
At 31 March 2024	8,717,982	475,341	6,000	99,232	70,678	238,185	9,607,418

Tangible fixed asset additions of £172,001 as shown above were funded by DfC in-year capital grant-in-aid.

If the land and buildings had not been valued, they would have been included at the following amounts:

	2025 £	2024 £
Cost	3,961,818	3,885,803
Aggregate depreciation	1,339,413(	1,260,455(
Net book value based on historic cost	2,622,405	2,625,348

Notes to the financial statements for the year ended 31 March 2025 (continued)

10 Tangible fixed assets (continued)

Depreciation on tangible fixed assets for the year was £706,434 (2024: £744,987).

Land and buildings include grounds and buildings with a net book value of £2,193,642 (2024: £2,132,515) which were donated to the organisation in 1790 by Archbishop Richard Robinson, the founder of the organisation.

Armagh Observatory and Planetarium includes in fixed assets any expenditure over £1,500 (on an item or group of related items) which is expected to be used for more than a year.

11 Heritage assets

	Books	Clocks & Watches	Scientific Equipment	Furniture, Artworks, etc	Total
At Valuation	£	£	£	£	£
Carrying Amount at 1 April 2024	644,075	625,600	1,435,900	290,395	2,995,970
Additions	-	-	600	-	600
Revaluation	-	-	-	-	-
Disposals	-	-	-	-	-
Depreciation / impairment	-	-	-	-	-
Carrying Amount at 31 March 2025	644,075	625,600	1,436,500	290,395	2,996,570

It is policy to regularly review the valuation of heritage assets and to carry out a formal revaluation at least once every five years. The most recent valuation took place in 2024.

Summary of heritage asset transactions

There were no charges for impairment or disposals of heritage assets in the five years ended 31 March 2025. Through a donation, there was a single purchase costing £600 in 2024/25. Ordnance Survey maps of Ireland and map chests owned by Armagh Observatory & Planetarium but held in Robinson Library, Armagh, were valued for the first time in 2021-22 at £100,000.

12 Stocks

	2025 £	2024 £
Goods for resale	17,469	25,152

13 Debtors

	2025 £	2024 £
Trade debtors	36,976	35,002
Prepayments and accrued income	56,402	51,578
Other debtors	11,604	26,560
	104,982	113,140

14 Creditors: amounts falling due within one year

	2025 £	2024 £
Trade creditors	31,641	150,577
Accruals and sundry creditors	328,581	580,562
Taxation and social security	31,853	32,242
	392,075	763,381

Notes to the financial statements for the year ended 31 March 2025 (continued)

15 Statement of Funds

	At 1 April 2024	Income	Expenditure	Revaluation	Transfers	At 31 March 2025
	£	£	£	£	£	£
Restricted Funds						
Government grant for fixed assets	-	140,000	-	-	)140,000(	-
Other grants for fixed assets	-	-	-	-	-	-
Restricted resource grants	47,937	495,118	)186,411(	-	)236,026(	120,618
Total restricted funds	47,937	635,118	)186,411(	-	)376,026(	120,618
Unrestricted Funds						
Designated Funds						
Donated assets reserve	1,720,283	-	-	-	-	1,720,283
Government grant for assets	1,830,326	-	-	-	)648,014(	1,182,312
General fund	1,202,083	2,911,219	)3,728,260(	-	1,303,946	1,688,988
	4,752,692	2,911,219	)3,728,260(	-	655,932	4,591,583
Undesignated Funds						
Revaluation reserve - Land & Buildings	5,986,397	-	-	283,841	)236,906(	6,033,332
Revaluation reserve - Heritage Assets	1,688,849	-	-	-	-	1,688,849
Pension reserve	-	-	-	43,000	)43,000(	-
	7,675,246	-	-	326,841	)279,906(	7,722,181
Total Unrestricted Funds	12,427,938	2,911,219	)3,728,260(	326,841	376,026	12,313,764
Total Funds	12,475,875	3,546,337	)3,914,671(	326,841	-	12,434,382

Details of Transfers between funds

	£
Release of restricted resource grant available to offset overheads	)236,026(
Release of deferred capital grant	)788,014(
Transfer of defined benefit pension service and interest cost	)43,000(
Transfer of depreciation adjustment on asset revaluation to general fund	)236,906(
General fund	1,303,946

16 Analysis of net assets between funds

	Pension Reserve	Revaluation Reserve	Unrestricted Funds	Restricted Funds	Total Funds
	£	£	£	£	£
Tangible fixed assets	-	6,033,332	3,448,541	-	9,481,873
Heritage assets	-	1,688,849	1,307,721	-	2,996,570
Current assets	-	-	227,396	120,618	348,014
Creditors: amounts falling due within one year	-	-	)392,075(	-	)392,075(
Net assets/(liabilities)	-	7,722,181	4,591,583	120,618	12,434,382

17 Reconciliation of net expenditure to net cash flow from operating activities

	2025 £	2024 £
Net expenditure for the year per statement of financial activities	)368,334(	)624,336(
Adjustments for:		
Depreciation	788,014	826,567
Interest received	)1,556(	)4,831(
Defined benefit pension scheme service and interest cost less contributions payable	43,000	37,000
Decrease/(increase) in stock	7,683	)5,300(
Decrease in debtors	8,158	67,885
Decrease in creditors	)304,141(	)54,644(
Net cash provided by operating activities	172,824	242,341

Notes to the financial statements for the year ended 31 March 2025 (continued)

18 Analysis of cash and cash equivalents

	31 March 2025 £	31 March 2024 £
Cash at bank and in hand	225,563	290,949
Total cash and cash equivalents	225,563	290,949

19 Pension scheme

Introduction

The disclosures below relate to the funded liabilities within the Northern Ireland Local Government Officers' Superannuation Pension Fund (the "Fund") which is part of the Local Government Pension Scheme (Northern Ireland) (the "LGPS") and certain related unfunded liabilities which have been separately disclosed. The LGPS is a funded defined benefit plan with benefits earned up to 31 March 2015 being linked to final salary. Benefits after 31 March 2015 are based on a Career Average Revalued Earnings scheme. Details of the benefits earned over the period covered by this disclosure are set out in 'The Local Government Pension Scheme Regulations (Northern Ireland) 2014' (as amended) and 'The Local Government Pension Scheme (Amendment and Transitional Provisions) Regulations (Northern Ireland) 2014' (as amended). The unfunded pension arrangements relate to termination benefits made on a discretionary basis upon early retirement in respect of members of the Local Government Pension Scheme under the 'Local Government (Early Termination of Employment) (Discretionary Compensation) Regulations (Northern Ireland) 2007'.

Funding / Governance Arrangements of the LGPS

The funded nature of the LGPS requires participating employers and their employees to pay contributions into the Fund, calculated at a level intended to balance the pension liabilities with investment assets. Information on the framework for calculating contributions to be paid is set out in 'The Local Government Pension Scheme Regulations (Northern Ireland) 2014' and the Fund's Funding Strategy Statement. The last actuarial valuation was at 31 March 2022 and the contributions to be paid until 31 March 2026 resulting from that valuation are set out in the Fund's Rates and Adjustment Certificate. NILGOSC as the Scheme manager is responsible for the governance of the Fund.

Assets

The assets allocated to the Employer in the Fund are notional and are assumed to be invested in line with the investments of the Fund for the purposes of calculating the return over the accounting period. The Fund holds a significant proportion of its assets in liquid investments. As a consequence there will be no significant restriction on realising assets if a large payment is required to be paid from the Fund in relation to an employer's liabilities. The assets are invested in a diversified spread of investments and the approximate split of assets for the Fund as a whole is shown in the disclosures. NILGOSC may invest a small proportion of the Fund's investments in the assets of some of the employers participating in the Fund if it forms part of their balanced investment strategy.

The NILGOSC actuary, Aon Solutions UK Ltd (Aon), has provided the following details for the purposes of accounting for the Armagh Observatory and Planetarium's joint share of the Scheme in accordance with FRS 102 at 31 March 2025.

Key assumptions used by the actuary were:

	31 March 2025	31 March 2024
Discount rate	5.8%	4.8%
CPI inflation	2.5%	2.6%
Pension increases	2.5%	2.6%
Pension accounts revaluation rate	2.5%	2.6%
Salary increases	4.0%	4.1%

Mortality assumptions

	31 March 2025 Years	31 March 2024 Years
Males		
Pensioner member aged 65 at accounting date	21.6	21.7
Active member aged 45 at accounting date	22.2	22.7
Females		
Pensioner member aged 65 at accounting date	24.5	24.6
Active member aged 45 at accounting date	25.2	25.6

Notes to the financial statements for the year ended 31 March 2025 (continued)

19 Pension scheme (continued)

Asset Allocation

	Value at 31/03/2025	Value at 31/03/2024
Equities	41.3%	43.7%
Property	9.5%	9.7%
Government bonds	15.7%	17.4%
Corporate bonds	3.9%	4.2%
Multi Asset Credit	13.0%	13.3%
Cash	10.7%	5.6%
Other	5.9%	6.1%
Total	100.0%	100.0%

Reconciliation of funded and unfunded status to balance sheet

	Value at 31/03/2025 £'000	Value at 31/03/2024 £'000
Fair value of assets	12,173	11,787
Present value of funded defined benefit obligation	(9,285)	(10,611)
Funded status	2,888	1,176
Unrecognised asset	(2,888)	(1,175)
Present value of unfunded defined benefit obligation	-	(1)
Asset/(Liability) recognised on the balance sheet	-	-

The split of the liabilities at the last valuation between the various categories of members is as follows:

Active members	36%
Deferred pensioners	20%
Pensioners	44%

Amounts recognised in statement of financial activities

	Year to 31/03/2025 £'000	Year to 31/03/2024 £'000
Operating cost		
Current service cost	(313)	(303)
Financing cost		
Interest on net defined benefit liability	63	14
Interest on unrecognised asset	(56)	-
Pension expense recognised in statement of financial activities	(306)	(289)
Allowance for administrative expenses included in Current Service Cost	7	7

Amounts recognised in statement of funds

	Year to 31/03/2025 £'000	Year to 31/03/2024 £'000
Asset gains/(losses) arising during the period	(131)	617
Actuarial gains/(losses) due to changes in financial assumptions	1,749	354
Actuarial gains/(losses) due to changes in demographic assumptions	78	164
Actuarial gains/(losses) due to liability experience	4	(81)
Adjustment gains/(losses) due to restriction of surplus	(1,656)	(1,175)
Total amount recognised in statement of funds	44	(121)

Changes to the present value of defined benefit obligation

	Year to 31/03/2025 £'000	Year to 31/03/2024 £'000
Opening defined benefit obligation	10,612	10,532
Current service cost	313	303
Interest expense on defined benefit obligation	502	488
Contributions by participants	119	130
Actuarial gains/(losses) due to changes in financial assumptions	(1,749)	(354)
Actuarial gains/(losses) due to changes in demographic assumptions	(78)	(164)
Actuarial gains/(losses) due to liability experience	(4)	81
Net benefits paid out	(430)	(404)
Closing defined benefit obligation	9,285	10,612

Notes to the financial statements for the year ended 31 March 2025 (continued)

19 Pension scheme (continued)

Changes to the fair value of assets

	Year to 31/03/2025 £'000	Year to 31/03/2024 £'000
Opening fair value of assets	11,787	10,690
Interest income on assets	565	502
Remeasurement gains/(losses) on assets	)131(	617
Contributions by the employer	263	252
Contributions by participants	119	130
Net benefits paid out	)430(	)404(
Closing fair value of assets	12,173	11,787

Actual return on assets

	Year to 31/03/2025 £'000	Year to 31/03/2024 £'000
Interest income on assets	565	502
Gain/(loss) on assets	(131)	617
Actual return on assets	434	1,119

Sensitivity Analysis

Funded LGPS benefits

Discount rate assumptions

Adjustment to discount rate

	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	9.155	9.285	9.415
% change in present value of total obligation	-1.4%		1.4%
Projected service cost (£m)	0.202	0.212	0.222
Approximate % change in projected service cost	-4.5%		4.6%

Rate of general increase in salaries

Adjustment to salary increase rate

	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	9.304	9.285	9.266
% change in present value of total obligation	0.2%		-0.2%
Projected service cost (£m)	0.212	0.212	0.212
Approximate % change in projected service cost	0.0%		0.0%

Rate of increase to pensions in payment and deferred pension assumption, and rate of revaluation of pension account assumptions:

Adjustment to pension increase rate

	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	9.396	9.285	9.174
% change in present value of total obligation	1.2%		-1.2%
Projected service cost (£m)	0.222	0.212	0.202
Approximate % change in projected service cost	4.6%		-4.5%

Post retirement mortality assumption

Adjustment to mortality age rating assumption

	-1 year	Base Figure	+1 year
Present value of total obligation (£m)	9.499	9.285	9.071
% change in present value of total obligation	2.3%		-2.3%
Projected service cost (£m)	0.219	0.212	0.278
Approximate % change in projected service cost	3.5%		-3.5%

Notes to the financial statements for the year ended 31 March 2025 (continued)

19 Pension scheme (continued)

Pension Surplus Restriction

AOP has applied the principles of FRS 102 in relation to pension surplus restriction. FRS 102 outlines that a defined benefit plan asset can only be recognised to the extent that the plan surplus can be recovered through reduced contributions in the future or through refunds from the plan. Aon has assessed that at 31 March 2025 the defined benefit plan asset is restricted to nil as no plan surplus can be recovered by these means.

Pensions Increase/Revaluation experience

Aon have adjusted the defined benefit obligation to reflect the impact of actual inflation being higher (or lower) than previously assumed. They have made allowance for the actual (and expected) impact of inflation on the active (CARE) liabilities, deferred liabilities and pensioner liabilities. They have allowed for inflation up to the month ending prior to the accounting date, to reflect the published CPI index at the accounting date.

Pay settlements for local government workers

The Local Government pay agreement for 2024/25 was an increase of £1,290 per annum. For a typical employer this is unlikely to be materially different to the pay increase that was assumed at the start of the accounting period. Therefore, Aon have not made an explicit allowance for any gain (or loss) from pay awards this year.

20 Capital commitments

Capital commitments at 31 March 2025 totalled £0 (2024: £58,000) in respect of expenditure on projects commenced during the year. DfC has not agreed funding for 2025/26.

21 Contingent liabilities

There were no contingent liabilities at the 31 March 2025 (2024: Nil).

22 Remote contingent liabilities (Audited)

There were no remote contingent liabilities at the 31 March 2025 (2024: Nil).

23 Related-party transactions

None of the members of the Board of Governors, the Management Committee, the Director or other related parties have undertaken any material transactions with the Armagh Observatory and Planetarium during the year. The Armagh Observatory and Planetarium has had various material transactions with a number of Government Departments, Executive Agencies and Non-Departmental Public Bodies in Northern Ireland. Most of these transactions have been with DfC, Construction and Procurement Delivery (CPD), Strategic Investment Board (SIB), Tourism NI, and the Education Authority (EA). DfC provides recurrent and capital grant-in-aid (note 2), SIB provides professional advisory and consultancy services, Tourism NI provides marketing and capital grants (note 3), and CPD and EA are the Centres of Procurement Expertise for the organisation. The Royal School Armagh leases land for playing fields at a nominal rent.

No other related party transactions took place in the year, other than certain trustees' expenses already disclosed in note 8.

24 Losses and special payments (Audited)

There were no losses or special payments during the year (2024: Nil).

25 Fees and charges (Audited)

AOP generates income from admissions, shop income and grant income. These income streams are disclosed in Notes 2, 3 and 4.

26 Financial instruments

As the cash requirements of the Armagh Observatory and Planetarium are met through grants from DfC and other grant funding bodies, financial instruments play a more limited role in creating risk than would apply to a non-public sector body of a similar size. The majority of financial instruments relate to contracts to buy non-financial items in line with the Observatory's expected purchase and usage requirements and the Armagh Observatory and Planetarium is therefore exposed to little credit, liquidity or market risk.

Notes to the financial statements for the year ended 31 March 2025 (continued)

27 Additional disclosures to comply with the Financial Reporting Manual (FReM)

FReM requires non-departmental public bodies to regard grant-in-aid received as contributions from controlling bodies giving rise to a financial interest in the residual interest of the body and hence accounting for as financing, that is by crediting them to income and expenditure reserve. In addition FReM requires grant-in-aid to be accounted for on a cash basis.

However, as the organisation is required to prepare accounts in accordance with the SORP for charities, DfC has given AOP permission to continue to treat grants as income. If AOP were required to comply with the FReM the result of this compliance would be as follows:

Statement of Financial Activities prepared under FReM

	Note	2025 £	2024 £
Incoming resources			
Incoming resources from research and other non-DfC grants	2	489,548	340,637
Operating income	2	380,101	450,958
Trading income	4	184,688	195,615
Total incoming resources		1,054,337	987,210
Resources expended			
Direct expenditure of the organisation		3,914,671	3,978,546
Total Resources expended		3,914,671	3,978,546
Net deficit for the year		(2,860,334)	(2,991,336)
Loss/(gain) on revaluation of Fixed Assets and Heritage Assets		283,841	500,740
Actuarial (loss)/gain on pension scheme		43,000	(121,000)
Amount transferred to funds		(2,533,493)	(2,611,596)

Analysis of funds prepared under the FReM

		2025 £	2024 £
Balance at 1 April		12,475,875	12,720,471
Grant-in-aid received in the year	2	2,492,000	2,367,000
Net operating costs for the year		(2,533,493)	(2,611,596)
Balance at 31 March		12,434,382	12,475,875

28 Events after the Reporting Date

1) Adjusting Events:

There were no events after the reporting date which would require adjustment to the financial statements.

2) Non-adjusting Events:

Funding required for the Outline Business Case (OBC1), which relates to the redevelopment of the AOP site, was approved by the Minister of Communities on 30 June 2025. In terms of the funding application, a total amount of £3,973k has been approved for the three years ending 31 March 2028.

Previously, The National Lottery Heritage Fund (NLHF) had allocated funding in the amount of £1,324k which was dependent on funding procured from other sources amounting to three-fold the funding allocated by NLHF.

The funding grant from DfC is therefore 75% of the total funding grant of £5,297k, with the balance of 25% being funded by NLHF.

The Accounting Officer authorised the issue of these financial statements on xx xxxx 2025.

Accounts

Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2024

Laid before the Northern Ireland Assembly

under clause 8 of The Armagh Observatory and Planetarium (Northern Ireland) Order 1995,

as amended by Schedule 1, clause 6 of the Audit and Accountability (Northern Ireland)

Order 2003, by the Department for Communities

on

18 November 2024

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Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2024

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The Trustees' Annual Report for the year ended 31 March 2024

The Board of Governors and Management Committee, who are the Trustees for Armagh Observatory and Planetarium (AOP) have pleasure in presenting the annual report and financial statements for this charity for the year ended 31 March 2024. These financial statements have been prepared in accordance with the accounting policies set out in note 1 to the accounts, with the guidance issued by the Department of Finance on the form and contents of the Annual Reports and Accounts of Executive Non-Departmental Public Bodies, *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* and Accounting and Reporting by Charities: Statement of Recommended Practice (SORP) applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102). The Remuneration and Staff report is prepared in accordance with the direction set out in The Government Financial Reporting Manual (FRM) 2023-24.

The sponsor Department for Armagh Observatory and Planetarium is the Department for Communities (DfC) (the Department).

Background to Charitable Status

Historically the Armagh Observatory and the Armagh Planetarium were treated as being distinct institutions; being two component divisions of a single statutory corporation and arms-length body (ALB), 'The Governors of The Armagh Observatory and Planetarium' as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*.

The principal function of the Armagh Observatory, founded in 1789 as part of Archbishop Richard Robinson's vision to see the creation of a university in the City of Armagh, is to undertake original research of a world-class academic standard that broadens and expands our understanding of astronomy and related sciences.

The Armagh Planetarium was founded by Dr Eric Mervyn Lindsay, the seventh director of the Armagh Observatory, and was officially opened on 1 May 1968. The Planetarium's primary activity is to disseminate scientific and technical knowledge of a wide range of science, technology, engineering, arts and mathematics (STEAM) subjects, and to promote public understanding of astronomy and science through its programme of educational services for schools and the wider public.

From 1 April 2016 the Charity Commission for Northern Ireland registered *The Governors of The Armagh Observatory and Planetarium*, (changed to *The Armagh Observatory and Planetarium* in 2023) as a charity under reference number NIC 103948.

Objectives and Activities

The organisation's statutory functions are set out at Article 4 of *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* (the Order). The Order requires that '*the Governors shall, for the purpose of developing and improving the knowledge, appreciation and practice of astronomy and related sciences, maintain and manage the Armagh Observatory and Planetarium and may take such other action as the Governors may think proper for the purpose of acquiring or disseminating knowledge relating to astronomy and related sciences*'.

In accordance with Paragraph 8(1) of Schedule 1 of the Order, the Armagh Observatory and Planetarium (AOP) Board of Governors has delegated the primary responsibility for the governance and management of AOP to a Management Committee with the statutory purpose of 'developing and improving the knowledge, appreciation and practice of astronomy and related sciences'.

The AOP Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department for Communities (our sponsor Department) and approved by the Minister and for promoting the efficient, economic and effective use of resources.

As the primary responsibility for the governance and management of AOP has been delegated to a Management Committee, the Governors considered the role of Charity Trustees would more appropriately align with their remit too. The Board of Governors agreed in principle to this. The Charity Commission of Northern Ireland recommended that the Members of the Management Committee be appointed as Trustees for the Charity alongside the Members of the Board of Governors. Accordingly, both the Members of the Board of Governors and the Members of the Management Committee are Charity Trustees.

Armagh Observatory is the oldest scientific institution in Northern Ireland, and the longest continuously operating astronomical research institute in the UK and Ireland. Armagh Planetarium is also the oldest operating planetarium in the UK and Ireland.

Our Mission:

“Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.”

Our Vision:

“Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.”

The organisation operates on the international stage and is underpinned by core funding from the Department and the receipt of external grants from the UK Science and Technology Facilities Council (STFC), and other grant-awarding bodies.

A Strategic Plan for 2021-26 was launched in September 2021 and this is now being implemented. The strategy is built around four strategic themes – Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

As at 31 March 2024, there were 29.8 full time equivalent permanent employees which comprised approximately one-third Research, one-third Education and one-third Corporate. Additionally, there were 3.6 full time equivalent temporary employees, some of whom were engaged on short term temporary projects. AOP also employs a number of casual staff on an ad hoc basis to meet operational needs. In addition, there is an Emeritus Director, an Emeritus Research Astronomer and 8 external research associates and academic visitors who are unpaid.

Public Benefits

The Trustees confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under Section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2024. This is demonstrated in the following summary of Principal Activities which provides detail on how the organisation has delivered against its objectives and the public benefit which has flowed from this.

Principal Activities

Introduction to AOP Research and its International Standing

AOP is one of the oldest scientific research institutes in the UK and Ireland with a long-established reputation of research excellence. It is also one of very few astronomical institutions in the world to have a modern planetarium through which its research can be effectively communicated and where a research-informed outreach and public engagement activity can be sustained.

AOP is strategically engaged in front-line research in several key areas of astrophysics. These range from the study of our Sun and the Solar System to that of distant galaxies, in keeping with the long and varied history of scientific achievements of the Armagh Observatory and with the desire to be perceived by the public as leaders in of all strands of astronomical research that are communicated through the Planetarium.

Typically, around a third of AOP research is funded by the award of project-specific external grants mainly from the STFC, together with several ad hoc grants. These grants support projects led by individual research astronomers with the provision of PhD scholarships, post-doctoral research assistant salaries, computing equipment and observation/conference travel funding. Early in 2024, AOP researchers secured one new STFC grant providing funding for one Post-Doctoral Research Assistant (PDRA) plus salary staff contribution and estate costs until March 2027. AOP researchers also secured Leverhulme Trust funding to support an additional PDRA who will be dedicated to solar-system studies based on the use of immersive technologies and AOP's data visualisation laboratory.

AOP research requires the use of state-of-the-art observing and computing facilities internationally in order to obtain new astronomical data and allow their analysis. STFC and UK government support provides access to world-class international facilities, and AOP research staff regularly win telescope time on some of the best and most sought-after telescopes in the world such as the European Southern Observatory (ESO) Very Large Telescope (VLT) or the Hubble Space Telescope (HST).

In addition, through the AOP's membership of the UK SALT Consortium, its research staff have access to the 11-metre diameter Southern African Large Telescope (SALT). Similarly, AOP is also a founder member of the international Gravitational-wave Optical Transient Observer (GOTO) project; a member of the UK consortia involved

in building the detectors for Inouye Solar Telescope (IST); LOFAR (Low Frequency Array) radio telescope project and a consortium member of the Cherenkov Telescope Array (CTA) gamma-ray observatory and the BlackGem project which conducts optical surveys from Chile. Finally, AOP is in a leadership position for nearly a quarter of all the observing time dedicated to Large Programs run by the 15-meter diameter James Clerk Maxwell Telescope (JCMT) in Hawaii which detects sub-mm radio waves.

These facilities can be extremely expensive to run (e.g., the running cost of one observing night at VLT is about £40,000 and a mid-size observing program with HST would be ten times more) so that through the award of their use, the international astronomical community essentially entrusts astronomers at Armagh to make effective use of the data. On average AOP researchers secure telescope time corresponding to a value of more than £300,000 per year, and the value of the telescope time obtained at facilities to which AOP has unique access far outweighs the costs of such arrangements.

AOP research staff also play a full role in the international astronomical community. For instance, they serve on committees of bodies such as the Royal Astronomical Society (RAS), the UK Science and Technology Facilities Council, the International Astronomical Union (IAU) - with three commission vice-presidents and two former presidents, ESO time allocation panels, assess grant and research proposals on behalf of external funding agencies, review scientific papers and edit international academic journals, and act as external PhD examiners in the UK and beyond. AOP researchers also sit on scientific advisory panels or lead specific projects with future ground-based observing facilities (Vera Rubin Observatory, ELT-METIS, VLT-BlueMUSE), space satellites and missions (European Space Agency's future Plato and Comet Interceptor missions) and large-scale surveys (MOONS).

The international reputation of AOP research staff is also testified by their ability to attract their international peers to Armagh either on research visits or organising international conferences and workshops at the Planetarium. This year was rather exceptional as regards the latter, as AOP welcomed over 120 delegates during three back-to-back research conferences in September 2023, which were delivered thanks to the concerted efforts of AOP staff and students and to funding from both the Armagh, Banbridge and Craigavon Council and the RAS.

Finally, AOP research staff are involved in the training of PhD students who also play a key part in AOP outreach and public engagement activity. AOP students are usually registered at Queen University Belfast (QUB), through an advantageous student fee arrangement that over time has allowed AOP to attract students from all over the world and achieve a vibrant diversity in our cohort that in turn prepares our students to be STEM champions, promoting equal opportunities in physics when they help at the Planetarium. This year AOP underwent a quinquennial review of the memorandum of agreement with QUB for the supervision of PhD students. This had a positive outcome, commending the AOP PhD program, the quality of our underlying research and the unique research environment, with a recommendation to setup an AOP/QUB studentship to further joint research opportunities.

Research Highlights

To provide a practical understanding of how the work of AOP research contributes to the region's international reputation and understanding of the cosmos, the following provides some highlights of the research undertaken at AOP in the financial year. This draws from international collaborations and the award of observing time on highly competitive facilities, as well as direct support from the Department allowing AOP to participate in several key international projects (such as SALT, GOTO, IST, I-LOFAR, Comet Interceptor, CTA and BlackGem). Full bibliographic references can be found in the publication list appended to this report.

Stellar and Galaxy Evolution

Introduction

When we look up on a dark night, we may think that stars are immutable and isolated. Yet, although stars can live for as long as the age of the Universe, they can also undergo dramatic changes in matter of seconds. They are also not isolated from other stars. Some are found in pairs or tight groups and more generally stars are related to each other through the very way in which they form and evolve. Stars are born from giant clouds of gas and return matter to those clouds, seeding the birth of new stars as they fade away or sometimes explode in dramatic events. Furthermore, stars produce the heavy elements necessary for the formation of rocky planets and of life as we know it.

In turn, the formation history of stars relates to the formation and evolution of the galaxies that contain them. Some galaxies no longer appear to form stars, unlike the case of the Milky Way. This may depend on whether fresh gas is available around them, on whether they have collided with other galaxies in the past or possibly also on whether their central supermassive black hole suddenly becomes active and pours out tremendous amounts of energy capable of clearing its host galaxy of any star-forming gas material. Finally, galaxies are carried by the general expansion of the Universe and the evolution of the dominant, yet unknown dark-matter material in which they themselves are embedded. Understanding the formation and evolutions of stars and galaxies therefore ultimately means understanding our origin in relation to the very fabric of the Universe.

Recent results

AOP stellar studies range from the most massive and brightest young stars to the faintest and ageing stars or stellar remnants such as white dwarfs and black holes.

The research in the group of Professor Jorick Vink is both theoretical and observational and is supported by STFC grants run in collaboration with Keele and York Universities. The theoretical work focuses on understanding of the formation of the heaviest stars and stellar black holes in the Universe. These stars are up to 10 million times brighter than the Sun. Key science questions involve the production of pair instability supernovae, where the entire star is disrupted, and one such event enriching galaxies with more heavy elements than all the lower mass stars combined. Recent studies lead by Vink's students and post-doctoral research assistants uncovered that the most massive stars undergo strong wind mass loss (e.g. *Sablahit et al. 2023*; *Higgins et al. 2023*). On the observational side, Vink is leading an ESO-VLT Large Programme called X-Shooting ULLYSES (XShootU; *Vink et al. 2023*) with a team of ~100 massive stars experts from around the globe trying to understand the stellar and mass-loss properties of massive star in pristine low-metallicity environments of the Large and Small Magellanic Clouds. These environments provide a key stepping stone to understand the very first stars in the distant Universe, which were likely very massive. Based on observations with the James Webb Space Telescope (JWST) of the discovery of huge amounts of Nitrogen in the distant Universe, Vink suggested that very massive stars (VMS) are the key sources (Vink 2023). Together with Gautham Sablahit, Vink developed a new mass-loss framework for how the most massive stars evolve until they collapse into a black hole (Vink and Sablahit 2023). In collaboration with Drs Aline Vidotto and Luca Fossati, the proceedings of IAU Symposium 370 with the Topic: "Winds from Stars and Exo-planets" were published (Vidotto, Fossati and Vink 2023).

The vast majority of stars will end their life as a "white dwarf", a very compact object with a mass comparable to that of the Sun but a size similar to that of the Earth. Stefano Bagnulo, working with AOP Visitor John Landstreet, led an international team of scientists in discovering a unique signature of the process by which white dwarf stars cannibalise their planetary systems. The research was conducted using the ESO's Chile-based VLT and outlines how a scar has been found imprinted on the surface of a magnetic white dwarf called WD0816-310. This object is an Earth-sized remnant of a star in the neighbourhood of our Solar System. The scar is a visible by-product of the process by which white dwarfs ingest the surrounding planets and asteroids that they are born with them. The scar is composed of a concentration of metals that originate from a planetary fragment as large as, or possibly larger than, the asteroid Vesta, which is about 500 kilometres across. The observations also provide clues as to how the star got its metal scar. The strength of the metal detection in the star changes as the star rotates, suggesting that the metals are concentrated on a specific area on the star's surface. The team found that these changes were synchronised with fluctuations of the white dwarf's magnetic field and discovered that the metal scar is located at one of the star's magnetic poles. This shows that the metals were funnelled onto the star by its magnetic field, so creating the scar. This research was the subject of an ESO press release (<https://www.eso.org/public/news/eso2403/>) that has attracted media attention at international level. Bagnulo has capitalised on the impact of his research by the organisation of a 4-week workshop in Garching (Germany) on stellar magnetic fields at the Munich Institute for Astro and Particle Physics (MIAPP) in October 2023 (<https://www.munich-iapp.de/magnetic-fields>).

Stars may pass through a number of stages after leaving the long-lived hydrogen-burning phase and becoming white dwarfs. Many become red giants, and a few become hot subdwarfs. Professor Simon Jeffery and his team study the latter, including stars that are in transition from one to another. By studying their distribution in the Galaxy, the team has shown that the extreme helium stars must come from both old and recent star formation (*Philip Monai et al. 2023*). Some hot subdwarfs evolving to become white dwarfs show large-amplitude pulsations, but their precise histories remain obscure (*Zhang et al. 2023*). Other hot subdwarfs have surface which are excessively rich in unusual elements such as lead. The team is working to discover whether this excess is of nuclear origin or due to the formation of thin clouds in their atmospheres (*Scott et al. 2024, in press*).

Linking to external galaxies, Marc Sarzi's main research focus remained the impact of galactic environment of galaxy evolution, particularly in dense cluster such as the Fornax cluster. For this he is pursuing follow up studies stemming from his past Fornax3D survey and relating to the evolution of cold-gas reservoirs around galaxies in Fornax while connecting this information to their star-formation formation history. The work led by his PDRA (*Loni et al. 2023*) exemplifies this approach, as it showed how the particular morphology of the peculiar galaxy NGC1436 is the result of a recent stripping of its outer gas reservoirs as this galaxy flew by the centre of the Fornax cluster, a process that also triggered a tremendous amount of star formation in the inner part of this galaxy. This is causing NGC1436 to gradually transform from a spiral to a lenticular galaxy, through an environmental process that may indeed contribute to explain the prominent lack of spiral galaxies in cluster environments. Future work combining Fornax3D MUSE data with S-PLUS imaging data (*Smith Castelli et al. 2024, in press*) will lead to even better reconstructions for the star-formation history of Fornax galaxies. The formation history of galaxies in dense environment is also dominated by direct interactions between galaxies. The impact of such encounters can be particularly well traced when focussing on the most fragile structures in galaxies, such as stellar disks. This was done by Sarzi's PhD student Pablo Galan de Anta through two sophisticated computer simulation studies (*Galan de Anta et al. 2023 a,b*)

A landmark survey of the molecular gas distribution in along the plane of Galaxy has been published by AOP. The programme was conceived by the Director in 2009 with the first observations taken in 2011 (following a near-catastrophic fire that engulfed, but fortunately didn't destroy, the telescope). Observations were completed in 2018 and the data then reduced leading to its publication in August 2023 (led by recently graduated Armagh PhD student Kerem Osman Çubuk) with the data being made publicly available through a data repository; see <https://mopracosurvey.wordpress.com>. The survey used the Mopra radio telescope in Australia and measured the millimetre-wavelength line emission from 4 isotopic variants of the CO molecule in its fundamental $J=1-0$ transition, achieving a spectral and spatial resolution of 0.1 km/s and 0.6 arcmin respectively, and covering 215 square degrees of the sky. The survey charts the distribution of the emission from the carbon monoxide molecule (the second most abundant molecule in space) across the southern Galactic plane. It covers approximately one-third of the great circle drawn around the celestial sphere that passes along the plane of the Milky Way.

This work is also close to the research of AOP's Öpik fellow, Dr David Eden who, by using the data from multiple JCMT Large Programs, is investigating the causes of star formation in the Milky Way. These Large Programs investigate multiple stages of the star-formation process from the formation of new molecular clouds (the sites of star formation; Rani, Moore, Eden *et al.*, 2023) to the role dense-gas (the gas most closely aligned to star formation) takes in the earliest stages of star formation (Xu, Wang, Liu, Eden *et al.*, 2024). Rani *et al.* (2023) identified a number of molecular clouds in the Galactic Plane, finding that the conditions for star formation are fairly uniform across the Inner Galaxy, regardless of whether they are located in or out of spiral arms. Xu *et al.* (2023) investigated the lack of dense gas outside of the Galactic Plane and found that the scarcity of it favours turbulence as the driving force behind star formation across the Universe, as opposed to supernovae.

The role of SALT

The Southern African Large Telescope (SALT) is the largest telescope in the Southern Hemisphere, providing unparalleled access to the skies for its shareholders, of whom AOP through its membership of the UK SALT Consortium is one. Participation in this major international facility brings visibility throughout the worldwide research community and allows AOP and just a few other UK universities to engage in collaborations with other SALT international partners. In turn, through such partnerships, AOP receives a return in terms of telescope time allocation that is equivalent to roughly 10 times its contribution. In 2023, a long-standing program led by Professor Simon Jeffery at AOP was awarded 130 hours and obtained over 290 unique astronomical observations, targeting some of the most exotic stars in the Universe. Indeed, 123 observations were made during one week in May alone. These contribute to a growing series of discovery papers and to the training of postgraduate research students at AOP. Participation in SALT also allows AOP to explore opportunities through the SALT Collateral Benefits Programme to develop links between local schools in Northern Ireland and in South Africa. AOP carries out the administration function for the UK SALT Consortium, which includes four other academic partners – Keele University, Open University, University of Central Lancashire and University of Southampton.



The 10-metre diameter Southern African Large Telescope (SALT), in the semi-desert region of the Karoo, South Africa.

Using SALT, Simon Jeffery leads a survey of chemically peculiar subdwarf stars in the southern sky. These are stars that are in the final stages of their lives but their histories from birth to the present are very diverse. By exploring the abundances of key elements such as hydrogen, helium, carbon, oxygen, and iron, and of exotic elements such as lead and zirconium, these histories and internal physics can be explored. These AOP-led SALT observations have already led to a first data-release and are now building towards a second data-release, including classifications, coarse analyses and kinematics for over 600 hydrogen-deficient hot subdwarfs. A treasure trove of data for exotic

stars is yielding exciting new discoveries. EC 19529-4430 is the most carbon-poor and metal-poor extreme helium star discovered to date (*Jeffery et al. 2024*); although it must have formed recently from the merging of two white dwarf stars, the original binary star system probably formed some 11 billion years ago. Meanwhile, the hot subdwarf Ton S 415 was discovered to be a double star system containing a white dwarf and a hot subdwarf spinning around each other every 84 minutes, separated by only 5 times the radius of the subdwarf (*Snowdon et al. 2023*). Jorick Vink and a team of international astronomers are using SALT to study the long-term polarised light from the most famous Luminous Blue Variable Eta Carina, which is quite possibly the most massive star in the Milky Way.

Transient and Periodic Variable Stars

Introduction

Apart from the bright planets and the occasional comet, the night sky might appear to be unchanging, with stars appearing to be the same brightness and place as they always are. However, astronomers from the ancient world detected new stars, “novae” or “supernovae”, which suddenly appeared in the night sky and then gradually faded from view over weeks or months. We now know that many of these “transient” events occur when one star circling a companion star unloads enough matter through the process of “accretion” to its companion to make it explode. Supernovae have now been used to show the universe is expanding at an accelerating rate. Other “variable stars” were first detected in the early 17th century when a star now called “Mira” was observed to change in its brightness on a timescale of nearly a year. We now know that Mira is a star several hundred times as large as the Sun, and contracts and expands in size over time. In fact, practically all stars are variable at some level. However, in many cases it is only recently that astronomers have been able to detect this variability.

By studying the brightness of stars in detail we can test physical models which set out to explain their observed behaviour. However, the diversity of variable stars requires different observing strategies. Explosive events can be extremely rare and short-lived, so that in order just to catch their initial rise to outburst it is necessary to observe the entire sky every night. On the other hand, targeted monitoring lasting many months is necessary to unravel the tiny vibrations of Sun-like stars. Professors’ Simon Jeffery and Gavin Ramsay have been using data from the *Kepler* and *TESS* satellites to better understand both the interior of stars and the accretion process. Further, Armagh astronomers have access to the GOTO, BlackGem and other telescopes which are used for many research areas including transients and variable stars.

Recent results

In the study of periodic phenomena, long continuous monitoring with extremely high accuracy has proved necessary to discover the signals due to exoplanets, star spots and gentle vibrations present in or around many stars. For these, space craft are essential to overcome poor weather and day light, with *Kepler/K2* (NASA 2000-2018), *TESS* (NASA 2018-ongoing) and *Plato* (ESA, from 2026) being pivotal missions. Using *TESS* data, Ramsay was a co-author of a study (*Hawthorn et al. 2024*) using *TESS* data which reported the discovery of 85 candidate exo-planets which have orbital periods (the planets year) longer than 20 days, with a number having periods longer than 100 days. Even today, planets with longer periods are difficult to detect. Ramsay was also a co-author of two studies (*Moulton et al. 2023*, *Smith et al. 2023*), which used data obtained from the New Generation Transient Survey (NGTS located in Chile) to study the rotation period and disc structures of very young stars in the Orion nebula.

GOTO and Transients and Variable stars

AOP became a founding partner of the international project the *Gravitational-wave Optical Transient Observer* (GOTO) through a successful bid for funds from the Northern Ireland Executive in January 2015. Its prime goal is to detect the optical counterpart of gravitational wave events such as the neutron star binary merger GW170817. The prototype GOTO node of telescopes was built in 2017 on the summit of the island of La Palma in the Canaries. Early in 2020 GOTO was awarded £3.2m by STFC to allow a second node to be built on La Palma and two nodes in Australia which were installed in April 2023. GOTO now images the whole observable sky every few nights and is ready and waiting for new gravitational wave events made by Ligo and Virgo. The current Ligo observing run started in May 2023 and is expected to continue until the Spring of 2025. GOTO was awarded £1.1M by STFC in March 2024 to cover the costs of operations and support over the next three years.



The two sites of the Gravitational-wave Optical Transient Observer (GOTO) at La Palma, the Canaries and Siding Spring Observatory, Australia.

As GOTO images the sky every night, many new transients and variable stars are discovered. It is now one of the most productive surveys for discovering supernovae in the world. In the current reporting period, GOTO and BlackGem (which targets nearby galaxies) reported more than two hundred new supernovae discoveries. In August 2023 and February 2024, GOTO had dedicated time on the Isaac Newton Telescope in La Palma to take spectra of newly discovered events by GOTO. For one event, the team obtained a spectrum just an hour or so after discovery and only six hours after the stellar explosion took place. Very early observations are key to revealing the nature of these events. GOTO has also been very productive in identifying the optical counterpart of Gamma-ray bursts which are caused by distant neutron stars or black holes events. As data continues to be obtained over the next few years, we expect many new galactic compact binaries to be discovered – these are expected to be the verification sources for LISA, the space based gravitational wave observatory, due to be launched in the mid-2030s.

Solar and Stellar Flares

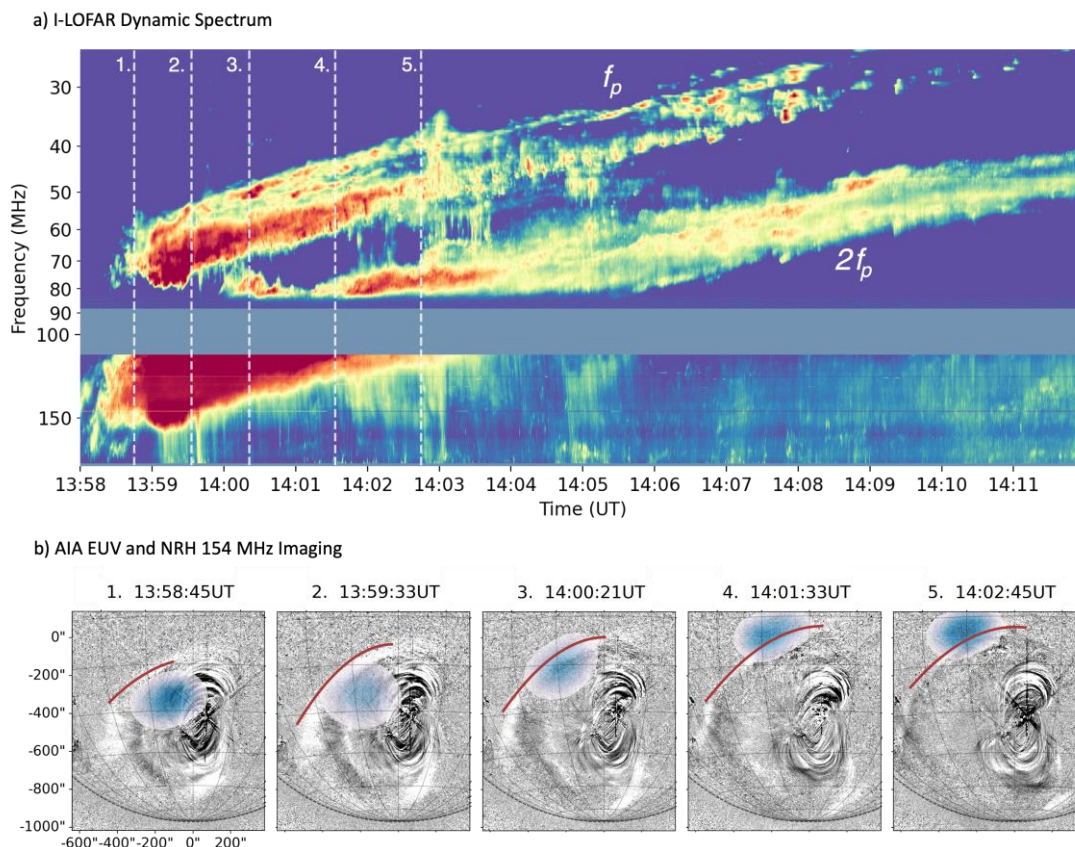
Introduction

Aurora, or Northern Lights in the northern hemisphere, were seen over much of the UK and Ireland in the first few months of 2024. The link between aurora and flares from the Sun date back to Richard Carrington who observed a white light flare on the Sun from England in 1859, which was followed by aurora only 18 hours later that were recorded in Armagh. We now know that flares are caused by regions of strong magnetic activity on the Sun whose intensity varies over the course of the ~11 year *Solar Cycle*. Although one of the wonders of the natural world, these auroral storms can also cause disruption to human activity: in 1989 the electricity grid in Canada was disrupted by a flare causing widespread blackouts. More recently, in February 2022, a solar storm caused forty newly launched Starlink satellites to prematurely enter the Earth's atmosphere costing up to \$20m. The first flares from stars other than the Sun were seen from low-mass dwarf stars nearly a century ago. With space missions such as *Kepler* and *TESS* which can study many stars continuously for many days or months, we can now study flares from many types of stars which can be used to help us determine how often the Sun can release intense flares.

Solar Physics

Solar Physics at AOP is led by Leverhulme Emeritus Fellow Gerry Doyle, whose student Nived Vilangot Nhalil obtained his PhD in Solar Physics in 2023 and now works at the Inter-University Centre for Astronomy and Astrophysics, India. Doyle's research uses data obtained from ground-based telescopes and satellites. One of these telescopes is the LOFAR array which observes the sky at low frequency radio waves. AOP joined I-LOFAR, the Irish consortium which now includes nine partners, in 2016 through capital funding from the NI Executive. The Irish station at Birr Castle links up with stations in ten European countries and strengthens Irish North-South collaboration and the more recent formal links made between AOP, Dunsink Observatory and Birr. It's a prime example of 'big-data' science with all stations in Europe being recently upgraded to LOFAR 2.0 which allows faster data transfer and more rapid data reduction.

In collaboration with colleagues in Dublin Institute for Advanced Studies (DIAS), Gavin Ramsay and Gerry Doyle supervise Jeremy Rigney (Lindsay PhD Scholar) who used data from I-LOFAR to study the intense solar storm of 10 May 2022. These data allowed them to investigate a moving source of low frequency radio emission as a Coronal Mass Ejection and associated Extreme Ultra-Violet wavefront, which was channelled along a region of lower density in the solar corona. Observations like these give insight to the physics processes in the Sun which can cause space weather which can be detected on Earth. Rigney, Ramsay and Doyle are also using the full LOFAR array to search for flares in other stars using simultaneous optical data from the TESS satellite.



Observations of an intense Solar radio flare on 10 May 2022 using I-LOFAR in Birr, Ireland. The top panel shows how the radio spectrum changed over the course of time, with the lower panels showing in grey, ultra-violet images made using the Solar Dynamic Observatory. The blue region shows radio emission obtained from the Nancay telescope in France, while the solid curved line shows the position of the shock front obtained from the I-LOFAR data (Rigney *et al.* 2024).

Stellar Activity

Gavin Ramsay and Gerry Doyle continue to study flares from low-mass stars and Solar type stars. Stars with a wide range of masses and age can produce flares whose energy can be millions of times greater than events from the Sun. Over the last few years, Ramsay and Doyle found a population of very rapidly rotating low mass stars which appear to be flare inactive. Since we expect rapidly rotating stars to be very active this was a great surprise. We have obtained spectroscopic observations of rapidly rotating stars and stars which are rotating much slower. These include data using the SAAO 1.9m telescope in South Africa and the 10.4m Gran Telescopio Canarias (GTC) which are being used to search for evidence of stellar activity using different spectral features. Ramsay and Doyle also obtained high speed observations of a low mass star using HiPERCAM on the GTC to search for short duration low amplitude flares from one of these rapidly rotating apparently inactive stars and are using TESS data to search for evidence of activity cycles in low mass stars.

Solar System Studies

Introduction

Our Solar System is an extraordinary natural laboratory to study the formation and evolution of planetary systems around the Sun and other stars. Our work here feeds into fundamental questions about how the Solar System and the Earth formed and the development of life in the Universe. Our study of comets, asteroids and planets impacts on models of solar system formation, the ever-present hazard to civilization if asteroids or comets hit our planet and

on the origin of water and organic compounds necessary for life to exist. The space industry benefits from improved detailed knowledge and understanding of the near-Earth and interplanetary environment.

Recent results

Apostolos Christou reports that significant progress has been made in the ongoing collaboration with Professor Stanley Dermott (University of Florida at Gainesville, FL, USA) and Dr Dan Li (NSF NOIRLab, Tucson, AZ, USA) to understand the origin and early evolution of our solar system. During this reporting period, Christou applied for and secured a £135k grant from the Leverhulme Trust to help develop advanced statistical methods designed to sift through the huge volume of data from the latest sky surveys to help identify the original planetesimal building blocks from which the rocky planets, including the Earth, came to be. The project focus is the asteroid belt between Mars and Jupiter, the broken-up fragments of leftover planetesimals. A continuous flow of asteroid data from ground-based telescopes and space missions will soon be complemented by the most comprehensive survey of the sky to-date by the Vera Rubin telescope currently under construction at the Atacama Desert in Chile. Existing analytical tools are not suited for the very high volume and complexity expected in the Rubin data. The grant will allow to advance the state-of-the-art in asteroid data analysis tools by hiring a professional data scientist and by borrowing methods and techniques from the emerging new field of Artificial Neural Networks, the ultimate aim being to reconstruct the original form and number of asteroids present in the primordial solar system.



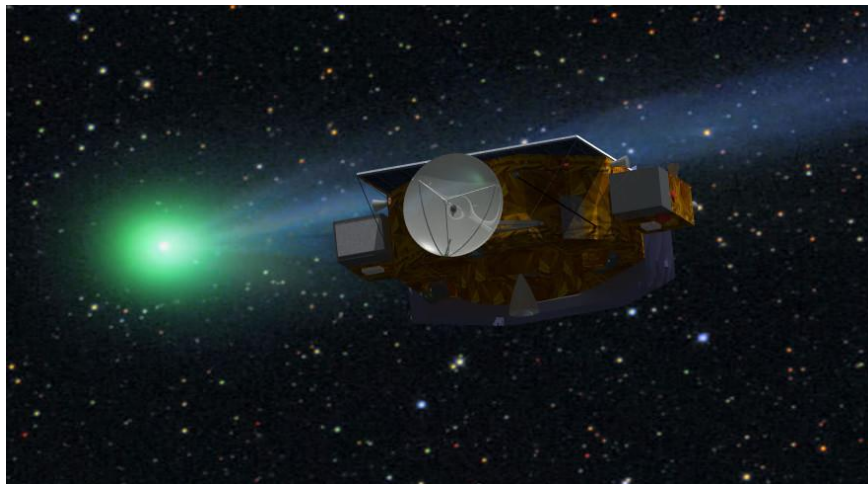
The Rubin telescope, seen here under the glittering light of the Milky Way at the Atacama Desert in Chile. The facility is expected to begin commissioning operations in 2025.

Another international collaboration, this time with Dr Auriane Egal (Paris Observatory, France; U. Western Ontario, Canada) and with Nick Georgakarakos (New York U., United Arab Emirates) succeeded in advancing our understanding of how the streams of material left behind by comets can interact with planetary bodies and measurably affect their environment. Observations in the Earth's atmosphere and in near-Earth space show that the Earth is subject to a continuous flow of particles or meteoroids raining down from space, the debris from comets and asteroids that cross our planet's path around the Sun. Since the time of Ernst Öpik, Armagh has been a leading centre of research to understand the Earth's meteoroid environment and in extending that understanding to other planetary bodies. Past work by Christou and by former Armagh astronomer Dr David Asher, had identified a meteor stream that appears both at the Earth and at the planet Mercury, helping to maintain a tenuous atmosphere around the planet made up of calcium atoms ejected from the surface. The new research that appeared in *Monthly Notices of the Royal Astronomical Society* in January 2024 (Christou, Egal and Georgakarakos, 2024) shows that some denser parts of the stream ("clumps") rich in large, fireball-producing meteoroids identified in the Earth observations also reach Mercury at certain times in the past and in the future. Significantly, the next encounter between the clump and Mercury will occur as the ESA/JAXA BepiColombo (BC) probe and its suite of instruments will be entering orbit around the planet. The fortuitous timing of the encounter presents a rare opportunity to document the effect of the clump in the Hermean environment during BC's short tenure at the solar system's innermost planet.

Stefano Bagnulo and his PhD student Zuri Gray secured telescope time at the ESO VLT to study the consequences of the impact of Double Asteroid Redirection Test (DART), a planetary defence mission to test a method of deflecting an asteroid on course to hit Earth. DART arrived at near-Earth asteroid Didymos on 26 September 2022. The spacecraft crashed into the asteroid's small moon Dimorphos, testing whether the kinetic impactor technique works. Because of the impact, dust clouds were ejected from Dimorphos, which was studied by Bagnulo and Gray from ground-based telescopes using polarimetric techniques (Bagnulo, Gray and Granvik 2023). Their work formulated two distinct scenarios for the formation of the dust on the surface of the impacted asteroid and has attracted international interest including through an official ESO press release.

Finally, AOP work on our Solar system links also to extra-solar planetary systems and in particular to ESA's Plato mission, which is due to be launched towards the end of 2026, has a prime goal of identifying Earth sized planets around Solar type stars in its habitable zone. Gavin Ramsay is one of two ESA Plato Community Scientists and member of the ESA Plato Science Working Team. At the start of the mission, Plato will point at region in the southern hemisphere covering 2,250 square degrees for at least two years.

The COMET INTERCEPTOR Space Mission



Artist impression of COMET INTERCEPTOR Space Mission

ESA recently approved a space mission to encounter a comet coming from the edge of our Solar System; the launch is expected in 2028. A novel idea sets this mission apart. So far, spacecraft have approached comets that are already well known and have gone around the Sun already several times. Therefore, it is very likely that the comet material has been “processed” by solar radiation and the space environment, and it is no longer in pristine condition. By contrast, here we are interested in comets on their first trip around the Sun, made of unprocessed material preserved in the cold outer parts of the solar system. To achieve the goal of visiting such a new comet, the spacecraft will be launched before the comet is found and will wait in deep space for instructions. Once a suitable target comet is found, instructions will be sent from the ground to guide the spacecraft to the comet (hence the name **Comet Interceptor**). Studying the material brought for the first time to the heat and light of the Sun will give us the opportunity to look at the solar system as it was when it formed. AOP is contributing to the development of the instrument that will send to Earth comet images (including polarimetric images) obtained with a fish-eye lens. Stefano Bagnulo is an expert in polarimetric observations and is one of the co-Investigators of the project, and his PhD student Zuri Gray is also involved in the mission team. Most recently, Bagnulo has officially become a Co-Investigator of the EnVisS instrument on-board Comet Interceptor, and member of the Comet Interceptor “Near Environment” working group. He has participated to the second CI Working Group meeting at the European Space Research and Technology Centre in March 2023.

Researcher Development Concordat

In February 2023 AOP became a signatory of the Concordat to Support the Career Development of Researchers, which is an aspirational Concordat that aims at increasing the appeal and sustainability of researcher careers in the UK. The Researcher Development Concordat focuses primarily on the rights and responsibilities of researchers who are employed solely or largely to conduct research (e.g. PDRAs and Research Fellows) and is often part of the eligibility criteria for securing research grants. The Concordat has three defining principles covering *Environment and Culture* (for a supportive and inclusive research culture), *Employment* (to ensure that researchers are recruited, employed and managed under conditions that recognise and value their contributions), and *Professional and Career Development*. The Concordat outlines key responsibilities for institutions in each of these areas and expect them to publish an action plan and to report progress in annual reports to their governing bodies.

Considering AOP's strong governance structure, in terms both of its comprehensive set of policies as well as its appraisal, recruitment and induction procedures – all of which reflect the Northern Ireland Civil Service (NICS) ethical and equal-opportunities principles. The following actions have been identified:

On Environment and Culture

- Ensure awareness of the Concordat for managers and researchers, including at the outset during the recruitment process and following induction.

- Continue to support staff and students' mental health and well-being through the Inspire Wellbeing employee assistance framework from NICS.
- Provide Equality, Diversity and Inclusion training to all AOP staff including managers of researchers.
- Avail of AOP agreement with QUB for the supervision of PhD student to train AOP managers on research integrity through the QUB Epigeum online courses.
- Supplement the periodical formal Research Excellence Framework (REF) and QUB reviews of AOP research environment with specific queries in annual staff surveys.

On Employment

- Continue to offer our dedicated Öpik fellowship as an opportunity for progression towards independent research.
- Promote researcher contribution to AOP research through presentations for AOP governing bodies and dedicated sections in AOP annual reports.

On Professional and Career Development

- Promote the commitment to ten annual career development days to researchers and their managers, including using existing reserved AOP training budget and by ensuring managers allow time for career development or researchers.
- Monitor the appetite and uptake on career development opportunities and training through appraisals and the subsequent annual meeting of researchers with the Head of Research (as already implemented through a Juno project action).
- Increase awareness of careers outside academia through dedicated seminars sessions, including from AOP or QUB alumni.

Research Integrity Concordat

The UK Committee on Research Integrity (UKCORI) was established in 2022, following the signing of the Concordat to Support Research Integrity, in order provide a national framework for good research conduct and its governance. The signatories of the Concordat include UK Research and Innovation (UKRI) and Department for the Economy for NI (DfE NI). UKCORI wish to raise awareness at Board level of the principles and importance of Research Integrity. Research integrity is also referenced in the Concordat for Researcher Development. AOP participated in a workshop held in the Ulster Museum that was organised by UKCORI this year designed to raise awareness of the importance of research integrity in Northern Ireland.

Research has integrity when it is carried out in a way that is trustworthy, ethical and responsible.

Research integrity is, therefore, about doing research that not only leads to findings and outcomes that people can trust, and have confidence in, but is carried out in an ethical manner with care and respect for those involved in the process.

When research is carried out with a high degree of integrity, other researchers, those who wish to apply the research, and members of the public have confidence in the findings. While the nature of our understanding of the conclusions drawn from research may change in time, if the research was conducted with high integrity people will still feel able to trust the findings and outcomes as they were understood at the time.

Education and Community Outreach

Planetarium

AOP is a special place that brings together fundamental research and public curiosity about the nature of the cosmos, all within a heritage environment that is rich in scientific history. Four pillars underlie and support the public programme of AOP - education, inspiration, entertainment and outreach. The Planetarium was established in 1968 and is world-renowned as an innovative centre of excellence in promoting the public understanding of science.

At the Planetarium, the primary activity is the education and the dissemination of scientific and astronomical knowledge. The Planetarium also promotes an understanding of astronomy and science to a large audience base of all ages, from nursery to seniors via a school's educational programme and science offering to the wider public through both onsite and outreach means.

In 2022/23 financial year we achieved a record breaking 72,000 visitors to AOP and it was encouraging to maintain this benchmark in 2023/24 having 71,905 visitors through our doors. This year we did not have a stand-out exhibition during the summer, but instead, we held themed weeks which maintained our visitor numbers at that high level. Our

stargazing evening and music shows have also been popular with sell-out events. All credit to our education team for delivering and maintaining a high level of customer service and educational learning for our visitors this year.

One of the largest visitor increases came towards the end of this year in the form of our off-site or outreach visitors. Thanks to funding from Science Foundation Ireland (SFI) and the UK Space Agency we had the opportunity to develop a dedicated outreach programme delivered by Dr Rok Nežič. The funding has allowed us to reach many rural schools that typically cannot engage with us in Armagh due to distance. The programme is fully funded for schools.

The education team also facilitated two Stranmillis College placement students this year, which supports the teaching college and also benefits us as we get students coming with different ideas and angles to help in our education programme. While our school pupil numbers held strong it must be noted that we had many cancellations due to both teachers strikes and Translink transport strikes during this year which did affect our school visitors.

A focus for 2024/25 will be our afternoon visits which we want to grow with afterschool and community groups. This year we made steps towards this goal of increasing afternoon visits through an IAU funded programme where we set up an after-school STEM club. A youth forum of children with additional needs was developed to advise us on programme changes required to make the centre more assessable, thanks to funding from the Association of Science and Discovery Centres (ASDC). The team delivered a pre-school club called "Little Astronomers" which was a monthly sold-out event. We participated in global events such as One Hundred Hours of Astronomy where we held afternoon solar viewing sessions. This has shown us the potential and possibilities we have for increasing that afternoon slot for many groups and families.

Accessibility is always a focus for us at AOP on how we can be as inclusive as possible to ensure that every person gets to experience the stars making us a "space for all". We hold monthly dome shows in British Sign Language (BSL) and Irish Sign Language (ISL). Our screening is of our popular dome show "CapCom Go" and this year we also extended the dome show interpretation to a children's tour of the planets called "Perfect Little Planet". This will be of benefit to schools and to the public as well. We also provided a BSL and ISL interpretation of our live Christmas experience "Mission Santa" and our dome show this year "The Alien who Stole Christmas" was interpreted into BSL and ISL. We added Makaton signing to our "Astronaut George" dome show which is due to be launched in May 2024.

Monthly relaxed dome show sessions are now standard in our programme as well as relaxed event sessions for workshops. We have also renewed our JAM (Just A Minute) Card registration with all front-line staff JAM Card trained and our staff received Level one Makaton training. Our sensory bag provision which was worked on by the Bold Futures forum and made possible through an ASDC Bold Futures fund have been really well received and used by many schools and families.

To enhance the outdoor grounds, we installed and launched a new kids Eco trail with a workbook, sculptures, clues and an augmented reality (AR) app around the grounds. There is also an adult app focusing on a tour of the grounds and Observatory. A lot of work across the organisation went into this new experience over the last year and these outdoor trails have already increased dwell time and been popular with visitors and locals, especially during the sunny days.

This year we held four scientific conferences at the Planetarium during September 2023. This month is the only time when demand on our Copernicus Hall is at a low level which allowed us the opportunity to hold back-to-back meetings. The conferences held were the British Association of Planetaria (BAP) annual conference, 31 August to 2 September, 5th International Workshop on AM CVn Binaries (AMCVn5), 5 to 8 September, 11th International Conference on Hot Subdwarf Stars and Related Objects (sdOB11), 11 to 15 September and, 42nd European Symposium on Occultation Projects (ESOP42), 16 to 17 September.

Successful funding opportunities this year include:

- ASDC: Explore your Universe – £9,500;
- ASDC: Bold Futures – £22,000;
- ASDC: Missions and Mindsets – £2,000;
- ASDC: Our World from Space – £9,500;
- IAU OAD: After Schools – €5,000;
- SFI – Discover Programme – €60,000 "Cosmic Explorers: Igniting STEM and Astronomy in Schools";
- UK Space Agency – Space for All – £66,075.

Other events to note this year were:

- British Orienteering Championships, which took place in Armagh (including AOP's grounds) in May 2023, we held an event for participants;
- Engineers Open House weekend of rocket making;
- Outdoor Creation NI Conference;

- Our World from Space Saturday Club (monthly);
- Events with the ABC Council for the Food and Cider Festival;
- Orienteering in the Astropark during February Half-Term;
- First Light: 230 Years of Observations from Armagh;
- European Open Heritage Day: Experience the Calver Telescope;
- Our Planet and the Universe: IAU 100 Hours of Astronomy;
- Data Visualisation Laboratory (DVL) sessions held during busy school holidays where the researchers and students delivered a presentation on their work in the DVL;
- Our Director who developed and delivered "Director's Cut" planetarium shows to audiences;
- We opened the Calver dome for special occasions and hope to build upon this with training for the education team this year;
- We held a scouts take-over day where the association booked the Planetarium for the whole day and provided shows and workshops for their members;
- Our staff participated in and delivered presentations at the ASDC annual meeting showcasing the great work being done at AOP;
- Our education team have opened a world of opportunity with dome show development, which started late in the year but is a programme that we would like to develop.

History and Heritage

History and Heritage Policy

AOP boasts a collection of over thirty-three thousand historic documents, rare and antiquarian books, scientific instruments and photographs. This collection is unique on the Island of Ireland and one of the best-preserved observatory collections in the United Kingdom. The heritage policies implemented ensure that the collection is cared for in accordance with best practice and has allowed ongoing historical research. AOP is now represented on the Board of Directors of the Northern Ireland Museums Council by the Museum Collections Officer who began their three-year term in September 2023.

During 2023-24 the Observatory has continued to be open to the public for the 'Legendary Telescope Tour' package, which has been well received. In 2023 the King George III collection was put on display for the first time in its entirety for the Armagh Georgian Festival in November. The eMuseum has 9,003 objects available for public viewing on the armagh.space website. The Planetarium display cases have hosted one loaned in exhibition 'The life of William John Roberts', and three additional exhibitions based on the AOP Historical Collection, 'Technology Past and Present', 'The Planetarium' and 'Navigation'. One temporary exhibition off-site was hosted in Dublin at the Bank of Ireland building and Dunsink Observatory for the Robinson Lecture and launch of the Astronomical Observatories of Ireland network. AOP accepted one donation in 2023-24, which was a functional late Victorian 'Magic Lantern' projector system from the Ulster Aviation Society.

In accordance with AOP's policy of making our collection available for the public and researchers to use we have continued to facilitate public information requests. The 2023-24 financial year brought twenty requests facilitated by the Museum Collections Officer. AOP hosted the British Association of Planetaria Annual Conference in September 2023 and a Study Visit by the Scientific Instrument Society in March 2024. Both events were showcases of the outstanding Historical Collection and provided opportunities for sessions delivered by the staff of AOP.

2023-24 saw the second year of the National Lottery Heritage Fund project. This project, 'Wisdom Begins with Wonder' is funded to run from May 2022 and it has now been extended to run until August 2024 and has seen the successful implementation of a volunteer program. Since launching, the volunteer program has facilitated over eight hundred hours of voluntary work in AOP, with more volunteers awaiting projects. The project has also funded the position of Museum Collections Officer from June 2022 - August 2024, on a part time basis. At present the five active volunteers are working on varied projects including academic research, archival work, and preventative conservation. In total volunteers have accessioned 1,809 new objects to the AOP Historical Collection in 2023-24.

AOP has also continued to publish historical research, and staff have been involved in a project to publish a book with the International Planetarium Society and have published three papers. The team also provided access to the operated collection of historic scientific instruments. Over the winter observation period, five successful observation sessions were held with the Grubb 10-Inch telescope, and two students were trained in its use. The Grubb 15 Inch and Troughton Equatorial have also undergone successful preventative conservation, and the Earnshaw Number 2 regulator has been returned to operational condition.

Library and Archives

AOP's suite of technical equipment is complemented by one of the finest astronomical study libraries on the Island of Ireland. The library provides an essential reference resource for AOP research, and especially for its student and young researcher cohort. It contains approximately 3,400 textbooks, monographs, special reports, and conference proceedings covering nearly all disciplines in astronomy. Some 17,000 volumes from nearly two hundred scientific

journal titles include nearly complete runs of all the major astronomy journals, as well as journals of significant historical interest.

During 2023-24 the collection has been supplemented by forty-eight new books on topics relevant to AOP research. Work continues binding the backlog of unbound journals, including all held copies of the Scientific Instrument Society Bulletin. A scoping audit of the remaining backlog has been conducted to inform future funding requirements. 51 loans have been processed and returned, and 60 volumes are currently on loan to the staff and students. To encourage greater engagement with the loans process, every researcher and student has been provided with a physical copy of the Loans Form QR code.

Whilst still under enormous pressure for space, the AOP library is now an attractive space and a more effective research tool, with potential for further development and revenue generation, and increasingly demonstrating its potential for historical discovery as well as astronomical research. It has been used weekly for the Student Discussion, and the Research Seminar. It has been used monthly by the Armagh and District History group for their meetings and will be opened to the public for the first time in April 2024.

Meteorological Record

As part of AOP's primary research role, staff and students take daily readings of a wide range of meteorological parameters at Armagh and maintain the Observatory's unique 229-year meteorological record and databank. This is believed to be the longest daily climate series in the UK and Ireland from a single site (though the log book for the period June 1825 to December 1832 appears to have been lost), as well as being one of the longest in the world. The climate station has been continuously maintained since July 1795 with readings currently taken every day at 09:00 (GMT). The World Meteorological Organisation (WMO) has recognised Armagh with Centennial Station status for its longevity and importance in contributing to the climate record.

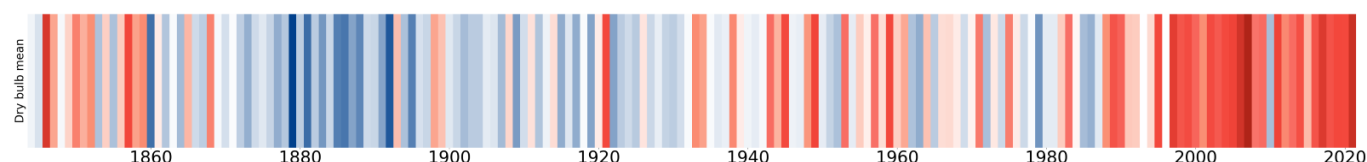
The automated weather station (AWS) was installed by the Met Office in 2019, sampling the weather every minute. This now provides the primary source of weather data in the Met Office records (e.g., temperature, pressure, rain fall, windspeed) since it is automatically uploaded to the Met Office. The instruments are inside a second Stevenson Screen within an expanded meteorological enclosure to ensure that the AWS enclosure is identical to those used by the Met Office in their UK-wide network. In October 2023 a grass minimum thermometer was added to the AWS to complement the similar sensor in the manual station. Manual collection still continues and provides the only source for some of the data collected (e.g. sunshine) at Armagh.

Calibration of these data has enabled researchers and government agencies to use the Armagh series for reports and research into global warming. The data contributes to the UK Meteorological Office's main climate database and are released to the general public on a monthly basis through press releases and on our climate website (<https://weather.armagh.space>) whilst also contributing to the UK Meteorological Office's main climate database.

Climate change is a subject of strategic importance for Northern Ireland in this era of climate variability. Armagh's unique climate record provides an exceptionally long historical baseline, enabling better informed judgements to be made as to how Northern Ireland's climate has responded and is responding to climate change world-wide. AOP has a movable exhibition on the climate change in the Copernicus Hall, centred around an interactive Puffersphere presentation, together with supporting exhibits around the room which expand on local impacts.

We developed a series of python scripts to store, analyse and provide access to the weather data base via the weather webpage listed above. This includes both the manual data as well as the automated weather station data. This takes the monthly observers log, provides a means of entering the information via an online log, and in addition automatically downloads the data received from the automated station, to ingest these data sets into a new database. Analysis scripts then allow this database to be interrogated, e.g. to find climate extrema over any date range of interest. This includes enquiring about weather on any single day (as might be used in a visitor display in the Planetarium), as well as examining the data set over any period of interest and searching for climate records (extrema) over a period of interest. The automated weather station data is now also available to inspect online, in addition to the manual data. Plotting tools allow the user to see the weather over any time period, as well as to find when extrema in the various measured parameters occurred.

The two new PhD students (Kyriakos Trakakis and Arjun Chawla) were trained in 2023 on weather observations, and then accredited as Level 1 Met Observers by the Director. This forms part of their PhD training in the techniques of scientific data measurement and analysis.



Armagh's version of the famous climate stripes that were used at COP26 in Glasgow to graphically demonstrate global warming has been extended to include new data. The colour of the stripes reflects the difference between the mean temperature that year compared to the long-term average. They are a superb example of science communication, for it is not necessary to understand the detail of how it made, the warming trend in the current millennium is clear. AOP's climate stripes extend back to 1844 when Armagh started measuring maximum and minimum temperatures.

Until 2023 for the month of September the hottest day in Armagh since 1838 (when daily temperature max readings began) had stood at 27.6°C, as measured on 1 September 1906. The 10th ranked hottest September day had been 24.9°C, as measured on 4 September 1898. However, the sequence of 5 successive days from 4th to 8th of September 2023 now feature in the top ten of all September highs for Armagh, with the new hottest September temperature being 28.5°C, as measured on 8 September 2023.

In October 2023, the record for rainfall in a single month in Armagh was broken since measurements began in 1838. A total of 195.4mm of rain was recorded in our manual weather station, breaking the previous record month, which was October 1870, when 193.8mm of rain fell.

Support

AOP is committed to ensuring fit for purpose governance and support services to support the delivery of organisational objectives.

Information and Communications Technology (ICT)

The comprehensive research computer facilities are used primarily for numerical analysis, computer modelling and data reduction. Update and renewal of computers and peripherals is mainly provided through a planned capital development plan funded by DfC and occasionally by external research grants. Research staff require access to high-end Apple Mac and Linux workstations. In addition to this, Corporate and Education is serviced within a Microsoft environment.

An ICT Strategy was approved in October 2022. Continuous focus and short, medium and long-term activities are considered by the Audit and Risk Assurance Committee (ARAC) each quarter.

AOP continues to modernise and improve its centralised ICT hub. All devices are now managed using Intune and are secured using multi-factor authentication and device registration. Auto patching of all Linux, Windows and Mac devices has reduced our exposure to cyber-attack. The focus now moves to software run on the devices as the next level of risk develops.

The biggest risk to AOP still remains user error through clicking on malicious links in emails. AOP mitigates this through regular reinforcement of messaging and a focus on continuing to educate users in best practice and system etiquette.

Finance

AOP has a well-established finance function. Financial policies and procedures are continually being enhanced to ensure that AOP meets the governance standards required. This includes the application of public sector procurement controls, meeting prompt payment targets and providing regular and ad hoc financial information within AOP and to DfC.

AOP continues to experience significant cost pressures within a core budget that has remained relatively static for 7 years. In 2023-24 it was able to mitigate some of the cost of the 2023 public sector pay award through an additional resource allocation and income from admissions and trading sales which exceeded expectations.

Human Resources

A Human Resources Strategy 2022-26 has been developed and approved and is supported by an annual Human Resources Action Plan. The 2023-24 plan has been implemented to include:

- Maintaining a Fit for Purpose Organisation Structure – review of the skills-gap paper and workforce planning papers in light of available budget and future needs; completion of necessary recruitment and training in a timely matter and identifying short term opportunities to plug skills gaps with short term projects or engagements;
- Continual review of Operating Models – supporting the Education Operations Manager with employee working arrangements and reviewing staffing needs in the context of budgets and affordability;
- Employing and Investing in Motivated and Engaged Staff – supporting annual appraisal process; completing/revising a rolling training plan; reviewing implementation of training plans in the context of

available budget; preparing a case for award of a special bonus scheme; preparing for engagement events and supporting the health and wellbeing of PhD students;

- Fair and Equitable Employment Policies and Procedures – completion of the annual Fair Employment return; retention of Bronze Diversity Mark Award; review of policies and induction and refresher training as required.

Diversity and Inclusion

AOP has an obligation under Section 75 of the Northern Ireland Act to ensure that equality of opportunity and good relations are central to policy making, policy implementation and review as well as service delivery. AOP monitors the composition of its workforce in terms of community background and sex and uses an equal opportunities monitoring form questionnaire. AOP submits an annual Fair Employment Monitoring return to the Equality Commission detailing staff composition and that of job applicants to AOP posts.

In the AOP Strategic Plan 2021-26 we state that having Fair and Equitable Employment Policies and Procedures is one of our key elements in delivering high standards. AOP has a number of policies in place including an Equal Opportunities Policy.

AOP retained the Bronze Diversity Mark Accreditation in July 2023. The three Equality, Diversity and Inclusion targets set for the next year are:

- To develop an Equality, Diversity and Inclusion Strategy;
- To increase the number of female research staff at AOP from 2 to 4; and
- To increase female representation on the AOP Management Committee from 3 to 5.

AOP retained Juno Practitioner status in August 2023. This is an award scheme that recognises and rewards university physics departments, schools of physics, and related institutes and organisations that can demonstrate they have taken action to address gender equality at all levels and to foster a more inclusive working environment. An application to become a Juno Champion in April 2023 was unsuccessful. A new Juno award is currently being developed and once launched AOP will assess its suitability against that scheme.

Governance

Governance and accountability continue to be strengthened and improved and risks reduced as demonstrated by external and internal audit reviews. Actions arising from effectiveness reviews undertaken by both ARAC and the Management Committee have also resulted in enhanced arrangements.

One outstanding Internal Audit recommendation, relating to Record Management, is currently being progressed. A Retention and Disposal schedule is actively under consideration by the Public Record Office of Northern Ireland (PRONI). The organisation has moved towards paperless record management systems which will be easier to manage and control in accordance with the approved Retention and Disposal Policy.

Future Redevelopment Project

AOP manages an extensive property estate which includes nine separate buildings, including the Grade A listed Observatory and a circa 20-acre historic estate. There are also several leases associated with land and property.

During the year AOP submitted a draft Outline Business Case (OBC) for redevelopment to the Department and has provided responses to queries raised in respect of same. The OBC is still under consideration with active engagement on final amendments ongoing. AOP views this project as imperative to future proof its role into the next generation. The case for change is predicated by an estate that is outdated and misaligned to expectations of modern-day visitors and future opportunities. On 29 March 2024 AOP was awarded circa £1.3m grant towards the development phase of the project, representing 25% of the funding required to bring the plans to RIBA stage 3. Another funding application to PeacePlus is still under consideration and a bid to DfC for capital match funding for this phase is also being considered.

NetZero

AOP's international research standing, and unique record of uninterrupted meteorological observations has allowed it to effectively communicate on the issue of climate change (CC) to the general public, thanks also to the design and installation of a temporary CC exhibition in the Planetarium and of a CC Puffersphere display given AOP's own commitment to reducing its carbon footprint by 50% by 2030.

Moving in this direction, in the last financial year Department for the Economy (DfE) capital funding was obtained to change the external lighting on AOP grounds to more efficient LED lights and following the standards of the International Dark Sky Association. In fact, one of AOP's key objectives is to achieve Urban Night Sky Place (UNSP)

accreditation through the International Dark-Sky Association and with it serve as beacon for promoting and informing local councils in Northern Ireland on how to reduce their own light pollution and corresponding energy waste.

Along the same line, two new green energy power generation stations based on wind and solar power, the Windtree and the Smartflower (see figure below), have been installed on AOP's grounds using previously allocated DfE funding. While this installation will not generate sufficient power to cover all the needs of the Planetarium, it will serve to illustrate the role that renewable energy technologies can play in harnessing energy from wind and the Sun, also adding to AOP's education offering.



AOP's Smartflower and Windtree, the only ones of their kind in Britain and Ireland

Achievements and Performance

The targets set for AOP in the 2023-24 Business Plan are shown in the following table. Actual performance achieved is shown along with the corresponding achievement in the previous financial year, where applicable.

Targets were achieved or exceeded in many areas; however, three targets were not met. Whilst the total visitors target was exceeded the target in respect of school visitors was not achieved due to a number of school cancellations as a result of education and bus strikes and also snow. Failure to meet the remaining two targets is beyond AOP's control in that they are reliant upon external factors.

KPI	Description	Target	As at 31 March 2024	As at 31 March 2023 (where applicable)	Comments
1	Attract 67,000 visitors (to include 55,000 public visitors and 12,000 school visitors)	67,000	Public 60,097	62,793	Total 71,905 visitors
			School 11,808	9,381	There were a number of school cancellations due to teacher and bus strikes and also snow.
2	Achieve 150 number bed nights from a collaboration with local accommodation providers	150	158	182	
3	Achieve bronze level certification to be a Makaton friendly business			New KPI	Award changed by Makaton Society and there have been delays in getting the new award live. KPI unachievable and beyond AOP's control.
4	Achieve £568,000 income from admissions and sales	£568,000	£592,494	£570,851	
5	Achieve an 80% satisfaction rating of 4 or above out of 5	80%+ evaluation ratings $\geq$ 4	90.83%	88.67%	
6	Provide in-reach or outreach visits to at least 10 special schools (25%)	10	23	New KPI	
7	Deliver 4 dedicated educational days: 2 for GCSE and 2 for Junior Cycle	4	2	New KPI	
			2		
8	Deliver 4 events focused on the work of astronomers and PhD students	4	22	7	
9	Deliver 2 events on Climate Change and AOP green agenda	2	2	New KPI	
10	Deliver one event to raise awareness of the Armagh-Birr-Dunsink partnership	1	1	1	
11	Achieve recognition as an Urban Dark Sky Place			Unachievable	The capital project encountered difficulties at procurement stage.
12	Publish 50 articles in referenced scientific journals	50	63	85	
13	Scientific Outreach:	12	35	39	

	12 scientific talks at international conferences 12 public talks by scientists	12	40	43	
14	Admit 2 new PhD students in October 2023	2	2	3	
15	Attract 8 external bookings for events or seminars	8	10	14	
16	Facilitate 6 onsite scientific visits	6	28	26	
17	Delivery of 3 astronomy conferences hosted by AOP	3	3	New KPI	
18	Develop one non-astronomy partnership in the use of DVL facilities	1	1	1	
19	Develop one new Puffersphere application around AOP research	1	1	2	
20	Submit one major funding application in pursuance of AOP future development	1	2	0	
21	Achieve £323,000 funding from scientific sources to support AOP research	£323,000	£380,732	£359,339	

Progress Key: Complete, Not Achieved

Financial Review

Operating Results

In the financial year to 31 March 2024, the value of charity funds increased by £2,111m, summarised below.

	2024 £	2023 £
Total incoming resources	3,354,210	3,730,874
Total outgoing resources	(3,978,546)	(4,285,869)
Net expenditure	(624,336)	(554,995)
Gains on the revaluation of fixed assets	500,740	255,242
Actuarial gains on defined benefit pension scheme	(121,000)	2,411,000
Net movement in funds for the year	(244,596)	2,111,247
Movement in Unusable Funds		
Capital financing		
Capital grants received	435,000	549,000
Government grant fund	(826,567)	(858,746)
Revaluation reserve	271,372	1,904
Pension reserve	(158,000)	2,035,000
Movement in Usable Funds		
Restricted	(100,091)	(26,080)
Unrestricted	133,690	410,169
	(244,596)	2,111,247

The total income for the year was £3.354m, a decrease of £0.377m from 2022-23, mainly due to a decrease in DfC resource and capital grant income of £0.269m, and the end of the Tourism NI supported capital project, offset by an increase in operating income of £0.036m.

Expenditure was £3.979m, a decrease of £0.307m from the previous year. Staff costs continue to be the largest component of operational expenditure, comprising 63% of all direct costs.

Unrestricted operating costs are funded primarily by DfC grant-in-aid. The balance of such unrestricted operating costs is funded by contributions from external grants, operating income, trading activities and miscellaneous income. We continue to seek other funding streams to maintain this important source of funds. In 2023-24 the Department provided 71% of the total income through recurrent and capital grant allocations (2022-23: 71%).

Net Assets

Net assets at 31 March 2024 were £12.476m (31 March 2023: £12.720m).

Reserves

The AOP reserves policy is included in note 1 of the accounts. Total accumulated funds are as follows:

Funds at 31 March	2024 £	2023 £
Restricted funds	47,937	148,028
Unrestricted funds	4,752,692	5,010,569
Revaluation Reserve	7,675,246	7,403,874
Pension Reserve	-	158,000
Total Charity Funds	12,475,875	12,720,471

Going Concern

The Trustees are satisfied that the organisation is a going concern on the basis that it has a reasonable expectation that it will continue in operation for the foreseeable future. The financial statements are therefore prepared on a going concern basis.

Pension Reserve

AOP is a member of Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) which manages Local Government Pension Scheme (LGPS) Northern Ireland, which in turn provides a defined benefits pension to employees. At 31 March 2024 the surplus was calculated by independent actuaries at £1,175,000 (2023: surplus £158,000). The assets, defined benefit obligation and current service cost shown in note 19 to the accounts have been calculated based on the data and results of the 2022 triennial actuarial valuation. AOP has applied the principles of IFRIC14 in relation to pension surplus restriction. IFRIC14 requires allowances to be made for a minimum funding requirement, which limits the amount of economic benefit available to the excess of the value of prospective current service costs above the funding requirement.

Key Risks and Uncertainties

At year end, the key risks were identified as:

- Reputation – loss of confidence in AOP's ability to deliver acceptable level of research of international value;
- Engagement:
 - Visitors – failure to provide experiences that attract new and returning visitors and/or failure to engage local pride in AOP as a cherished asset;
 - Partners and collaborators – failure to attract support and commitment from key stakeholders to be able to deliver future vision;
- Resources:
 - Staff - failure to maintain an appropriately skilled, highly motivated and engaged workforce of sufficient capacity to satisfactorily deliver AOP objectives;
 - Budget – insufficient or poor management of budget could result in objectives not being met and/or value for money not being achieved;
- Asset Management:
 - Buildings and Heritage – failure to plan for the long term development needs of the estate and assets resulting in increasing reliance on remedial intervention and failure to protect heritage assets from irreparable decline;
 - Other physical assets including ICT – failure to plan for the upkeep and renewal of plant and equipment resulting in reduced service delivery; and
- Governance and Planning:
 - Failure to embed best practice approaches to corporate governance and risk management resulting in loss of confidence and reputational damage and/or legal challenge;
 - Inadequate information/data security measures resulting in information breaches and/or cyber security breaches.

As part of the Risk Management Strategy, management regularly review the inherent level of risk for each of the above and how the risk is currently managed. An Action Plan is documented to reduce the level of risk, mindful of the risk appetite of the organisation. This Risk Register is reviewed on a quarterly basis by the Audit and Risk Assurance Committee and approved by the Management Committee. Many of the above risks derive from the uncertainty around funding. Until AOP has both a budget appropriate to its needs and long-term security of funding, this situation is likely to continue. In managing these funding risks, the organisation has developed and maintained close communication links with the Department and submitted in-year monitoring bids for additional funding while carefully monitoring spend and budgets. For many of the above risks all reasonable steps within AOP's control are being taken to manage the risk.

The above risks also take account of recommendations from internal and external audit exercises and reports. Significant progress has been made in addressing the weaknesses identified in previous years and considerable effort has been put into the management of these risks going forward.

Plans for Future Periods

In 2021, AOP published a Strategy for 2021-26 with the four key themes of Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

Leading on from this AOP has prepared a Business Plan for 2024-25 for consideration by the Department. The business plan has been developed in the context of an unclear and uncertain financial environment, however AOP remains focused and optimistic towards continued achievements within its key priority areas.

AOP, in conjunction with the Dublin Institute of Advanced Studies, Dunsink Observatory, and the Birr Science and Heritage Foundation, have embarked on a formal strategic process to develop an inter-institutional partnership for mutual benefit, the “Astronomical Observatories of Ireland”. This takes place in acknowledgement of the potential for strengthening the partner institutions’ collaborative working capacity and for our wider national and international impact. This also includes taking into account emerging opportunities for strengthening the long-standing North-South connections between Armagh, Dunsink and Birr in a way which maintains the integrity of each partner’s core mission, and also promotes the intrinsic value of scientific knowledge and heritage represented by the body of work carried out over the three sites since their establishment and ongoing collaborative activities. This will continue to be a key area of work in 2024-25 and will include an application to be included in the Republic of Ireland Tentative List for UNESCO World Heritage Status as a transnational bid with the UK.

Following on from the submission of an Outline Business Case for future development AOP will continue to work with partners and stakeholders to identify funding opportunities and other resources to move the project forward to the next phase of planning.

Structure, Governance and Management

Armagh Observatory and Planetarium is a single statutory corporation and arms-length body (ALB). ‘The Governors of The Armagh Observatory and Planetarium’ are as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*.

This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled ‘*An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever*’, and an Amendment of 1938 (‘The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938’).

AOP is a registered charity under the title “The Armagh Observatory and Planetarium”.

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one Department nominee;
- one Queen’s University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

The Order places a statutory duty on “the Governors of Armagh Observatory and Planetarium” to maintain and manage AOP with the purpose of “developing and improving the knowledge, appreciation and practice of astronomy and related sciences.”

The Board of Governors (the Board) has retained a role to ensure that the culture and character, history and patrimony embodied in AOP are protected and preserved and that the institution is managed in line with the statutory purpose outlined in the Order. This role will normally be fulfilled through an Annual Review meeting (visitation) where the Board will receive assurance as to the management and performance of AOP from the Management Committee.

Management Committee of Armagh Observatory and Planetarium

The Board has delegated primary responsibility for the governance and management of AOP to a Management Committee. The Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department and approved by the Minister and for promoting the efficient, economic and effective use of resources. The Management Committee provides leadership, challenge, oversight, support and encouragement to the Director and staff.

The Management Committee comprises:

- three nominees from the Board of Governors;
- six nominees from the Department appointed through open competition;
- one nominee of Queen’s University, Belfast;
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS);
- a Chair appointed through open competition; and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

The following committees are established as sub-committees of the Management Committee.

Audit and Risk Assurance Committee (ARAC)

The ARAC is a sub-committee of the Management Committee established in accordance with DAO (DFP) 06/13 - Corporate governance in central government departments: Code of Good Practice NI 2013, and in line with the HM Treasury Audit and Risk Assurance Committee Handbook (DoF 03/18) to advise the Board of Governors, the Management Committee and the Director of AOP as Accounting Officer and to support them in their responsibilities

for issues of organisational risks, internal control, governance and their associated assurances and in reviewing the reliability and integrity of these assurances.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is a sub-committee of the Management Committee and provides advice and recommendations to the Management Committee on employment issues.

Research and Education Advisory Committee

The Research and Education Advisory Committee is a sub-committee of the Management Committee and advises it on research and education issues.

Redevelopment Committee

The Redevelopment Committee is a sub-committee of the Management Committee and was established to develop an Outline Business Case for redevelopment proposals.

Further details on the membership of these Committees are set out in the Governance Statement on pages 31 to 40.

Reference and Administrative Details

Name of the Charity

The charity is registered and operates under the title of The Armagh Observatory and Planetarium.

Charity number

Registered with the Charity Commission for Northern Ireland 103948.

Principal Office

College Hill, Armagh, BT61 9DG

Trustees

Archbishop J McDowell, (Board Chair)
The Very Revd S Forster
The Venerable E Cairns
The Venerable Dr P Thompson
Revd Canon W M Adair BEM
Revd Canon W J A Dawson (to 31 December 2023)
Revd Canon M Hagan MBE
Revd Canon D Hilliard
Revd Canon B Paine
Revd Canon R J N Porteus
Mr G Cox
Professor A Fitzsimmons
Mr R Wilson
Archbishop E Martin
Mr J Briggs (Management Committee Chair)
Professor L Harra (to 30 April 2024)
Mr S Brown (to 30 April 2024)
Mr P McGurgan (to 30 April 2023)
Professor M Mathioudakis
Professor C Jackman
Professor M Darnley
Mr P Kennedy
Dr K Lemon
Mr E Rooney
Ms S Leslie

Director and Accounting Officer

Professor Michael Burton

Auditors

Northern Ireland Audit Office, 106 University Street, BELFAST, BT7 1EU

Internal Auditors

Cavanagh Kelly, 36-38 Northland Row, Dungannon, BT71 6AP

Bankers

Danske Bank, Donegal Square West, Belfast, BT1 6JS

Register of Interests

A Register of Interests is maintained for Board and Committee Members and Senior Management and is available for inspection at the Principal Address. Declared Interests by Board and Committee Members and the Director are available on the AOP website – www.armagh.space.

Related party transactions are shown in note 23 of the accounts.

Gifts

AOP adheres to the limits and rules laid out in its Partnership Agreement approved by the Department and the guidance in Managing Public Money Northern Ireland (MPMNI). There were no gifts made or accepted during the 2023-24 financial year that exceeded these limits.

Personal Data Related Incidents

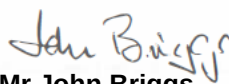
AOP has considered the requirement to report personal data related incidents. It is content that there were no such incidents in the year ended 31 March 2024.

Disclosure of Audit Information

So far as the Accounting Officer is aware, there is no relevant audit information of which AOP's auditors are unaware. The Accounting Officer has taken all necessary steps to make himself aware of any relevant audit information and to establish that AOP's auditors are aware of that information.

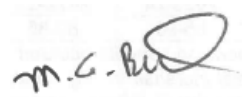
Events after the end of the reporting period

There have been no events since the end of the financial year requiring disclosure.



Mr John Briggs
Trustee

Date: 21 October 2024



Professor Michael Burton
Director / Accounting Officer

Date: 21 October 2024

Remuneration and Staff Report

The remuneration and staff report sets out AOP's remuneration policy for Board members and senior managers, reports on how that policy has been implemented and sets out the amounts awarded to the Director. In addition, the report provides details on remuneration and staff that users see as key to accountability.

Remuneration Policy

The pay remit for the Northern Ireland Civil Service (NICS), including senior civil servants (SCS), is normally approved by the Minister of Finance. Following the Secretary of State for Northern Ireland's 27 April 2023 Written Ministerial Statement (WMS) on the budget, the NI public sector pay policy guidance was published on 31 May 2023 in FD (DoF) 05/23. This was subsequently updated on 12 March 2024 in FD (DoF) 04/24 to reflect the return of Executive Ministers and revised departmental budgets.

Annual NICS pay awards are made in the context of the wider public sector pay policy. The pay award for NICS non-industrial staff, including SCS, for 2023/24 has been finalised and was paid in June 2024.

AOP staff remuneration is aligned with NICS pay scales. The Accounting Officer is authorised by DfC to approve its pay remit and business case, notifying same to DfC, prior to implementation of the pay award. Staff received he pay award, including backpay, in June 2024.

Trustees

Trustees do not receive any remuneration. They receive travel and subsistence allowances at rates and on conditions determined by AOP, subject to Departmental approval. No Trustee receives pension benefits or makes pension contributions in their capacity as a Board member. Management Committee members who were not trustees during the financial year received travel and subsistence expenses of £2,287 (2023: £1,766).

Service Contracts

The Director of AOP, Professor Michael G. Burton, is the person in a senior position having authority and responsibility for directing and controlling the activities of the organisation. The service contract of the Director commenced on 1 August 2016.

Current terms and conditions for staff are those set out in various policies and individual employment contracts. Senior staff are permanent employees of AOP. The notice period for senior staff is three months. Termination payments are in accordance with contractual terms and those of the principal Civil Service Pension Scheme (NI).

Director's Remuneration (including Salary and Pension Entitlements) (Audited Information)

The following tables provide details of the remuneration and pension entitlements of the Director of the organisation.

Single Total Figure of Remuneration of Director							
	Salary (£'000)		Pension Benefits* (£'000)		Total (£'000)		Percentage Change
Official	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	
M.G. Burton	85-90	80-85	35	14	120-125	95-100	(9.7%)

**The value of pension benefits accrued during the year is calculated as (the real increase in pension multiplied by 20) plus (the real increase in any lump sum) less (the contributions made by the individual). The real increases exclude increases due to inflation and any increase or decrease due to a transfer of pension rights.*

'Salary' includes gross salary (on an accruals basis) to the extent that it is subject to UK taxation. There was no overtime, benefit-in-kind, bonus or other allowances. The salary of the Director shown above is based on the Northern Ireland Senior Civil Service Grade 5 pay scale.

Compensation on early retirement or for loss of office

No payment for compensation on early retirement or for loss of office has been made (2022-23: £nil).

AOP Fair Pay Disclosures (Audited Information)

AOP is required to disclose the relationship between the remuneration of the Director and the lower quartile, median and upper quartile remuneration of the organisation's workforce. The banded remuneration of the Director in the financial year 2023-24 was £85,000 - £90,000 (2022-23: £80,000 - £85,000). The relationship between the mid-point of this band and the remuneration of AOP's workforce is disclosed below.

2023-24	25 th percentile	Median	75 th percentile
Total remuneration	£21,053	£27,913	£33,780
Pay ratio	4.2:1	3.1:1	2.6:1

2022-23	25 th percentile	Median	75 th percentile
Total remuneration	£18,783	£29,731	£37,373
Pay ratio	4.4:1	2.8:1	2.2:1

Total remuneration includes salary, overtime and performance-related bonuses. It does not include severance payments, employer pension contributions and the cash equivalent transfer value of pensions. Remuneration ranged from £14,189 to £87,500. The 25th percentile remuneration increased following a 12% increase in the NICS AA pay scale. Because overall employment numbers are low, small changes in the staffing structure can appear disproportionate.

The percentage changes in respect of AOP are shown in the following table. It should be noted that the calculation for the Director is based on the mid-point of the band within which their remuneration fell in each year.

Percentage change for:	2023-24 v 2022-23	2022-23 v 2021-22
Average employee salary and allowances	8.6%	2.4%
Director's salary and allowances	6.1%	-5.7%
Average employee performance pay and bonuses	-7.2%	14.9%

No performance pay or bonus was payable to the Director in these years.

Pension Entitlements (Audited Information)

Official	Accrued pension at pension age as at 31/03/24	Real increase in pension at pension age	Accrued Lump Sum at 31/03/24	Real Increase in Lump Sum	CETV at 31/03/24	CETV at 31/03/23	Real Increase in CETV
	£'000	£'000	£'000	£'000	£'000	£'000	£'000
M.G. Burton	14	2	-	-	247	194	33

The figures enclosed are based on last year's guidance from the Department of Finance on the pension information that should be disclosed in accounts for 2022/23 i.e. these figures exclude the McCloud Remedy from the calculations for any eligible members. The real increase in CETVs is based on the factors in force at 31 March 2024. Due to changes to the non-club transfer factors, provided by the Government Actuary's Department during the year the CETV calculations for the 2022/23 year have been re-run and provided as the starting input CETV value for the start of the 2023/24 year. When calculating the real increase in CETV and the pension benefits accrued during the year 2023-24 for the single total figure of remuneration, NILGOSC takes account of inflation. The CPI increase for September 2023 was 6.7%. The in-service revaluation rate for the Career Average Revalued Earnings Scheme was also 6.7%.

Pension Scheme

Pension benefits are provided through the Northern Ireland Local Government Officers' Superannuation Committee Pension Scheme (NILGOSC). For members, 1/49th of pensionable pay will be added to their pension account each year and retirement pension is based on career average earnings. Details can be obtained at <http://www.nilgosc.org.uk>.

Active members of the pension scheme will receive an Annual Benefit Statement. The accrued pension quoted is the pension the member is entitled to receive when they reach their scheme pension age, or immediately on ceasing to be an active member of the scheme if they are at or over pension age.

Employee contribution rates for all members for the period covering 1 April 2023 to 31 March 2024 are as follows:

Pensionable Pay	Contribution Rate
£0 to £16,900	5.5%
£16,901 to £26,000	5.8%
£26,001 to £43,400	6.5%
£43,401 to £52,800	6.8%
£52,801 to £104,700	8.5%
More than £104,700	10.5%

Employer contribution rates are determined by the Scheme's actuary every three years. Following the results of the 2022 actuarial valuation, the Committee agreed with its actuary the employer contributions of 19% for the following three years, effective from 1 April 2023. The next valuation is due as at 31 March 2025.

Cash Equivalent Transfer Values

A Cash Equivalent Transfer Value (CETV) is the actuarially assessed capitalised value of the pension scheme benefits accrued by a member at a particular point in time. The benefits valued are the member's accrued benefits and any contingent spouse's pension payable from the scheme. A CETV is a payment made by a pension scheme or arrangement to secure pension benefits in another pension scheme or arrangement when the member leaves a scheme and chooses to transfer the benefits accrued in their former scheme. The pension figures shown relate to the benefits that the individual has accrued as a consequence of their total membership of the pension scheme, not just their service in a senior capacity to which disclosure applies. The CETV figures include the value of any pension benefit in another scheme or arrangement which the individual has transferred to the NICS pension arrangements. They also include any additional pension benefit accrued to the member as a result of their purchasing additional years of pension service in the scheme at their own cost. CETVs are calculated in accordance with The Occupational Pension Schemes (Transfer Values) (Amendment) Regulations 2015 and do not take account of any actual or potential benefits resulting from Lifetime Allowance Tax which may be due when pension benefits are taken.

Real increase in CETV

This reflects the increase in CETV effectively funded by the employer. It does not include the increase in accrued pension due to inflation, contributions paid by the employee (including the value of any benefits transferred from another pension scheme or arrangement) and uses common market valuation factors for the start and end of the period. However, the real increase calculation uses common actuarial factors at the start and end of the period so that it disregards the effect of any changes in factors and focuses only on the increase that is funded by the employer.

Total Permanently Employed Staff Costs (Audited Information)

	Permanent staff £	Others ¹ £	2023-24 £	2022-23 £
Wages and salaries	1,305,600	141,083	1,446,683	1,341,618
Social security costs	137,506	13,316	150,822	142,108
Employer's pension contributions	233,129	26,111	259,240	250,805
Defined benefit pension additional service cost	51,000	-	51,000	327,000
	1,727,235	180,510	1,907,745	2,061,531

¹ "Others" includes £13,501 for agency staff

Average staff numbers (Audited Information)

	Permanent staff	Others ²	2023-24 Total Number	2022-23 Total Number
Average staff numbers	28.5	6.7	35.2	35.3

² "Others" includes 4.1 fixed term, 2.3 casuals and 0.3 agency staff

Staff Composition – permanent employees (full time equivalent)

	Male	Female
Directors/senior managers	2.6	2.0
Other employees	10.7	13.2

Staff Turnover

	2023-24	2022-23
Leavers as a percentage of average staff in post	1.5%	3.1%

Sickness Absence (Audited Information)

Staff sickness for the period 1 April 2023 to 31 March 2024 totalled 94 days (2023: 126 days) which equates to an average per FTE of 1.24% (2023: 1.66%).

Expenditure on External Consultancy (Audited Information)

Expenditure on external consultancy during the year was £nil (2022-23: £nil).

Off-payroll Engagements (Audited Information)

There were no “off-payroll” engagements in place as at 31 March 2024, nor were any arrangements entered into between 1 April 2023 and 31 March 2024.

Exit Packages (Audited Information)

Exit package cost band	No of compulsory redundancies	No of other departures agreed	Total no. of exit packages by cost band	Total no. of exit packages by cost band
	2023-24	2023-24	2023-24	2022-23
Total no. of exit packages	-	-	-	-
Total resource cost	Nil	Nil	Nil	Nil

Statement of the Responsibilities of the Governors and Accounting Officer

In accordance with The Armagh Observatory and Planetarium (Northern Ireland) Order 1995, The Governors shall prepare and submit to the Department a statement of accounts in respect of each financial year, and that statement shall be in such form and contain such information as the Department may direct and shall give a true and fair view of the state of the Governors' affairs at the end of the financial year and of the income and expenditure of the Governors in the financial year.

In preparing the accounts, the Accounting Officer is required to comply with the requirements of the Government Financial Reporting Manual and in particular to:

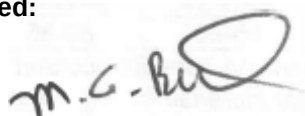
- apply suitable accounting policies on a consistent basis;
- make judgements and estimates on a reasonable basis;
- state whether applicable accounting standards as set out in the Government Financial Reporting Manual have been followed, and disclose and explain any material departures in the accounts;
- prepare the accounts on a going concern basis; and
- confirm that the Annual Report and Accounts as a whole is fair, balanced and understandable and take personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

The Department for Communities has appointed Professor M.G. Burton as Accounting Officer of AOP. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding AOP's assets, are set out in Managing Public Money Northern Ireland.

Statement of Disclosure of Information to the Auditors

As the Accounting Officer, I have taken all the steps that I ought to have taken to make myself aware of any relevant audit information and to establish that Armagh Observatory and Planetarium's auditors are aware of that information. So far as I am aware, there is no relevant audit information of which the auditors are unaware.

Signed:



Professor Michael Burton
Accounting Officer for Armagh Observatory and Planetarium

Date: 21 October 2024

Governance Statement

AOP is a Non-Departmental Public Body established under The Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

1. Compliance with Corporate Governance Code

In 2013 the Department of Finance and Personnel published Corporate Governance in Central Government Departments: Code of Good Practice NI. The Code draws on best practice in the public, private and charity sectors by: reinforcing the importance of corporate governance as a pre-requisite to achieving good financial management; reflecting changes in governance best practice, including increased emphasis on good leadership; and promoting better governance arrangements within departmental families.

The Code is written for departments, concentrating throughout on key principles which will have wider application for other parts of the public sector. Such bodies (including arms-length bodies (ALBs)) are encouraged to consider and adopt the practices set out in the Code wherever it is relevant and practical and suits their business needs.

AOP in so far as they are relevant for an arms-length body, complies with the principles of good practice in the Corporate Governance Code.

2. Governance Framework

Accounting Officer

Name	In post
Professor Michael Burton – Director and Chief Executive	From 1 September 2016 onwards

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one DfC nominee;
- one Queen's University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

During 2023-24 one new Member was appointed to the Chapter of the Church of Ireland Cathedral of Armagh and one Member retired. There are currently two vacant positions.

BOARD OF GOVERNORS			
GOVERNOR	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 1)
Archbishop J McDowell (Chair)	28 April 2020	None	1
The Very Revd S Forster Dean of Armagh	14 February 2021	None	1
The Ven E Cairns Archdeacon of Ardboe	13 December 2020	None	1
The Ven Dr P Thompson Archdeacon of Armagh	13 January 2019	None	1
Revd Canon W M Adair BEM	10 September 2008	None	0
Revd Canon W J A Dawson	1998	31 December 2023 (Retired)	0
Revd Canon D Hilliard	13 March 2016	None	1
Revd Canon W B Paine	7 May 2017	None	0
Revd Canon R J N Porteus	1998	None	0
Revd Canon M Hagan MBE	23 April 2023	None	1
VACANT (from Feb 2023)			
VACANT (from 1 January 2023)			
Professor A Fitzsimmons	18 April 2019	1 May 2024	1

Mr R Wilson	1 December 2019	30 November 2024	0
Archbishop E Martin	1 January 2021	31 December 2025	0
Ms S Leslie	From 1 June 2021	31 May 2026	0
Mr G Cox	1 March 2021	28 February 2026	1

At the annual meeting on 16 May 2023 the Board of Governors endorsed the continuing membership of Messrs Cox and Wilson as its nominees on the Management Committee and afforded the Archbishop time to consider a replacement for Revd Canon Adair as a nominee on the Management Committee. Revd Canon Hagan was subsequently appointed as the third nominee.

The Board considered a paper regarding the Charity Name and Delegation of Charity Trustee Status, which had been prepared following discussions with the Charity Commission for Northern Ireland, and agreed to include the Members of the Management Committee as Charity Trustees (alongside Members of the Board of Governors) and to change the name of the Charity from 'The Governors of Armagh Observatory and Planetarium' to 'Armagh Observatory and Planetarium.'

The Board approved the draft Outline Business Case for AOP Redevelopment Project for submission to DfC.

The Chairs of the Management Committee and Audit and Risk Assurance Committees provided verbal reports to the Board and the minutes of both meetings between June 2022 and April 2023 (draft) were provided.

The Board formally retrospectively approved the Annual Report and Accounts 2021-22 and approved the draft Annual Report and Accounts 2022-23.

The Board noted the Management Report for 2022-23 which included the Director's Report; Corporate Plan Objectives; Key Performance Indicators and the Risk Register as at 31 March 2023 and approved the draft Business Plan 2023-24.

The Board confirmed that it was satisfied that comprehensive arrangements were in place to ensure that high-quality information was received to enable it to make informed decisions. Internal controls were in place to validate the accuracy and completeness of information presented to the Board.

Minutes of the meeting record the business carried out and actions agreed.

Management Committee of Armagh Observatory and Planetarium

The Management Committee comprises:

- a Chair appointed through open competition;
- three nominees from the Board of Governors;
- six nominees from DfC;
- one nominee of the Queen's University Belfast (QUB);
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS); and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

During 2023-24 there were three changes to the Membership of the Management Committee. Mr McGurgan retired on 30 April 2023 and Revd Canon Hagan replaced Revd Canon Adair as one of the Board of Governors' nominees to the Management Committee. The term of appointment for both Professor Harra and Mr Brown was extended by one year from 30 April 2023 to 30 April 2024.

There is currently one vacant position, with two further vacancies arising on 30 April 2024. A public appointment process to fill all three of these positions completed in June 2024.

MANAGEMENT COMMITTEE			
MEMBER	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 6)
Mr J Briggs (Chair)	1 January 2018	31 December 2027	6
Professor L Harra	1 November 2014	30 April 2024	4
Mr S Brown	1 November 2014	30 April 2024	6
Mr P McGurgan	1 November 2014	30 April 2023	1 from 1
Professor M Mathioudakis	11 November 2016	10 November 2026	5

Mr R Wilson	1 December 2019	30 November 2024	2
Professor C Jackman	1 January 2021	31 December 2025	3
Professor M Darnley	1 January 2021	31 December 2025	4
Mr P Kennedy	1 March 2021	28 February 2026	6
Dr K Lemon	1 March 2021	28 February 2026	5
Mr E Rooney	1 March 2021	28 February 2026	5
Mr G Cox	19 May 2021	18 May 2026	5
Revd Canon W M Adair BEM	15 September 2021	16 May 2023	0 from 1
Revd Canon M Hagan MBE	17 May 2023	NONE	1 from 3
VACANT (from 1 May 2023)			

A special meeting of the Management Committee was held in May 2023 to consider the draft Outline Business Case for AOP Redevelopment Project and in April 2023 the Management Committee recommended the final draft for Board approval at a Special Meeting held on Thursday 4 May 2023.

On 17 April 2023, the Committee noted an Armagh City, Banbridge and Craigavon Borough Council Notice of Motion acknowledging, endorsing and supporting the work of AOP and its international linkages and partnership with Birr and Dunsink – the Astronomical Observatories of Ireland.

The draft 2023-24 Business Plan was approved for submission to DfC in April 2023. It was approved by the Permanent Secretary on 14 November 2023.

In April the Management Committee considered a number of papers relating to Whistleblowing/Raising a Concern and approved AOP's updated Policy; reaffirmed its commitment to an ethical culture where all concerns were taken seriously; undertook to provide assurance to the Permanent Secretary regarding staff awareness of the Policy and appointed Mr Greg Cox as AOP's Designated Officer (Whistleblowing Champion).

The Management Committee considered an update on discussions with the Charity Commission for Northern Ireland in relation to changing the Charity Name and the Delegation of Charity Trustee Status in April 2023. In June 2023 it noted that the Charity Commission was comfortable with changing the registered name from 'The Governors of Armagh Observatory and Planetarium' to 'Armagh Observatory and Planetarium' and unanimously agreed that the Management Committee Members take on the responsibility of Charity Trustee alongside the Members of the Board.

A two-day meeting took place in June 2023. In addition to routine business over the two days the Management Committee received a presentation on Carbon Reduction and Action Plan; held an interactive session with staff; undertook practical taster sessions; received a presentation and discussion with the Council in relation to Armagh Place Strategies; received a presentation on DfC's Building Inclusive Communities Strategy and a reviewed the draft Memorandum of Understanding (MoU) which would formally establish the Astronomical Observatories of Ireland. The MoU was signed on Thursday 21 September 2023 in Dunsink, Dublin.

The Committee considered and was content with the summary of its annual Effectiveness Review in September 2023.

In September, on the Chair's recommendation, it approved the establishment of a Liaison Committee between Management Committee and key SMT officers to ensure all issues relating to the redevelopment project were aligned and addressed. The first meeting took place on 17 November 2023.

At the December meeting the Management Committee received a Mid-Term Review of the Strategic Plan. A sub-committee was also established to consider the 2024-25 budget.

At each of its meetings throughout the year the Committee received a report from the Director, a presentation on Research from an Astronomer, updates from each of its standing sub-committees and approved relevant reports. Regular governance reports such as the Bi-Annual Assurance Statement, the Corporate Risk Register, ICT Risk Register, Key Performance Indicators and Finance reports were reviewed and approved. The Committee considered and noted amendments to policies that had been reviewed in line with the policy review process and approved new policies as appropriate.

Throughout the year, the Management Committee also considered progress on AOP's Vision and redevelopment which included updates from the Redevelopment Sub-Committee.

Internal controls are in place to validate the accuracy and completeness of information presented to the Management Committee.

Minutes of the meetings record the business carried out and actions agreed.

Audit and Risk Assurance Committee

The Audit and Risk Assurance Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members. A special meeting took place in June 2023 to discuss the Internal Audit Strategy with the reappointed Internal Audit provider.

AUDIT AND RISK ASSURANCE COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 5)
Mr S Brown Chair (from June 2021)	5
Professor L Harra	3
Mr P McGurgan (to 30 April 2023)	1 from 1
Mr P Kennedy	5
Mr E Rooney	5
Dr K Lemon (from June 2023)	4 from 4

During 2023-24 the Audit and Risk Assurance Committee considered the Internal Audit Charter; the Internal Audit Strategy 2023-2026, Internal Audit Plan 2023-24; reports from Internal Audit on progress against the audit plan and on outstanding recommendations; a revised Report to Those Charged With Governance in respect of the 2021-22 Accounts and reports from external auditors on the 2022-23 Annual Report and Accounts; review of the Accounting Officer's Assurance Statement and review of the Risk Register. In view of the severity of ICT related risks, including data/cyber security, a separate ICT Risk Register was developed.

The Committee is satisfied that the integrated approach, the frequency of meetings, the breadth of the business undertaken, the skills of Members and the range of attendees at meetings of the Committee has allowed the Committee to meet the governance requirements of the organisation and assisted the Management Committee to demonstrate its stewardship of the public resources with which it is charged.

The Committee is satisfied that the organisation has robust risk management arrangements in place which are in line with the good practice in the HM Treasury 'Orange Book' and are reviewed regularly by the Management Committee.

There were 4 Internal Audit recommendations from prior years outstanding, 2 of which have been completed. The Committee is satisfied that progress is being made to complete the remaining outstanding recommendations. There were 6 new internal audit recommendations identified during 2023-24, 3 of which have been implemented.

Minutes of the meetings record the business carried out and actions agreed.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members. Special Meetings took place in October 2023 and January 2024 to discuss Strategic Workforce Planning and PDRA pay scales respectively.

STAFFING POLICY AND REMUNERATION COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 6)
Mr E Rooney (Chair)	6
Mr S Brown	6
Mr J Briggs	6
Dr K Lemon	6
M P Kennedy	6

In 2023-24, amongst other matters, the Committee considered:

- staffing and recruitment, including Skills Gaps Analysis and Strategic Workforce Planning;
- updates to staff related policies, including review of Hybrid Working Policy; and
- a range of Human Resources issues including progress against the Human Resources Strategy and Action Plan.

AOP retained its Diversity Mark (Bronze Award) and Project Juno Practitioner Status. The application for Juno Champion did not meet the standard.

Research and Education Advisory Committee

The Research and Education Advisory Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

RESEARCH AND EDUCATION ADVISORY COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 2)
Professor L Harra (Chair)	2
Professor M Darnley	2
Dr K Lemon	1
Professor M Mathioudakis	1

In 2023-24, amongst other matters, the Committee considered:

- education and outreach activities, including visitor reports;
- research activities, including changes to the publication environment; Research Excellence Framework (REF) updates; funding opportunities; PDRA Salaries; UK Committee on Research Integrity; Commentary on AOP Research Strategy; and
- an Intellectual Property Paper.

A Local Organising Committee (LOC) comprising members from across AOP ensured the smooth delivery of 4 Conferences held at the Planetarium in September 2023.

Redevelopment Sub-Committee

The Redevelopment Sub-Committee's membership is drawn from the Management Committee and comprises of six members.

REDEVELOPMENT SUB-COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 3)
Mr S Brown (Chair)	3
Mr J Briggs	2
Mr G Cox	1
Mr P Kennedy	3
Dr K Lemon	2
Mr E Rooney	2

The primary purpose of the Sub-Committee was to drive the 'Development of AOP Science and Education Park' Project forward, and oversee the delivery of the outcomes and benefits, most notably initially an Outline Business Case (OBC) by March 2023. It was a very ambitious and challenging timetable and there was a little slippage. The OBC, which was submitted to DfC on 1 June 2023, remains under consideration.

Since submission of the OBC in June 2023, this 'task and finish' Sub-Committee, which will continue until the OBC is approved, has met twice and considered a range of issues associated with project governance including the Business Case, planning / design issues, funding packages and stakeholder engagement.

Finance Sub-Committee

An interim finance sub-committee was established in December to consider the potential budget constraints faced for 2024/25 and possible actions to be taken. The sub-committee met three times, taking a detailed look at budget proposals and determining cost priorities. This culminated in a letter from the Accounting Officer to the DfC Permanent Secretary in May 2024 setting out identified savings and inescapable costs.

Conflicts of Interest

The organisation maintains a register of interests to ensure that potential conflicts of interest can be identified and addressed in advance of Board, Management Committee and other Committee discussions. The register is formally revisited on an annual basis. Where conflicts exist, they are recorded in the Committee minutes and the Chair of the meeting decides the most appropriate way of managing the conflict. This may include that member not taking part in discussions or making decisions on certain matters or being excluded for part or all of that meeting.

The Register of Interests for Board of Governors, Management Committee and senior staff is published on the AOP website in accordance with central government guidance.

Directors and Secretary

Professor Michael Burton is Director and Chief Executive.

The Corporate Manager provides a range of secretarial support services to the Board of Governors, Management Committee and Audit and Risk Assurance Committee; the HR and Policy Officer provides secretarial support to the Staffing Policy and Remuneration Committee, and Executive Officers support the Research and Education Advisory Committee and Redevelopment Sub-Committee.

3. Business Planning and Risk Management

Business Planning

'Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.'

'Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.'

The pillars that support us are – Knowledge, Legacy, People and Engagement.

The five-year strategy is built around four strategic themes - Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

The Strategic Plan aligns closely with the aims and objectives of the Observatory and Planetarium's sponsor - the Department for Communities (DfC) – and with the broader aims and objectives of the Northern Ireland Executive's Programme for Government. The organisation's Strategic Plan 2021-26 received Departmental approval on 17 August 2021.

The work of the Observatory encompasses both internationally acclaimed research and a unique cultural heritage — scientific, historical, architectural — as well as maintaining the unique daily climate series (the longest daily series from a single site in the UK and Ireland) and undertaking a world-class programme of science in the community, which complements the Planetarium's main business of education.

The Planetarium's main business is education, and all age and social groups are welcome to visit. The educational programmes and demonstrations are designed to include participation by children of pre-nursery age up to senior citizens and all age groups in between. The primary educational aim of the Planetarium is to endorse and promote the Science, Technology, Engineering, Arts and Mathematics (STEAM) agenda which promotes scientific careers to young people. All of the ancillary activities support the primary aim, with the additional target of offering excellent value for money, both to the visitors taking part and to the public purse. The Planetarium maintains a focus on being inclusive so that all children can enjoy the Planetarium experience.

Full details of all the Observatory and Planetarium's activities are provided in comprehensive Annual Reports which are available online at: www.armagh.space.

No Ministerial Directions have been given regarding the work of AOP.

Risk Management

Risk Management is an essential element of AOP's corporate governance framework and is closely linked to the system of internal control and business planning process. HM Treasury Orange Book establishes the concept of risk management and provides a basic introduction to its concepts, development and implementation of risk management processes in government organisations. A robust risk management process assists AOP in identifying and managing issues which may hinder the achievement of objectives. The arrangements are regularly reviewed.

As well as ensuring that there is an effective system in place to deal with threats to AOP's aims and objectives, the organisation encourages a proactive approach to innovation and well-managed risk taking where there is potential to realise sustainable improvements in the organisation's research and educational services. For this reason, the organisation's Risk Appetite is 'Open'.

The Management Committee sets the risk appetite for AOP. The Accounting Officer, Senior Management and other staff are responsible for ensuring that residual risks are reduced to a level as low as reasonably practicable and wherever possible consistent with the level of risk appetite established by the Management Committee.

Updates are provided to the Audit and Risk Assurance Committee on the development and implementation of the risk management process across AOP. The Audit and Risk Assurance Committee provides the Accounting Officer with objective advice on issues concerning the risk, control and governance of the organisation and the associated assurances. An update on the main points considered by the Audit and Risk Assurance Committee is provided to the Management Committee following each meeting and the Management Committee has access to all papers for the Audit and Risk Assurance Committee.

4. Fraud and Information Risk

The Accounting Officer has overall responsibility for managing the risk of fraud including:

- developing a fraud risk profile and undertaking a regular review of the fraud risks associated with each of the key organisational objectives in order to keep the profile current;
- establishing an effective fraud prevention policy and fraud response plan, commensurate with the level of fraud risk identified in the fraud risk profile;
- designing an effective control environment to prevent fraud commensurate with the fraud risk profile;
- operating appropriate pre-employment screening measures;
- establishing appropriate mechanisms for reporting fraud risk issues, reporting significant incidents of fraud, and coordinating assurances about the effectiveness of fraud prevention policies to support the Governance Statement;
- liaising with the Audit and Risk Assurance Committee;
- ensuring that all staff are aware of the organisation's fraud prevention policy and know what their responsibilities are in relation to combating fraud;
- ensuring fraud awareness training is provided as appropriate and, if necessary, more specific fraud prevention training and development is provided to relevant staff;
- ensuring that vigorous and prompt investigations are carried out if fraud occurs, is attempted or is suspected by the establishment of a Fraud Investigation Oversight Group;
- ensuring, where appropriate, legal and/or disciplinary action against perpetrators of fraud;
- ensuring, where appropriate, disciplinary action against supervisors where supervisory failures have contributed to the commission of fraud;
- ensuring, where appropriate, disciplinary action against staff who fail to report fraud;
- taking appropriate action to recover assets and losses;
- ensuring that appropriate action is taken to minimise the risk of similar frauds occurring in future; and
- ensuring that an anti-fraud culture is promoted throughout the organisation in line with the seven Nolan Principles of Public Life.

Risks to data and information held by the organisation are owned and managed by individuals designated as information asset owners. The Corporate Policy and HR Officer responds to requests for information under the Data Protection and Freedom of Information Acts following consultation with the Accounting Officer and the organisation's governing Committees, as appropriate.

AOP operates a Whistleblowing Policy which informs all members of the organisation of the standards of behaviour expected of them in carrying out their duties, and to provide information on the procedures to follow if a situation arises in which they are required to act in a way which is believed by them to be illegal, improper, or in breach of the Nolan Principles.

5. Governance and Accountability

AOP seeks to achieve excellence in good governance, in particular the precepts: (1) leadership; (2) effectiveness; (3) accountability and (4) sustainability.

The Chair of the Board of Governors has a particular leadership responsibility for securing the sustainability and vitality of the organisation in the long term; giving advice and direction in formulating AOP's forward look and overall strategy; ensuring that account is taken of guidance provided by the Minister or the Department; promoting the efficient and effective use of staff and other resources; encouraging high standards of probity amongst staff and Board and Committee members alike; and ensuring that the Board and its Committees meet at regular intervals throughout the year and that the Minutes of meetings accurately record the decisions taken and, where appropriate, the views of individual Board members.

Within AOP, the Director, supported by his Senior Management team, has responsibility for the management and effective operation of their organisation. Their operational responsibilities include:

- developing, implementing and monitoring the strategic and operational plans;
- undertaking financial management and Accounting Officer responsibilities;
- managing and developing a team of highly qualified professional and administrative staff;
- identifying and attracting sources of external income;
- promoting their respective organisations in relevant local, national and international arenas; and
- promoting Public Understanding of Science with the objective of improving the level of scientific literacy in the community and to ensure a strong link with government policy and the STEM agenda.

Members of the Board of Governors and of the Management Committee and their various Sub Committees exercise an effective challenge function on the leadership team in accord with their respective roles in the organisation. They also provide guidance and advice on strategic and operational matters such as Human Resource issues, accountability and relationships with stakeholders.

The members of these Committees are drawn from a very wide community background within, and beyond, Northern Ireland, and provide the organisation with a correspondingly wide range of expert knowledge and advice. All the Committees of AOP operate with full transparency and accountability, and over the last year have proved effective in the discharge of their duties and responsibilities.

It was agreed by the Board of Governors and the Management Committee that the governance arrangements in place removed the need for the current Board of Governors to complete an internal self-assessment of its effectiveness.

The Board of Governors and supporting Committees receive assurances from the Director and his Senior Management and Internal Audit that the governance and accountability processes are being managed effectively.

6. Sources of Independent Assurance

Internal Audit

CavanaghKelly was reappointed as Internal Auditors for the 3 years 2023-24 – 2025-26 using CPD as the Centre of Procurement Expertise. Their work was carried out in accordance with the Public Sector Internal Audit Standards.

The three year Audit Strategy was approved by the Audit and Risk Assurance Committee in June 2023.

The Audit and Risk Assurance Committee considered reports on the following areas:

Audit Assignment	Assurance Rating
Governance including Whistleblowing and Risk Management	Satisfactory
Budgetary Control	Satisfactory
Health and Safety and Safeguarding	Satisfactory
Internal Audit Follow Up 2023-24	N/A

An overall satisfactory internal audit assurance opinion has been provided.

External Audit

The Comptroller and Auditor General (C&AG) is required to audit the financial statements under *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. The C&AG is responsible for reporting whether in her opinion the financial statements give a true and fair view and whether they and the part of the Remuneration Report to be audited have been properly prepared in accordance with the Order and DfC directions made thereunder and applicable law and United Kingdom accounting standards. The C&AG is required to report whether, in her opinion, in light of the knowledge and understanding of AOP and its environment obtained in the course of the audit, she has identified any material misstatements in the Trustees' Annual Report and whether the information which comprises the Statement of the Responsibilities of the Governors and Accounting Officers and Governance Statement, as included within the Annual Report, is consistent with the financial statements. She also reports on whether, in her opinion, in all material respects, the expenditure and income presented in the financial statements have been applied to the purposes intended by the Assembly and whether the financial transactions conform to the authorities which govern them.

A representative from the Northern Ireland Audit Office is invited to all Audit and Risk Assurance Committee meetings.

7. Review of the Effectiveness of the System of Internal Governance

The system of internal governance is designed to manage risk to a reasonable level, rather than to eliminate all risk of failure to achieve certain policies, aims and objectives; it can therefore only provide reasonable and not absolute assurance of effectiveness. The system of internal governance is based on an ongoing process designed to identify and prioritise risks to the achievement of the AOP policies, aims and objectives; to assess the likelihood of the events occurring and the impact should they be realised; and to manage the risks effectively, efficiently and economically. The system of internal governance has been in place in AOP for the year ended 31 March 2024 and up to the date of approval of the annual accounts, and accords with Department of Finance guidance.

As previously detailed in Section 2, the responsibilities of the Accounting Officer include the need to maintain a sound system of internal control which supports the achievement of the organisation's policies, aims and objectives. The review of the effectiveness of the system of internal governance has been informed by the assurances provided by relevant parties such as: Internal Audit and the Senior Management team. Where weaknesses have been identified these have been promptly drawn, through normal reporting mechanisms, to the attention of the Audit and Risk Assurance Committee, Management Committee and/or Board of Governors, as appropriate.

The main procedures in place to monitor the effectiveness of the system of internal governance are as follows:

- ongoing independent assessment of the Observatory's research outputs;
- regular reports by financial staff on progress against principal financial targets and the projected financial outcome for the year and progress reports by staff responsible for major projects;
- detailed progress reports to the Management Committee and Board of Governors at their regular meetings and inclusion of performance measures and results against targets in the annual operating plan;
- annual reports on the system of internal control from internal auditors to the Audit and Risk Assurance Committee;
- regular Accountability meetings with officials from the Sponsor Department to consider operational and strategic issues and matters relating to the system of internal control;
- Bi-Annual Assurance Statements submitted to the Sponsor Department;
- periodic review of the AOP Risk Register by the Audit and Risk Assurance Committee, the Management Committee, the Accounting Officer and Senior Management and the Sponsor Department;
- continuous assessment of the quality of research through peer review of grant applications, applications for telescope time, and the submission of scientific papers to academic journals of international standing by AOP staff and students;
- peer review of the research quality, capability and output of the Observatory, and through participation in an objective external Assurance Committee, which provide an opinion on the adequacy and effectiveness of the system and contain recommendations for improvement; and
- annual reports from Northern Ireland Audit Office to the Audit and Risk Assurance Committee, the Management Committee and the Board of Governors on the Annual Report and Accounts, providing an opinion on the state of affairs of the organisation and its total incoming resources and expenditure of resources.

All reports based on the internal and external audits include opinions on the adequacy and effectiveness of risk management and the control framework in place. These matters are considered by the Audit and Risk Assurance Committee and are reported by the Audit and Risk Assurance Committee Chair to the Management Committee and the Board of Governors.

Weaknesses identified in AOP's control systems and internal governance are set out within the next section. Upon identification, plans were immediately put into place to address these issues.

8. Internal Governance Divergences

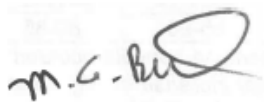
During its audit for 2023-24, NIAO identified no priority 1 issues to be addressed by management in their areas of responsibility.

9. Conclusion

AOP has an effective governance structure and is operating to a high standard of integrity and probity. In signing this report, I have taken assurances, where available, from the Audit and Risk Assurance Committee and I will continue to monitor the Internal Audit and Northern Ireland Audit Office recommendations to ensure that all issues are appropriately addressed.

To the best of my knowledge this report provides a fair and accurate reflection of the business of AOP and of the status of the controls and checks that have been put in place to regulate and inform the organisation's committees.

Signed:

A handwritten signature in dark ink, appearing to read 'm.c. Burton', is written over a faint, circular official stamp.

Date: 21 October 2024

Professor Michael Burton
Accounting Officer
Armagh Observatory and Planetarium

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Armagh Observatory and Planetarium

Non Refereed Journal Publications: April 2023 – March 2024

Bailey M. E., Christou A. A., Finnegan J. A., 2023, The Flying Fish Fireball of 2014 July 17, WGN, Journal of the International Meteor Organization, 51, 38, <https://ui.adsabs.harvard.edu/abs/2023JIMO...51...38B>

Belkin S., et al., inc. **Ramsay G.**, 2024, GRB 230911A: The First Discovery of a Fermi GRB Optical Counterpart with the Gravitational-wave Optical Transient Observer (GOTO), Research Notes of the American Astronomical Society, 8, 6, doi:10.3847/2515-5172/ad1876, <https://ui.adsabs.harvard.edu/abs/2024RNAAS...8....6B>

Christou A., Gritsevich M., 2023, in EGU General Assembly Conference Abstracts. Meteor phenomena in the atmosphere of Venus, EGU General Assembly Conference Abstracts. pp EGU–4306, doi:10.5194/egusphere-egu23-4306

Dermott S., Li D., **Christou A.**, 2023, in AAS/Division of Dynamical Astronomy Meeting. Do HED meteorites originate from two large craters on asteroid Vesta?. p. 202.04

McMahon, M., 2023, Herschel Family Papers held at Armagh Observatory and Planetarium. Journal of the Herschel Society 22, 4–13

McMahon, M., 2024, Hugh Breen, Father of Astronomers. History Armagh 5, 38–40

McMahon, M., Black, A., 2024, The Armagh Observatory Troughton Equatorial Telescope (1795) Network. Scientific Instrument Society Bulletin 27–40 (2024).

McMahon M., Nežič R., 2024, Archival research in a planetarium: The first projector at Armagh Planetarium, Communicating Astronomy with the Public Journal, 34, 37, <https://ui.adsabs.harvard.edu/abs/2024CAPJ...34...37M>

Morgan L., Law C. Y., Tan J., **Eden D.**, 2024, in American Astronomical Society Meeting Abstracts. Filaments All the Way Down: Examining the hierarchical nature of the ISM. p. 156.05

Stricklan A., **Shetye J.**, 2023, in American Astronomical Society Meeting Abstracts. What do coronal hole jets eat: A look at these beasts and the mechanisms that feed them. p. 103.02

During the reporting year, G Ramsay published many reports related to the discovery of transients and is directly related to his work on the GOTO and BlackGem projects. The Transient Name Server (TNS) is an IAU supported service which reports newly discovered extragalactic transients. He led or was co-Investigator on 201 TNS Discovery Reports and 14 TNS AstroNotes. In addition, he was co-Investigator on 11 GRB Coordinates Network Circular Services (GCNs), which report the results of optical follow-up of Gravitational Wave and Gamma-ray Burst events. He led 1 Astronomical Telegram (ATel) reporting the outburst of a CV candidate.

Armagh Observatory and Planetarium **Presentations: April 2023 – March 2024**

Date	AOP Speaker	Title	Location/Mode	Category
03 Apr 2023	G. Ramsay	Key Tools, Techniques and Methods Over Last 20 Years	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
06 Apr 2023	J.S. Vink	Mixing and Mass Loss in Massive Stars	SDSS-V/IReNA Science Festival, KU Leuven, Belgium (virtual)	Research
16 Apr 2023	J. Rigney	From the Leviathan to LOFAR	Birr Castle, Co. Offaly, Ireland	Outreach
17 Apr 2023	A. Philip Monai	Recap: The Formation of the Solar System	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
17 Apr 2023	J.S. Vink	The Heaviest Stars and Black Holes in the Universe	AOP Management Committee Meeting, Armagh Observatory and Planetarium, Armagh	Outreach
28 Apr 2023	G. Ramsay	Stellar Activity and NGTS	NGTS Consortium Meeting, Queen's University Belfast	Research
29 Apr 2023	M.E. Bailey	Giant Comets and Their Impacts Through Time: The Most Recent Giant Comet and its Impact on Civilization	Society for Interdisciplinary Studies Spring Meeting, Watford, England	Outreach
03 May 2023	J.S. Vink	Space	St Teresa Primary School, Belfast	Outreach
05 May 2023	M. Burton	The Director's Cut – Orienteering the Cosmos	A Special Planetarium Show for Participants in the British Orienteering Championships in Armagh, Armagh Planetarium, Armagh	Outreach
13 May 2023	J. Rigney	From the Leviathan to LOFAR	Birr Castle Co. Offaly, Ireland	Outreach
16 May 2023	M. Sarzi	The Fornax3D Survey	Galaxy Groups and Clusters III Conference, La Serena, Chile	Research
24 May 2023	J. Rigney	Single Station Science	LOFAR Science Summer School Workshop, Sofia, Bulgaria	Teaching
24 May 2023	J. Rigney	Pulsars and Fast Radio Bursts	LOFAR Science Summer School Workshop, Sofia, Bulgaria	Teaching
30 May 2023	D. Eden	MAJORS: Massive, Active, JCMT-Observed Regions of Star Formation.	JCMT Users' Meeting 2023, University College London, London	Research
02 Jun 2023	C.S. Jeffery	The SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Science Highlights from SALT Conference, Nicolas Copernicus Astronomical Centre, Warsaw, Poland	Research
06 Jun 2023	C.S. Jeffery	The SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Institut für Physik und Astronomie, Universität Potsdam, Germany	Research
08 Jun 2023	M. Burton	Armagh – Exploring the Cosmos	Lisburn Probus Club, Lisburn Golf Club, Lisburn, Co. Antrim	Outreach
09 Jun 2023	M. Burton	The Director's Cut – The Planets	Armagh Planetarium, Armagh	Outreach
12 Jun 2023	C.S. Jeffery	Shocks and Chaos in Pulsating Helium Stars	Department of Applied Mathematics and Theoretical Physics, University of Cambridge, England	Research
12 Jun 2023	J.S. Vink	Why are the Most Massive Stars not the Largest?	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
13 Jun 2023	J. Rigney	Low Frequency Radio Emission Associated with a CME and EUV Wave	LOFAR Family Meeting 2023 Conference, Olsztyn, Poland	Research

14 Jun 2023	G. Ramsay	Stellar Activity and BlackGem	BlackGem Consortium Meeting, Nijmegen, The Netherlands	Research
15 Jun 2023	M.E. Bailey	Using Kinesthetic Learning to Bring Heaven Down to Earth in a Practical Way	U3A Summer School, Greenmount College, Antrim	Outreach
19 Jun 2023	J.S. Vink	The Fundamentals of the WR Phenomenon	The Wolf-Rayet Phenomenon in the Universe Meeting, Morelia, Michoacán, Mexico	Research
21 Jun 2023	Z. Gray	The Aftermath of the DART Impact: A Polarimetric Study of Didymos-Dimorphos	Asteroids, Comets and Meteors (ACM) Conference 2022, Flagstaff, Arizona, USA	Research
22 Jun 2023	R. Nežič	Sungrazers Through Space and Time: Polarimetric Behaviour of Selected Sungrazing Comets Near Perihelion	Asteroids, Comets, Meteors (ACM) Conference 2023, Flagstaff, Arizona, USA	Research
29 Jun 2023	M. McMahon	Science and Spectacle	Crossing Frontiers: Elements and Environment in the Middle Ages, International Research Conference, Queen's University Belfast	Research
29 Jun 2023	M.E. Bailey	How Astronomy Impacts Our Understanding of the Middle Ages and Its Changing Environment	Panel Discussion, Crossing Frontiers: Elements and Environment in the Middle Ages, International Research Conference, Queen's University Belfast	Research
30 Jun 2023	M. Sarzi	The SAURON Survey and the Oxford Years	Conference Celebrating the Retirement of Prof Roger Davies, Oxford, England	Research
07 Jul 2023	J. Rigney	Stellar Activity	STELLAR BG Final Meeting, Plovdiv, Bulgaria	Research
11 Jul 2023	M. Sarzi	Artificial Intelligence and Data Visualisation in Astronomy	UKRI Summer School in Artificial Intelligence and Astronomy, Canterbury University, England	Teaching
18 Jul 2023	M. McMahon	First Light: 230 Years of Observing in Armagh	Armagh Planetarium, Armagh	Outreach
23 Aug 2023	L. Scott	Heavy Metal Subdwarfs: Testing Chemical Stratification	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
24 Aug 2023	M. Burton	UNESCO and the Astronomical Observatories of Ireland	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
24 Aug 2023	J. Rigney	Low Frequency Radio Emission Associated with a CME Shock and EUV Wave	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
24-Aug-23	C.S. Jeffery	The SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
31 Aug 2023	M. Sarzi	The Fornax3D and Meerkat Fornax Surveys	MeerKAT Fornax Workshop, Cagliari, Italy	Research
01 Sep 2023	M.E. Bailey	Near-Earth Objects: Origins, Impacts and Risk	North Down and Ards U3A, Bangor, Co. Down	Outreach
02 Sep 2023	M. Burton, H. Alexander, S. Mackle, M. Grimley, M. McMahon	The Armagh Experience Compere [Heather] Small Changes, Big Impact [Sinead] Our Solar System [Mark] Historical Research [Matthew] Present and Future [Michael]	British Association Planetaria Annual Conference, Armagh Planetarium, Armagh	Research and Education

04 Sep 2023	S. Schlagenhauf	Using Adaptive-Optics Assisted MUSE Observations to Measure Galaxy Distances with the Planetary Nebulae Luminosity Function	IAU Symposium, Krakow, Poland	Research
06 Sep 2023	J.S. Vink	Wind and Mass Loss in Hot Stars	Symposium on Chemical Yields, Heidelberg, Germany	Research
08 Sep 2023	M. Burton	The Director's Cut – A Cosmic Journey	AMCVn5 Workshop, Armagh Planetarium, Armagh	Outreach
11 Sep 2023	L. Scott	Surface Abundances of Hot Subdwarfs	Annual Meeting of the UK BRIDGCE and IReNA Network, The University of Edinburgh, Scotland	Research
15 Sep 2023	C.S. Jeffery	Highlights from the SALT Survey of Helium-Rich Hot Subdwarfs	11th Workshop on Hot Subluminous Stars and Related Objects, Armagh Planetarium, Armagh	Research
15 Sep 2023	G. Ramsay	Plato Complementary Science and the Guest Observer Programme	Plato UK Meeting, University of Warwick, England	Research
15 Sep 2023	L. Scott	Modelling Lead Stratification in Heavy Metal Subdwarfs Atmospheres	11th Workshop on Hot Subluminous Stars and Related Objects, Armagh Planetarium, Armagh	Research
19 Sep 2023	G. Ramsay	Report from the Executive Board	GOTO Science Meeting, University of Warwick, England	Research
25 Sep 2023	J.S. Vink	Introduction	The Second XShootU In-Person Meeting, Prague, Czech Republic	Research
01 Oct 2023	K.O. Çubuk	One Planet and the Universe - 100 Hours of Astronomy	Armagh Observatory and Planetarium, Armagh	Outreach
02 Oct 2023	M.E. Bailey	Earth's Place in Space: A Brief Introduction to Astronomy	Causeway U3A, Portstewart, Co. Antrim	Outreach
05 Oct 2023	M.E. Bailey	The Human Orrery: Ground-Based Astronomy for All! (Zoom)	Online Across Scotland: Across Scotland U3A Astronomy Group, Scotland	Outreach
06 Oct 2023	M. Burton	The Director's Cut – Star Formation	Armagh Planetarium, Armagh	Outreach
12 Oct 2023	J. Landstreet	The Magnetic Attraction of White Dwarfs	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
12 Oct 2023	J. Rigney	The Sun and the (Low Mass) Stars, Searching for Radio Flares and CMEs on M Dwarfs	Seminar, Armagh Observatory and Planetarium, Armagh	Research
13 Oct 2023	A. Humpage, A. Marshall Lee, A. Philip Monai, E. Winch, K. Trakakis, S. Schlagenhauf	PhD Flash Talks	Armagh Planetarium, Armagh	Outreach
18 Oct 2023	J. Landstreet	What is an Ap Star?	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
20 Oct 2023	D. Eden	Astronomy: From Large to Small	DJK House, Liverpool, England	Outreach

20 Oct 2023	S. Bagnulo	Plus or Minus	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
22 Oct 2023	M. Sarzi	Italian Stars in Armagh	Event about research and sustainability organised with the Italian Consulate, Armagh Planetarium, Armagh	Outreach
25 Oct 2023	M.E. Bailey	Near-Earth Objects: Origins, Impacts and Risk	University of Northumbria, Newcastle upon Tyne, England	Research
26 Oct 2023	S. Bagnulo	No So fast, Not So Furious, Just Magnetic	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
27 Oct 2023	M. Burton	Geographies of Outer Space at the Armagh Observatory and Planetarium	"Geographies of Outer Space" QUB Course, Armagh Observatory and Planetarium, Armagh	Teaching
27 Oct 2023	S. Bagnulo	Magnetically Driven Accretion at the Surface of a Metal Polluted White Dwarf	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
31 Oct 2023	L. Scott	Diffusion in Stars and Stratified Atmosphere Models	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Armagh	Research
02 Nov 2023	G. Sabhahit	Massive Stars Near the Eddington Limit	Seminar, Armagh Observatory and Planetarium, Armagh	Research
03 Nov 2023	M. Burton	The Director's Cut – Star Death	Armagh Planetarium, Armagh	Outreach
05 Nov 2023	J. Rigney	The Sun and the (Low Mass) Stars	Mayo Dark Skies Festival 2023, Co Mayo, Ireland	Outreach
06 Nov 2023	J.S. Vink	First Light from JWST	Northern Ireland Amateur Astronomy Society (NIAAS), Ballyclare, Co. Antrim	Outreach
10 Nov 2023	D. Eden	MAJORS: First Results from W49A	New Eyes on the Cold Universe: Star Formation in the Milky Way and Beyond in the Era of JWST and ALMA, Royal Astronomical Society, London, England	Research
15 Nov 2023	L. Scott	Heavy Metal Subdwarfs	Astrophysics Seminar, Queen's University Belfast	Research
22 Nov 2023	K.O. Çubuk	Engaging Space Facts and Future Space Missions	UK Space Conference, ICC, Belfast	Outreach
01 Dec 2024	M. Burton	The Director's Cut – Galaxies	Armagh Planetarium, Armagh	Outreach
07 Dec 2023	C.S. Jeffery	The Secret Lives of Ancient Stars	AOP Management Committee Meeting, Armagh Planetarium, Armagh	Governance
15 Dec 2024	J.S. Vink	How Heavy is the Most Massive Star	Seminar, University of Leeds, England	Research
09 Jan 2024	C.S. Jeffery	A Brief Tour of the Universe	Presbyterian Women's Association, First Presbyterian Church, Armagh, Armagh	Outreach
10 Jan 2024	M. McMahon	UNESCO	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
11 Jan 2024	J.S. Vink	Mass loss History of Very Massive Stars	Supermassive Stars Workshop, University of Geneva, Switzerland	Research

24 Jan 2024	Z. Gray	Placement in La Palma	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
25 Jan 2024	E. Higgins	Nucleosynthesis, Winds and Chemical Yields of Very Massive Stars	Seminar, Armagh Observatory and Planetarium, Armagh	Research
26 Jan 2024	C.S. Jeffery	Highlights from the SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Institute of Astronomy, Cambridge, England	Research
07 Feb 2024	L. Scott	Heavy Metal Stars	Irish Astronomical Association Seminar, Queen's University Belfast	Outreach
08 Feb 2024	A. Christou	Introduction to Orbital Motion	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
08 Feb 2024	J. Rigney	Radio Astronomy	Transition Year Workshop, Dunsink Observatory, Co Dublin, Ireland	Outreach
13 Feb 2024	J.S. Vink	Introduction	XShootU Virtual VII	Research
15 Feb 2024	S. Bagnulo	Night Time Astronomy	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
16 Feb 2024	M. Burton	The Director's Cut – The Lives of Stars	Armagh Planetarium, Armagh	Outreach
21 Feb 2024	M.E. Bailey	Using Kinesthetic Learning to Help Understand Our Place in Space: From Solar System to Near Universe	Irish Astronomical Association, Queen's University Belfast	Outreach
21 Feb 2024	C.S. Jeffery	Highlights from the SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	"Next Generation of Binary Population Synthesis Models for Hot Subdwarf Stars: Theory Meets Observations" Workshop, Bamberg, Germany	Research
22 Feb 2024	M. Burton	Our Galaxy: Gas, Dust and Surveys	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
22 Feb 2024	D. Eden	Molecular Clouds and Star Formation in the Milky Way	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
22 Feb 2024	M. Burton	Armagh, Birr and Dunsink: Research and Education Entwined with History and Heritage	Royal Geographical Society, Queen's University Belfast	Outreach
22 Feb 2024	Z. Gray	Careers in Astronomy (4 x talks)	W5, NI Science Festival, Belfast	Outreach
23 Feb 2024	Z. Gray	Careers in Astronomy (4 x talks)	W5, NI Science Festival, Belfast	Outreach
28 Feb 2024	L. Scott	Stars	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
29 Feb 2024	J.S. Vink	Radiative Transfer and Stellar Winds, Massive Stars, Black Holes a GWs	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
04 Mar 2024	M.E. Bailey	Earth, Moon, and Space: From Planet Earth to the Stars	Carolside Primary School, Clarkston, East Renfrewshire, Scotland	Outreach
04 Mar 2024	M.E. Bailey	Earth, Moon, and Space: From Planet Earth to the Stars	Carolside Primary School, Clarkston, East Renfrewshire, Scotland	Outreach

05 Mar 2024	M.E. Bailey	Earth, Moon, and Space: From Planet Earth to the Stars	Carolside Primary School, Clarkston, East Renfrewshire, Scotland	Outreach
06 Mar 2024	J.S. Vink	Discussion Sample Selection	1st Binarity at LOw Metallicity (BLOeM) Collaboration Meeting, KU Leuven, Belgium	Research
07 Mar 2024	C.S. Jeffery	Topics in Stellar Pulsation	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
07 Mar 2024	J. Rigney	The Scale of Telescopes	Visitor Night, Dunsink Observatory, Co Dublin, Ireland	Outreach
09 Mar 2024	M. Burton	The Director's Cut – Scientific Instrument Society	Scientific Instrument Society Study Tour, Armagh Observatory and Planetarium, Armagh	Outreach
10 Mar 2024	C.J. Butler	The Armagh Observatory Weather and Climate Record	Scientific Instrument Society Study Tour, Armagh Observatory and Planetarium, Armagh	Research and Heritage Outreach
10 Mar 2024	J.S. Vink	Massive Star Science Goals, Importance of UV	Ulysses: Continuing the Voyage of Discovery Research, Space Telescope Science Institute, Baltimore, USA	Research
13 Mar 2024	D. Eden	What Causes Stars to Form?	University of Leeds, England	Research
14 Mar 2024	C.S. Jeffery	Highlights from the SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Seminar, Armagh Observatory and Planetarium, Armagh	Research
14 Mar 2024	M. McMahon	The Imagined Planetarium - Building Armagh Planetarium 1937-1968	Armagh and District History Group, Armagh Observatory and Planetarium, Armagh	Outreach
14 Mar 2024	G. Ramsay	1. Super-flares from the Sun and other stars. 2. Multi-Messenger Astronomy and wide-field optical surveys	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
18 Mar 2024	M. Sarzi	St Patrick Green Day, Climate Change	Armagh Observatory and Planetarium, Armagh	Outreach
19 Mar 2024	K.O. Çubuk	Our Solar System	Ballycraig Primary School, Antrim, Co. Antrim	Outreach
19 Mar 2024	A. Philip Monai	Groups in the SALT Dample	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Armagh	Research
21 Mar 2024	M. Sarzi	Galaxy Formation and Evolution, The Use of Integral-Field Spectroscopy	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
22 Mar 2024	J. Rigney	Leviathan to I-Lofar	UL Conference for Undergraduate Women in Physics, Birr Castle, Co. Offaly, Ireland	Outreach
26 Mar 2024	C.S. Jeffery	Project Sirius	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Armagh	Teaching
26 Mar 2024	G. Ramsay	Activity on M dwarfs	BlackGem Consortium Meeting, Nijmegen, The Netherlands	Research
27 Mar 2024	K.O. Çubuk	The Distribution of Molecular Clouds Along the Southern Galactic Plane	Seminar, Armagh Observatory and Planetarium, Armagh	Research
29 Mar 2024	S. Bagnulo	Observations of Magnetic White Dwarfs	Current Challenges in the Physics of White Dwarfs Stars Conference, Santa Fe, USA	Research

Armagh Observatory and Planetarium

Education and Outreach: April 2023 – March 2024

Date	Event Description
Apr 2023 – Mar 2024	The Legendary Telescope Tours at Armagh Observatory
Apr 2023 – Mar 2024	Little Astronomers (Monthly)
Apr 2023 – Mar 2024	Our World from Space Club (Monthly)
April 2023 – Mar 2024	STEM Cadets Afterschools Club (Weekly)
5 May 2023	Orienteering the Cosmos – A Special Planetarium Show for the Orienteers attending the 2023 British Championships in Armagh
27 May 2023	2023 Robinson Lecture “From Mars to the Multiverse” by Professor Martin Rees, Astronomer Royal. Hosted by the Astronomical Observatories of Ireland at Armagh, Birr and Dunsink and held in Dunsink Observatory.
29 May 2023	Wee Critters – Interactive Animal Education
4 – 9 Jul 2023	Jurassic Arc – Interactive Workshop
11 – 16 Jul 2023	Bricks 4 Kidz Workshop
18 Jul 2023	First Light: 230 Years of Observatories in Armagh
18 – 23 Jul 2023	Planet Roar – Live Dinosaur Show
26 – 27 Jul 2023	The Ultimate Bubble Show – Live Science Show
15 – 17 Aug 2023	The Science of Dragons with Scientific Sue
3 Aug 2023	Bakineering in Space with Andrew Smyth
Jul – Aug 2023	DVL Summer Public Demonstrations Every Thursday in July and August
9 Sep 2023	Armagh Food and Cider Weekend 2023 Event. Planet Cookies
9 Sep 2023	European Heritage Open Day: Experience The Calver Telescope
12 Sep 2023	Conferences 2023 Public Lecture – The Exciting Lives of Double Stars with Dr Stephen Geier
1 Oct 2023	One Planet and the Universe. IAU 100 Hours of Astronomy Event.
13 Oct 2023	PhD Flash Talks at the Planetarium
18 Oct 2023	Rocket Routes: Navigating with Math with the AmmA Creative Learning Centre. Maths Week Workshop
21 Oct 2023	International Observe the Moon Day
27 Oct 2023	Stargazing Evening at Armagh Planetarium
30 – 31 Oct 2023	Tall Tales and Terror at Armagh Observatory
30 – 31 Oct 2023	The Witches Are Back – Live Show
23 Nov 2023	Stargazing Evening at Armagh Planetarium
25 Nov – 23 Dec 2023	Mission Santa
12 and 14 Dec 2023	Christmas Lecture Live Stream with the Royal Institution
24 – 25 Nov 2023	Armagh Georgian Festival: A Very Georgian Collection Tour
29 Dec 2023	Stargazing Evening at Armagh Planetarium
26 Jan 2024	Stargazing Evening at Armagh Planetarium
15 – 16 Feb 2024	NI Science Festival 2024 Event: Orienteering at the Planetarium
15 – 16 Feb 2024	NI Science Festival 2024 Event: Data Visualisation Laboratory
15 Feb 2024	NI Science Festival 2024 Event: Experience the Calver Dome
16 – 17 Feb 2024	NI Science Festival 2024 Event: The Ultimate Bubble Show
16 Feb 2024	NI Science Festival 2024 Event: Director's Cut – This Month in Astronomy

23 Feb 2024	NI Science Festival 2024 Event: Little Astronomers
23 – 24 Feb 2024	NI Science Festival 2024 Event: Pink Floyd Dome Show
23 Feb 2024	NI Science Festival 2024 Event: Stargazing Evening
24 Feb 2024	NI Science Festival 2024 Event: Legendary Telescopes Tour
24 Feb 2024	NI Science Festival 2024 Event: Our World from Space Family Club
25 Feb 2024	NI Science Festival 2024 Event: CapCom Go – Dome Show
15 Mar 2024	Stargazing Evening at Armagh Planetarium

Armagh Observatory and Planetarium

Intergalactic Craic Podcasts: April 2023 – March 2024

Date	Podcast Title
21 Apr 2023	S3Ep3 – Wee Bitta Craic: Bout Ye Ethan?
26 May 2023	S3Ep4 – Wee Bitta Craic: Bout Ye Alice?
16 Jun 2023	S3Ep5 – Craic with all these moons?
27 Oct 2023	S3Ep6 – Intergalactic Craic On The Road

Presenters: H Alexander, E Wince, A Humpage and Z Gray

All published via anchor.fm/intergalacticcraic

See also: <https://podcasters.spotify.com/pod/show/intergalacticcraic>

THE CERTIFICATE AND REPORT OF THE COMPTROLLER AND AUDITOR GENERAL TO THE NORTHERN IRELAND ASSEMBLY

Opinion on financial statements

I certify that I have audited the financial statements of the Armagh Observatory and Planetarium for the year ended 31 March 2024 under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995. The financial statements comprise: the Statement of Financial Activities, the Balance Sheet, the Cash Flow Statement; and the related notes including significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom accounting standards including Financial Reporting Standard (FRS) 102, the Financial Reporting Standard applicable in the UK and Republic of Ireland (United Kingdom Generally Accepted Accounting Practice).

I have also audited the information in the Trustees' Annual Report that is described in that report as having been audited.

In my opinion the financial statements:

- give a true and fair view of the state of Armagh Observatory and Planetarium's affairs as at 31 March 2024 and of its total incoming resources and expenditure of resources for the year then ended;
- have been properly prepared in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102); and
- have been properly prepared in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995 and Department for Communities directions issued thereunder.

Opinion on regularity

In my opinion, in all material respects the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Basis for opinions

I conducted my audit in accordance with International Standards on Auditing (ISAs) (UK), applicable law and Practice Note 10 'Audit of Financial Statements and Regularity of Public Sector Bodies in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of my certificate.

My staff and I are independent of Armagh Observatory and Planetarium in accordance with the ethical requirements that are relevant to my audit of the financial statements in the UK, including the Financial Reporting Council's Ethical Standard, and have fulfilled our other ethical responsibilities in accordance with these requirements.

I believe that the audit evidence obtained is sufficient and appropriate to provide a basis for my opinions.

Conclusions relating to going concern

In auditing the financial statements, I have concluded that Armagh Observatory and Planetarium's use of the going concern basis of accounting in the preparation of the financial statements is appropriate.

Based on the work I have performed, I have not identified any material uncertainties relating to events or conditions that, individually or collectively, may cast significant doubt on the Armagh Observatory and Planetarium's ability to continue as a going concern for a period of at least twelve months from when the financial statements are authorised for issue.

The going concern basis of accounting for Armagh Observatory and Planetarium is adopted in consideration of the requirements set out in the Government Financial Reporting Manual, which require entities to adopt the going concern basis of accounting in the preparation of the financial statements where it anticipated that the services which they provide will continue into the future.

My responsibilities and the responsibilities of the Trustees and the Accounting Officer with respect to going concern are described in the relevant sections of this certificate.

Other Information

The other information comprises the information included in the Trustees' annual report other than the financial statements, the parts of the Trustees' Report described in that report as having been audited, and my audit certificate and report. The Trustees and the Accounting Officer are responsible for the other information included in the annual report. My opinion on the financial statements does not cover the other information and except to the extent otherwise explicitly stated in my certificate, I do not express any form of assurance conclusion thereon.

My responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or my knowledge obtained in the audit or otherwise appears to be materially misstated. If I identify such material inconsistencies or apparent material misstatements, I am required to determine whether this gives rise to a material misstatement in the financial statements themselves. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact.

I have nothing to report in this regard.

Opinion on other matters

In my opinion based on the work undertaken in the course of the audit:

- the parts of the Trustees' Report have been properly prepared in accordance with Department for Communities directions made under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995; and
- the information given in the Trustees' Annual Report for the financial year for which the financial statements are prepared is consistent with the financial statements.

Matters on which I report by exception

In the light of the knowledge and understanding of the Armagh Observatory and Planetarium and its environment obtained in the course of the audit, I have not identified material misstatements in the Trustees' Annual Report.

I have nothing to report in respect of the following matters which I report to you if, in my opinion:

- adequate accounting records have not been kept; or
- the financial statements and the parts of the Trustees' Report to be audited are not in agreement with the accounting records; or
- certain disclosures of remuneration specified by the Government Financial Report Manual are not made; or
- I have not received all of the information and explanations I require for my audit; or
- the Governance Statement does not reflect compliance with the Department of Finance's guidance.

Responsibilities of the Board of Governors and Accounting Officer for the financial statements

As explained more fully in the Statement of the Governors and Accounting Officer Responsibilities, the Governors and the Accounting Officer are responsible for:

- the preparation of the financial statements and for being satisfied that they give a true and fair view;
- ensuring such internal controls are in place as deemed necessary to enable the preparation of financial statements to be free from material misstatement, whether due to fraud or error;
- ensuring the Trustees' Annual Report, which includes the Remuneration and Staff Report, is prepared in accordance with the Government Financial Reporting Manual;
- assessing the Armagh Observatory and Planetarium's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Trustees and Accounting Officer anticipates that the services provided by Armagh Observatory and Planetarium will not continue to be provided in the future.

Auditor's responsibilities for the audit of the financial statements

My responsibility is to examine, certify and report on the financial statements in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

My objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error and to issue a certificate that includes my opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

I design procedures in line with my responsibilities, outlined above, to detect material misstatements in respect of non-compliance with laws and regulation, including fraud.

My procedures included:

- obtaining an understanding of the legal and regulatory framework applicable to the Armagh Observatory and Planetarium through discussion with management and application of extensive public sector accountability knowledge. The key laws and regulations I considered included the Armagh Observatory and Planetarium (Northern Ireland) Order 1995;
- making enquires of management and those charged with governance on Armagh Observatory and Planetarium's compliance with laws and regulations;
- making enquiries of internal audit, management and those charged with governance as to susceptibility to irregularity and fraud, their assessment of the risk of material misstatement due to fraud and irregularity, and their knowledge of actual, suspected and alleged fraud and irregularity;
- completing risk assessment procedures to assess the susceptibility of Armagh Observatory and Planetarium's financial statements to material misstatement, including how fraud might occur. This included, but was not limited to, an engagement director led engagement team discussion on fraud to identify particular areas, transaction streams and business practices that may be susceptible to material misstatement due to fraud. As part of this discussion, I identified potential for fraud in the following areas: revenue recognition and posting of unusual journals;

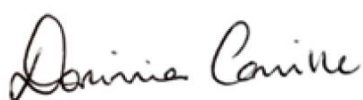
- engagement director oversight to ensure the engagement team collectively had the appropriate competence, capabilities and skills to identify or recognise non-compliance with the applicable legal and regulatory framework throughout the audit;
- documenting and evaluating the design and implementation of internal controls in place to mitigate risk of material misstatement due to fraud and non-compliance with laws and regulations;
- designing audit procedures to address specific laws and regulations which the engagement team considered to have a direct material effect on the financial statements in terms of misstatement and irregularity, including fraud. These audit procedures included, but were not limited to, reading board and committee minutes, and agreeing financial statement disclosures to underlying supporting documentation and approvals as appropriate; and
- addressing the risk of fraud as a result of management override of controls by:
 - performing analytical procedures to identify unusual or unexpected relationships or movements;
 - testing journal entries to identify potential anomalies, and inappropriate or unauthorised adjustments;
 - assessing whether judgements and other assumptions made in determining accounting estimates were indicative of potential bias; and
 - investigating significant or unusual transactions made outside of the normal course of business.

A further description of my responsibilities for the audit of the financial statements is located on the Financial Reporting Council's website www.frc.org.uk/auditorsresponsibilities. This description forms part of my certificate.

In addition, I am required to obtain evidence sufficient to give reasonable assurance that the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Report

I have no observations to make on these financial statements.



Dorinnia Carville
 Comptroller and Auditor General
 Northern Ireland Audit Office
 106 University Street
 BELFAST
 BT7 1EU

29 October 2024

Statement of Financial Activities for the year ended 31 March 2024

	Note	Unrestricted Funds 2024 £	Restricted Funds 2024 £	Total Funds 2024 £	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £
Income from:							
Charitable activities	2	2,348,511	810,084	3,158,595	2,502,195	1,035,208	3,537,403
Other trading activities	4	195,615	-	195,615	193,471	-	193,471
Total incoming resources		2,544,126	810,084	3,354,210	2,695,666	1,035,208	3,730,874
Expenditure on:							
Charitable activities	5	3,670,849	200,797	3,871,646	3,948,037	227,819	4,175,856
Other trading activities	7	106,900	-	106,900	110,013	-	110,013
Total outgoing expenditure		3,777,749	200,797	3,978,546	4,058,050	227,819	4,285,869
Net income / (expenditure)		(1,233,623)	609,287	(624,336)	(1,362,384)	807,389	(554,995)
Transfers between funds	15	709,378	(709,378)	-	833,469	(833,469)	-
Other recognised gains/(losses):							
Gains/(losses) on the revaluation of fixed assets and heritage assets	10 & 11	500,740	-	500,740	255,242	-	255,242
Actuarial gains less provisions on defined benefit pension scheme	15 & 19	(121,000)	-	(121,000)	2,411,000	-	2,411,000
Net Movement in Funds		(144,505)	(100,091)	(244,596)	2,137,327	(26,080)	2,111,247
Reconciliation of funds							
Total funds brought forward at 1 April 2023		12,572,443	148,028	12,720,471	10,435,116	174,108	10,609,224
Total funds carried forward at 31 March 2024		12,427,938	47,937	12,475,875	12,572,443	148,028	12,720,471

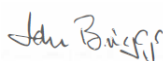
All amounts above relate to continuing operations of the organisation.
The notes on pages 62 to 74 form part of the financial statements.

Armagh Observatory and Planetarium

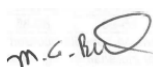
Balance Sheet as at 31 March 2024

	Note	2024 £	2023 £
Fixed Assets			
Intangible assets	9	206,627	288,207
Tangible assets	10	9,607,418	9,885,719
Heritage Assets	11	2,995,970	2,698,595
Total fixed assets		12,810,015	12,872,521
Current assets			
Stocks	12	25,152	19,852
Debtors	13	113,140	181,025
Cash at bank and in hand	18	290,949	379,211
Total current assets		429,241	580,088
Creditors: amounts falling due within one year	14	(763,381)	(890,138)
Net current liabilities		(334,140)	(310,050)
Total assets less current liabilities		12,475,875	12,562,471
Creditors: amounts falling due after more than one year		-	-
Net assets excluding pension asset		12,475,875	12,562,471
Defined benefit pension scheme asset	19	-	158,000
Net assets		12,475,875	12,720,471
Funds			
Restricted funds	15	47,937	148,028
Unrestricted funds	15	4,752,692	5,010,569
Revaluation Reserves	15	7,675,246	7,403,874
Pension Reserve	15	-	158,000
Total Charity Funds		12,475,875	12,720,471

The financial statements on pages 59 to 74 were approved by the Board of Trustees of Armagh Observatory and Planetarium on 30 September 2024 and were subsequently signed on 21 October 2024 on its behalf by:



Trustee
Mr John Briggs



Accounting Officer
Professor Michael Burton

Statement of cash flows for the year ended 31 March 2024

	Note	2024 £	2023 £
Net cash provided by operating activities	17	242,341	669,531
Cash flows from investing activities:			
Interest received		4,831	1,418
Purchase of tangible fixed assets		(335,434)	(683,100)
Sale of tangible fixed assets		-	8,575
		(330,603)	(673,107)
Increase / (decrease) in cash and cash equivalents		(88,262)	(3,576)

Further detail is reported in Notes 17 and 18.

Reconciliation of net cashflow to movement in net cash funds

		2024 £	2023 £
Increase / (decrease) in cash and cash equivalents in the year		(88,262)	(3,576)
Cash and cash equivalents at 1 April 2023		379,211	382,787
Cash and cash equivalents at 31 March 2024	18	290,949	379,211

The notes on pages 62 to 74 form part of the financial statements.

Notes to the financial statements for the year ended 31 March 2024

1 Summary of significant accounting policies

(a) Basis of accounting

These financial statements have been prepared in accordance with the historical cost convention as modified by the revaluation of certain assets. The accounts comply with relevant accounting standards and disclosure requirements issued by the Department of Finance. In all other aspects the financial statements comply with the Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS102) (Charities SORP (FRS102)).

The Trustees of Armagh Observatory and Planetarium confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2024.

The Trustees are satisfied that there are no material uncertainties related to events or conditions which cast significant doubt on the ability of Armagh Observatory and Planetarium to continue as a going concern.

(b) Incoming resources

Grant income from Department for Communities (DfC) is shown in the Statement of Financial Activities (SOFA) in the year in which it is received. Grants that relate to specific capital expenditure are initially recognised in the SOFA and transferred to a restricted fund, Government Grant for Fixed Assets. Where no restriction on the use of the assets exists the value is transferred to an unrestricted fund. Grants that relate to specific research projects are recognised in the Statement of Financial Activities and transferred to a restricted fund. Once the relevant conditions for recognition (entitlement and certainty of value) have been met, they are transferred to funds to match the relevant expenditure. Other grants are credited to the Statement of Financial Activities when receivable.

(c) Resources expended

Resources expended are accounted for on an accruals basis. Expenditure is classified under the principal charitable activities of Research, Education and Governance & Support.

(d) Pension scheme

The organisation provides pension benefits to its employees by participating in the Local Government Pension Scheme for Northern Ireland, administered by Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC), which is a defined benefit scheme. Annual contributions to the NILGOSC scheme are determined by the scheme and based on actuarial advice. The operating costs of providing retirement benefits to the organisation's employees are recognised in accounting periods in which the benefits are earned by employees, and the related finance costs and other changes in value of the assets and liabilities are recognised in the period in which they arise. AOP has decided to apply the principles of IFRIC14 in relation to pension surplus restriction. IFRIC14 requires allowances to be made for a minimum funding requirement, which limits the amount of economic benefit available to the excess of the value of prospective current service costs above the funding requirement.

(e) Intangible fixed assets

Intangible fixed assets represent contributions to international astronomical research projects, financed by capital grant. They are identifiable, for example, as part of a major telescope installation. The organisation benefits in the form of research participation or collaboration, which in turn contributes to the research outputs. Intangible fixed assets are stated at cost and amortised over the expected life of the project.

(f) Tangible fixed assets

The cost of tangible fixed assets is their purchase cost or valuation together with any incidental costs of acquisition. Depreciation is calculated so as to write off the cost or valuation of tangible fixed assets, less their estimated residual values, on a straight-line basis over the expected useful economic lives of the assets concerned. Land is not depreciated.

The principal annual depreciation rates used are as follows:

Buildings	Remaining asset life as valued
Digistar	20%
Fixtures and fittings	20 - 50%
Office equipment	20 - 25%
Scientific equipment	10 - 25%
Exhibits	10 - 50%
Motor Vehicles	20%

Land and buildings are included in the balance sheet at depreciated replacement cost, estimated value in use or market value. Land and buildings are professionally revalued at least every 5 years in accordance with accounting guidance. Land and buildings were last revalued as at the 31 March 2024. Revaluation gains (losses) are transferred to a revaluation reserve. Land and buildings in years where no revaluation occurs are restated using indices.

The valuations of Land and Buildings have been undertaken having regard to International Financial Reporting Standards (IFRS) as applied to the United Kingdom public sector and in accordance with HM Treasury guidance, International Valuation Standards and the requirements of the Royal Institution of Chartered Surveyors Global Standards.

Other fixed assets (non Land & Buildings) with a life estimated over 5 years have a net book value of £55,099 at 31 March 2024. This accounts for 0.6% of the net book value of fixed assets. The Trustees do not consider it appropriate to carry out an annual indexation of such assets on grounds of immateriality.

Armagh Observatory and Planetarium

Notes to the financial statements for the year ended 31 March 2024 (continued)

(g) Heritage Assets

Armagh Observatory was founded in 1789 and from this date the Observatory has collected through its operations scientific items, books, furniture and other artefacts which would be considered heritage assets. It is not the policy of Armagh Observatory and Planetarium to acquire heritage assets but has collected such assets through donations and operations. As at 31 March 2024, heritage assets were re-valued for insurance purposes with reference to auction estimates for replacement. Antique books were valued by Doerr Dallas Valuations Limited. Meteorites were valued by Ulster Museum. Coram James Limited carried out a desktop valuation of clocks, scientific instruments, fine art, furniture and sculptures. The remainder were valued by experienced members of management. It is policy to regularly review the valuation of heritage assets. The heritage assets are being documented on the Collections Database and environmental controls were further improved in 2023/24.

Heritage assets are summarised in these accounts in four categories: Books; Clocks and watches; Scientific instruments; and Furniture, Artworks, etc, and are recorded in catalogues and on databases. Historic buildings which have heritage value are included within operational assets. These were included within the recent property revaluation as operational assets and continue to be used for operational purposes.

(h) Stocks

Stocks are stated at the lower of cost and net realisable value. In general, cost is determined on a first in first out basis. Provision is made where necessary for obsolete, slow moving and defective stocks.

(i) Debtors

Debtors comprise amounts due from customers, grants due, prepaid expenses and value added tax refunds.

(j) Cash at bank and in hand

Cash held in bank accounts payable on demand and cash floats.

(k) Creditors

Creditors comprise payments due to suppliers and accruals for other amounts due but not invoiced at the year end.

(l) Fund accounting

The organisation has various types of funds for which it is responsible, and which require separate disclosure, totalling £12,475,875 at 31 March 2024 (£12,720,471 at 31 March 2023).

Restricted funds

Grants or donations received which are earmarked by the donor for specific purposes. Such purposes are within the overall aims of the organisation.

Unrestricted funds

Unrestricted funds, comprising designated funds and undesignated funds, are those which are expendable at the discretion of the trustees in furtherance of the objectives of the organisation. In addition to expenditure on the provision of services, such funds may be held in order to finance capital investment and working capital.

Designated funds include the donated assets fund, the government grants fund and the general fund. The general fund is the day to day operating fund.

Donated assets are the buildings and grounds donated to the organisation in 1790 by its founder Archbishop Richard Robinson. The value is adjusted annually by any revaluation of the underlying assets.

The government grant fund represents the capital financing of the Charity's tangible fixed assets. The fund is reduced annually by a value equivalent to depreciation charged on the related assets.

Undesignated funds - These represent the revaluation reserve which records the movement from the revaluation of the Charity's assets and a pension reserve which matches the long term liability of an underfunded defined benefits pension scheme.

(m) Reserves policy

Armagh Observatory and Planetarium adopts a risk-based approach to establishing a sound system of control covering all types of risks to the aims and objectives of the organisation. There is a need to retain a sufficient level of unrestricted cash reserves to meet the risks associated with short term financial contingencies, uncertainties and demands. The Trustees do not believe there are any key assumptions or key sources of estimation uncertainty which could cause a material adjustment to the carrying amounts of assets and liabilities within the next reporting period. Armagh Observatory and Planetarium budgets to operate on an annual basis within a balanced funding formula of grant-in-aid and self-generated income.

Notes to the financial statements for the year ended 31 March 2024 (continued)

2 Income from charitable activities

	Note	Unrestricted Funds 2024 £	Restricted Funds 2024 £	Total Funds 2024 £	Total Funds 2023 £
Grant Income					
DfC Recurrent grant-in-aid		1,932,000	-	1,932,000	2,087,000
DfC In-year capital grant-in-aid		-	435,000	435,000	549,000
Total grant-in-aid from the DfC		1,932,000	435,000	2,367,000	2,636,000
Income from other grants and receipts	3	-	340,637	340,637	486,208
Total Grant Income		1,932,000	775,637	2,707,637	3,122,208
Operating Income					
Admissions		408,680	-	408,680	391,301
Profit/(loss) on disposal of fixed assets		-	-	-	8,575
Miscellaneous income		7,831	34,447	42,278	15,319
Total Operating Income		416,511	34,447	450,958	415,195
Total Income from Charitable Activities		2,348,511	810,084	3,158,595	3,537,403

3 Income from other grants and receipts

	Note	Unrestricted Funds 2024 £	Restricted Funds 2024 £	Total Funds 2024 £	Total Funds 2023 £
STFC Research and Studentship grants		-	270,259	270,259	295,229
Europlanet 2024 RI grant		-	8,895	8,895	-
UKRI Open Access block grant		-	5,668	5,668	4,193
Science Foundation Ireland grant		-	4,576	4,576	-
ASDC grants		-	9,583	9,583	-
IAU grant		-	4,270	4,270	-
Tourism NI grants		-	15,872	15,872	126,735
Royal Astronomical society grant		-	5,000	5,000	-
National Lottery Heritage Fund		-	-	-	42,624
DfC Sign Language Partnership grant		-	3,450	3,450	-
Museums Association		-	9,500	9,500	14,500
JobStart scheme		-	3,364	3,364	2,925
Sundry grants and donations		-	200	200	2
Total other grants and receipts	2	-	340,637	340,637	486,208

4 Income from other trading activities

	Unrestricted Funds 2024 £	Restricted Funds 2024 £	Total Funds 2024 £	Total Funds 2023 £
Shop income	174,419	-	174,419	178,752
Rental income	21,196	-	21,196	14,719
Total Income from other trading	195,615	-	195,615	193,471

5 Expenditure on charitable activities

	Note	Unrestricted Funds 2024 £	Restricted Funds 2024 £	Total Funds 2024 £	Total Funds 2023 £
Research	6	1,105,162	194,034	1,299,196	1,281,107
Education	6	1,502,938	6,763	1,509,701	1,454,743
Governance and Support	6	1,062,749	-	1,062,749	1,440,006
		3,670,849	200,797	3,871,646	4,175,856

Notes to the financial statements for the year ended 31 March 2024 (continued)

6 Expenditure on charitable activities

		Unrestricted Funds 2024	Restricted Funds 2024	Total Funds 2024	Total Funds 2023
	Note	£	£	£	£
Research					
Staff costs		559,379	106,912	666,291	627,695
Direct costs		166,507	86,852	253,359	266,947
Support costs		143,734	270	144,004	113,193
Depreciation		235,542	-	235,542	273,272
	5	1,105,162	194,034	1,299,196	1,281,107
Education					
Staff costs		513,774	-	513,774	468,668
Direct costs		128,010	1,880	129,890	180,890
Support costs		300,095	4,883	304,978	254,801
Depreciation		561,059	-	561,059	550,384
	5	1,502,938	6,763	1,509,701	1,454,743
Governance and Support					
Staff costs		727,680	-	727,680	965,168
Direct costs		8,166	-	8,166	10,372
Support costs		296,935	-	296,935	429,377
Depreciation		29,968	-	29,968	35,089
	5	1,062,749	-	1,062,749	1,440,006

Included within Governance and Support costs are the following governance costs:

	Unrestricted Funds 2024	Restricted Funds 2024	Total Funds 2024	Total Funds 2023
	£	£	£	£
Management Committee expenses	3,613	-	3,613	4,813
Internal Audit	15,254	-	15,254	9,852
External Audit	26,700	-	26,700	18,300
	45,567	-	45,567	32,965

The cost of audit shown above includes £26,700 fees payable to Northern Ireland Audit Office for statutory audit. NIAO does not provide any other service.

7 Expenditure on trading activities

	Unrestricted Funds 2024	Restricted Funds 2024	Total Funds 2024	Total Funds 2023
	£	£	£	£
Trading				
Direct costs	106,900	-	106,900	110,013
	106,900	-	106,900	110,013

Notes to the financial statements for the year ended 31 March 2024 (continued)

8 Average staff numbers and related costs

	Permanent staff	Others	2024 Number	2023 Number
Average staff numbers	28.5	6.7	35.2	35.3

Staff costs comprise:	Permanent staff £	Others £	2024 £	2023 £
Wages and salaries	1,305,600	141,083	1,446,683	1,341,618
Social security costs	137,506	13,316	150,822	142,108
Employer's pension contributions	233,129	26,111	259,240	250,805
Defined benefit pension additional service cost	51,000	-	51,000	327,000
	1,727,235	180,510	1,907,745	2,061,531

The number of employees whose employee benefits (excluding employer pension costs) exceeded £60,000 was:

	2024 Number	2023 Number
£60,001 - £70,000	1	1
£70,001 - £80,000	-	-
£80,001 - £90,000	1	1

The key management personnel of the organisation comprise the trustees and the Executive Director.

The total amount of employee benefits (including employer pension contributions) received by the Executive Director for his services to the organisation was £105,154 (2023: £100,526).

There was no remuneration paid to trustees during the year (2023: Nil). No travel and subsistence expenses were reimbursed to trustees (2023: Nil). Management Committee members incurred travel and subsistence expenses of £2,287 (2023: £1,766)

Average student numbers and related costs (not included above)

	2024 Number	2023 Number
PhD students	7.0	8.5

	2024 £	2023 £
Student maintenance grants & stipends	135,617	175,440

Notes to the financial statements for the year ended 31 March 2024 (continued)

9 Intangible fixed assets

	2024 £	2023 £
Cost		
At 1 April	622,018	622,018
Additions	-	-
Disposals	-	-
At 31 March	622,018	622,018
Depreciation		
At 1 April	333,811	243,480
Charge for year	81,580	90,331
Disposals	-	-
At 31 March	415,391	333,811
Net book value		
At 31 March 2024	206,627	288,207
At 31 March 2023	288,207	378,538

10 Tangible fixed assets

	Freehold Land & buildings £	Exhibits £	Assets under construction £	Digistar Projection System £	Scientific Equipment £	Other Equipment & Vehicles £	Total £
Cost or valuation							
At 1 April 2023	8,701,213	927,837	91,919	500,351	737,672	1,285,200	12,244,192
Asset revaluation	(26,003)	-	-	-	-	-	(26,003)
Additions	42,772	174,700	-	-	(10,847)	56,696	263,321
Transfers	-	91,919	(85,919)	-	-	(6,000)	-
Disposals	-	-	-	-	(3,127)	(19,412)	(22,539)
At 31 March 2024	8,717,982	1,194,456	6,000	500,351	723,698	1,316,484	12,458,971
Depreciation							
At 1 April 2023	-	497,384	-	301,888	608,520	950,681	2,358,473
Adjustment for asset revaluation	(229,368)	-	-	-	-	-	(229,368)
Charge for year	229,368	221,731	-	99,231	47,627	147,030	744,987
Disposals	-	-	-	-	(3,127)	(19,412)	(22,539)
At 31 March 2024	-	719,115	-	401,119	653,020	1,078,299	2,851,553
Net book value							
At 31 March 2024	8,717,982	475,341	6,000	99,232	70,678	238,185	9,607,418
At 31 March 2023	8,701,213	430,453	91,919	198,463	129,152	334,519	9,885,719

Tangible fixed asset additions of £249,990 as shown above were funded by DfC in-year capital grant-in-aid. The remainder was funded by Tourism NI.

If the land and buildings had not been valued, they would have been included at the following amounts:

	2024 £	2023 £
Cost	3,885,803	3,862,869
Aggregate depreciation	(1,260,455)	(1,183,129)
Net book value based on historic cost	2,625,348	2,679,740

Armagh Observatory and Planetarium

Notes to the financial statements for the year ended 31 March 2024 (continued)

10 Tangible fixed assets (continued)

Included within Additions above are certain assets under construction:

	Exhibits £	Total £
External lighting	6,000	6,000

Depreciation on tangible fixed assets for the year was £744,987 (2023: £768,415).

Land and buildings include grounds and buildings with a net book value of £2,132,515 (2023: £2,143,316) which were donated to the organisation in 1790 by Archbishop Richard Robinson, the founder of the organisation.

Armagh Observatory and Planetarium includes in fixed assets any expenditure over £1,500 (on an item or group of related items) which is expected to be used for more than a year.

11 Heritage assets

	Books £	Clocks & Watches £	Scientific Equipment £	Furniture, Artworks, etc £	Total £
At Valuation					
Carrying Amount at 1 April 2023	546,975	572,600	1,298,900	280,120	2,698,595
Additions	-	-	-	-	-
Revaluation	97,100	53,000	137,000	10,275	297,375
Disposals	-	-	-	-	-
Depreciation / impairment	-	-	-	-	-
Carrying Amount at 31 March 2024	644,075	625,600	1,435,900	290,395	2,995,970

It is policy to regularly review the valuation of heritage assets and to carry out a formal revaluation at least once every five years. The most recent valuation took place in 2024.

Summary of heritage asset transactions

There were no purchases, donations, charges for impairment or disposals of heritage assets in the five years ended 31 March 2024. Ordnance Survey maps of Ireland and map chests owned by Armagh Observatory & Planetarium but held in Robinson Library, Armagh, were valued for the first time in 2021-22 at £100,000.

12 Stocks

	2024 £	2023 £
Goods for resale	25,152	19,852

13 Debtors

	2024 £	2023 £
Trade debtors	35,002	14,733
Prepayments and accrued income	51,578	119,174
Other debtors	26,560	47,118
	113,140	181,025

14 Creditors: amounts falling due within one year

	2024 £	2023 £
Trade creditors	150,577	365,384
Accruals and sundry creditors	580,562	492,889
Taxation and social security	32,242	31,865
	763,381	890,138

Notes to the financial statements for the year ended 31 March 2024 (continued)

15 Statement of Funds

	At 1 April 2023	Income	Expenditure	Revaluation	Transfers	At 31 March 2024
	£	£	£	£	£	£
Restricted Funds						
Government grant for fixed assets	-	435,000	-	-	(435,000)	-
Other grants for fixed assets	-	13,322	-	-	(13,322)	-
Restricted resource grants	148,028	361,762	(200,797)	-	(261,056)	47,937
Total restricted funds	148,028	810,084	(200,797)	-	(709,378)	47,937
Unrestricted Funds						
Designated Funds						
Donated assets reserve	1,720,283	-	-	-	-	1,720,283
Government grant for assets	2,221,893	-	-	-	(391,567)	1,830,326
General fund	1,068,393	2,544,126	(3,777,749)	-	1,367,313	1,202,083
	5,010,569	2,544,126	(3,777,749)	-	975,746	4,752,692
Undesignated Funds						
Revaluation reserve - Land & Buildings	6,012,400	-	-	203,365	(229,368)	5,986,397
Revaluation reserve - Heritage Assets	1,391,474	-	-	297,375	-	1,688,849
Pension reserve	158,000	-	-	(121,000)	(37,000)	-
	7,561,874	-	-	379,740	(266,368)	7,675,246
Total Unrestricted Funds	12,572,443	2,544,126	(3,777,749)	379,740	709,378	12,427,938
Total Funds	12,720,471	3,354,210	(3,978,546)	379,740	-	12,475,875

Details of Transfers between funds

	£
Release of restricted resource grant available to offset overheads	(261,056)
Release of deferred capital grant	(826,567)
Transfer of external capital grant	(13,322)
Transfer of defined benefit pension service and interest cost	(37,000)
Transfer of depreciation adjustment on asset revaluation to general fund	(229,368)
General fund	1,367,313

16 Analysis of net assets between funds

	Pension Reserve	Revaluation Reserve	Unrestricted Funds	Restricted Funds	Total Funds
	£	£	£	£	£
Tangible fixed assets	-	5,986,397	3,827,648	-	9,814,045
Heritage assets	-	1,688,849	1,307,121	-	2,995,970
Current assets	-	-	381,304	47,937	429,241
Creditors: amounts falling due within one year	-	-	(763,381)	-	(763,381)
Pension scheme liability	-	-	-	-	-
Net assets/(liabilities)	-	7,675,246	4,752,692	47,937	12,475,875

17 Reconciliation of net expenditure to net cash flow from operating activities

	2024 £	2023 £
Net expenditure for the year per statement of financial activities	(624,336)	(554,995)
Adjustments for:		
Depreciation	826,567	858,746
Interest received	(4,831)	(1,418)
(Profit)/Loss on disposal of assets	-	(8,575)
Defined benefit pension scheme service and interest cost less contributions payable	37,000	376,000
Increase in stock	(5,300)	(3,622)
Decrease/(increase) in debtors	67,885	(99,396)
(Decrease)/increase in creditors	(54,644)	102,791
Net cash provided by operating activities	242,341	669,531

Notes to the financial statements for the year ended 31 March 2024 (continued)

18 Analysis of cash and cash equivalents

	31 March 2024 £	1 April 2023 £
Cash at bank and in hand	290,949	379,211
Total cash and cash equivalents	290,949	379,211

19 Pension scheme

Introduction

The disclosures below relate to the funded liabilities within the Northern Ireland Local Government Officers' Superannuation Pension Fund (the "Fund") which is part of the Local Government Pension Scheme (Northern Ireland) (the "LGPS") and certain related unfunded liabilities which have been separately disclosed. The LGPS is a funded defined benefit plan with benefits earned up to 31 March 2015 being linked to final salary. Benefits after 31 March 2015 are based on a Career Average Revalued Earnings scheme. Details of the benefits earned over the period covered by this disclosure are set out in 'The Local Government Pension Scheme Regulations (Northern Ireland) 2014' (as amended) and 'The Local Government Pension Scheme (Amendment and Transitional Provisions) Regulations (Northern Ireland) 2014' (as amended). The unfunded pension arrangements relate to termination benefits made on a discretionary basis upon early retirement in respect of members of the Local Government Pension Scheme under the 'Local Government (Early Termination of Employment) (Discretionary Compensation) Regulations (Northern Ireland) 2003'.

Funding / Governance Arrangements of the LGPS

The funded nature of the LGPS requires participating employers and their employees to pay contributions into the Fund, calculated at a level intended to balance the pension liabilities with investment assets. Information on the framework for calculating contributions to be paid is set out in 'The Local Government Pension Scheme Regulations (Northern Ireland) 2014' and the Fund's Funding Strategy Statement. The last actuarial valuation was at 31 March 2022 and the contributions to be paid until 31 March 2026 resulting from that valuation are set out in the Fund's Rates and Adjustment Certificate. NILGOSC is responsible for the governance of the Fund.

Assets

The assets allocated to the Employer in the Fund are notional and are assumed to be invested in line with the investments of the Fund for the purposes of calculating the return over the accounting period. The Fund holds a significant proportion of its assets in liquid investments. As a consequence there will be no significant restriction on realising assets if a large payment is required to be paid from the Fund in relation to an employer's liabilities. The assets are invested in a diversified spread of investments and the approximate split of assets for the Fund as a whole is shown in the disclosures. NILGOSC may invest a small proportion of the Fund's investments in the assets of some of the employers participating in the Fund if it forms part of their balanced investment strategy.

The NILGOSC actuary, Aon Solutions UK Ltd (Aon), has provided the following details for the purposes of accounting for the Armagh Observatory and Planetarium's joint share of the scheme deficit in accordance with FRS 102 at 31 March 2024.

Key assumptions used by the actuary were:

	31 March 2024	31 March 2023
Discount rate	4.8%	4.7%
CPI inflation	2.6%	2.7%
Pension increases	2.6%	2.7%
Pension accounts revaluation rate	2.6%	2.7%
Salary increases	4.1%	4.2%

Mortality assumptions

	31 March 2024 Years	31 March 2023 Years
Males		
Pensioner member aged 65 at accounting date	21.7	22.2
Active member aged 45 at accounting date	22.7	23.2
Females		
Pensioner member aged 65 at accounting date	24.6	25.0
Active member aged 45 at accounting date	25.6	26.0

Notes to the financial statements for the year ended 31 March 2024 (continued)

19 Pension scheme (continued)

Asset Allocation

	Value at 31/03/2024	Value at 31/03/2023
Equities	43.7%	40.0%
Property	9.7%	11.2%
Government bonds	17.4%	20.6%
Corporate bonds	4.2%	3.0%
Multi Asset Credit	13.3%	13.3%
Cash	5.6%	6.5%
Other	6.1%	5.4%
Total	100.0%	100.0%

Reconciliation of funded and unfunded status to balance sheet

	Value at 31/03/2024 £'000	Value at 31/03/2023 £'000
Fair value of assets	11,787	10,690
Present value of funded defined benefit obligation	(10,611)	(10,530)
Funded status	1,176	160
Unrecognised asset	(1,175)	-
Present value of unfunded defined benefit obligation	(1)	(2)
Asset/(Liability) recognised on the balance sheet	-	158

The split of the liabilities at the last valuation between the various categories of members is as follows:

Active members	36%
Deferred pensioners	20%
Pensioners	44%

Amounts recognised in statement of financial activities

	Year to 31/03/2024 £'000	Year to 31/03/2023 £'000
Operating cost		
Current service cost	(303)	(579)
Financing cost		
Interest on net defined benefit liability	14	(49)
Pension expense recognised in statement of financial activities	(289)	(628)
Allowance for administrative expenses included in Current Service Cost	7	6

Amounts recognised in statement of funds

	Year to 31/03/2024 £'000	Year to 31/03/2023 £'000
Asset gains/(losses) arising during the period	617	(1,243)
Actuarial gains/(losses) due to changes in financial assumptions	354	5,024
Actuarial gains/(losses) due to changes in demographic assumptions	164	(55)
Actuarial gains/(losses) due to liability experience	(81)	(1,315)
Adjustment gains/(losses) due to restriction of surplus	(1,175)	-
Total amount recognised in statement of funds	(121)	2,411

Changes to the present value of defined benefit obligation

	Year to 31/03/2024 £'000	Year to 31/03/2023 £'000
Opening defined benefit obligation	10,532	13,497
Current service cost	303	579
Interest expense on defined benefit obligation	488	374
Contributions by participants	130	93
Actuarial gains/(losses) due to changes in financial assumptions	(354)	(5,024)
Actuarial gains/(losses) due to changes in demographic assumptions	(164)	55
Actuarial gains/(losses) due to liability experience	81	1,315
Net benefits paid out	(404)	(357)
Closing defined benefit obligation	10,612	10,532

Notes to the financial statements for the year ended 31 March 2024 (continued)

19 Pension scheme (continued)

Changes to the fair value of assets

	Year to 31/03/2024 £'000	Year to 31/03/2023 £'000
Opening fair value of assets	10,690	11,620
Interest income on assets	502	325
Remeasurement gains/(losses) on assets	617	(1,243)
Contributions by the employer	252	252
Contributions by participants	130	93
Net benefits paid out	(404)	(357)
Closing fair value of assets	11,787	10,690

Actual return on assets

	Year to 31/03/2024 £'000	Year to 31/03/2023 £'000
Interest income on assets	502	325
Gain/(loss) on assets	617	(1,243)
Actual return on assets	1,119	(918)

Sensitivity Analysis

Funded LGPS benefits

Discount rate assumptions

Adjustment to discount rate	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	10.441	10.611	10.781
% change in present value of total obligation	-1.6%		1.6%
Projected service cost (£m)	0.276	0.288	0.300
Approximate % change in projected service cost	-4.1%		4.2%

Rate of general increase in salaries

Adjustment to salary increase rate	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	10.632	10.611	10.590
% change in present value of total obligation	0.2%		-0.2%
Projected service cost (£m)	0.288	0.288	0.288
Approximate % change in projected service cost	0.0%		0.0%

Rate of increase to pensions in payment and deferred pension assumption, and rate of revaluation of pension account assumptions:

Adjustment to pension increase rate	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	10.760	10.611	10.462
% change in present value of total obligation	1.4%		-1.4%
Projected service cost (£m)	0.300	0.288	0.276
Approximate % change in projected service cost	4.2%		-4.0%

Post retirement mortality assumption

Adjustment to mortality age rating assumption	-1 year	Base Figure	+1 year
Present value of total obligation (£m)	10.887	10.611	10.335
% change in present value of total obligation	2.6%		-2.6%
Projected service cost (£m)	0.298	0.288	0.278
Approximate % change in projected service cost	3.6%		-3.6%

Notes to the financial statements for the year ended 31 March 2024 (continued)

19 Pension scheme (continued)

Pension Surplus Restriction

AOP has applied the principles of FRS 102 in relation to pension surplus restriction. FRS 102 outlines that a defined benefit plan asset can only be recognised to the extent that the plan surplus can be recovered through reduced contributions in the future or through refunds from the plan. Aon has assessed that at 31 March 2024 the defined benefit plan asset is restricted to nil as no plan surplus can be recovered by these means.

Cost Management in the LGPS (NI)

Legislation requires HM Treasury to undertake periodic valuations to monitor the cost of the LGPS (NI) to ensure it remains sustainable and affordable.

The outcome of the review relating to the 2016 Valuation recommended no changes to the provisions of the Scheme. The legality of Government's decision to include McCloud costs as a member cost within the 2016 HMT process was challenged by a Judicial Review in 2023 brought by the trades unions. The Judicial Review was unsuccessful, however the unions have been given permission to appeal that decision. If that appeal is successful this may cause the 2016 HMT process to be re-run and could result in changes in benefits or member contributions backdated to 1 April 2019.

Aon were expecting the result of the Judicial Review early in 2024. As the review has not concluded at the time of preparing these results, they have not made any allowance for the potential cost of improving members' benefits.

Goodwin ruling

In June 2020 an Employment Tribunal ruled, in relation to the Teachers' Pension Scheme, that provisions for survivor's benefits of a female member in an opposite sex marriage are less favourable than for a female in a same sex marriage or civil partnership, and that treatment amounts to direct discrimination on grounds of sexual orientation. The chief secretary to the Treasury announced in a written ministerial statement on 20 July 2020 that he believed that changes would be required to other public service pension schemes with similar arrangements. Changes to NI regulations were made on 24 March 2022 and came into effect on 18 April 2022. These changes are yet to be reflected in data provided by NILGOSC, so Aon have not allowed for this ruling in their calculations.

Pay settlements for local government workers

In 2023 the National Joint Council (NJC) offer to local government workers was an increase of £1,925 on all pay points 1 and above. Additionally, in the Autumn budget 2023 the Chancellor announced an increase to the National Living Wage from £10.42 per hour to £11.44 per hour.

Aon do not usually update the active liabilities between valuations for the impact of pay settlements above or below those assumed, however given the above changes, they have allowed for pay experience at a rate of 7% on pre-2015 active liabilities for years ending in 2024, which is the same rate of experience as was proposed for financial year ends in 2023.

20 Capital commitments

Capital commitments at 31 March 2024 totalled £58,000 (2023: £125,000) in respect of expenditure on projects commenced during the year. DfC has agreed funding for 2024/25.

21 Contingent liabilities

Pension liability - Goodwin judgement

In June 2020, an Employment Tribunal ruled, in relation to the Teachers' Pension Scheme that provisions for survivor's benefits of a female member in an opposite sex marriage are less favourable than for a female in a same sex marriage or civil partnership, and that treatment amounts to direct discrimination on grounds of sexual orientation. The chief secretary to the Treasury announced in a written ministerial statement on 20 July 2020 that he believed that changes would be required to other public service pension schemes with similar arrangements. Changes to the NI Regulations were made on 24 March 2022 and came into effect on 18 April 2022. Those changes have not yet been reflected in the pensions data in note 19, but Aon advise that the impact is likely to be immaterial.

There were no other contingent liabilities at the 31 March 2024 (2023: Nil).

22 Remote contingent liabilities (Audited)

There were no remote contingent liabilities at the 31 March 2024 (2023: Nil).

23 Related-party transactions

None of the members of the Board of Governors, the Management Committee, the Director or other related parties have undertaken any material transactions with the Armagh Observatory and Planetarium during the year. The Armagh Observatory and Planetarium has had various material transactions with a number of Government Departments, Executive Agencies and Non-Departmental Public Bodies in Northern Ireland. Most of these transactions have been with DfC, Construction and Procurement Delivery (CPD), Strategic Investment Board (SIB), Tourism NI, and the Education Authority (EA). DfC provides recurrent and capital grant-in-aid (note 2), SIB provides professional advisory and consultancy services, Tourism NI provides marketing and capital grants (note 3), and CPD and EA are the Centres of Procurement Expertise for the organisation. The Royal School Armagh leases land for playing fields at a nominal rent.

No other related party transactions took place in the year, other than certain trustees' expenses already disclosed in note 8.

Notes to the financial statements for the year ended 31 March 2024 (continued)

24 Losses and special payments (Audited)

There were no losses or special payments during the year (2023: Nil).

25 Financial instruments

As the cash requirements of the Observatory and Planetarium are met through grants from DfC and other grant funding bodies, financial instruments play a more limited role in creating risk than would apply to a non-public sector body of a similar size. The majority of financial instruments relate to contracts to buy non-financial items in line with the Observatory's expected purchase and usage requirements and the Observatory and Planetarium is therefore exposed to little credit, liquidity or market risk.

26 Additional disclosures to comply with the Financial Reporting Manual (FReM)

FReM requires non-departmental public bodies to regard grant-in-aid received as contributions from controlling bodies giving rise to a financial interest in the residual interest of the body and hence accounting for as financing, that is by crediting them to income and expenditure reserve. In addition FReM requires grant-in-aid to be accounted for on a cash basis.

However, as the organisation is required to prepare accounts in accordance with the SORP for charities, DfC has given AOP permission to continue to treat grants as income. If AOP were required to comply with the FReM the result of this compliance would be as follows:

Statement of Financial Activities prepared under FReM

	Note	2024 £	2023 £
Incoming resources			
Incoming resources from research and other non-DfC grants	2	340,637	486,208
Operating income	2	450,958	415,195
Trading income	4	195,615	193,471
Total incoming resources		987,210	1,094,874
Resources expended			
Direct expenditure of the organisation		3,978,546	4,285,869
Total Resources expended		3,978,546	4,285,869
Net deficit for the year		(2,991,336)	(3,190,995)
Loss/(gain) on revaluation of Fixed Assets and Heritage Assets		500,740	255,242
Actuarial (loss)/gain on pension scheme		(121,000)	2,411,000
Amount transferred to funds		(2,611,596)	(524,753)

Analysis of funds prepared under the FReM

		2024 £	2023 £
Balance at 1 April 2023		12,720,471	10,609,224
Grant-in-aid received in the year	2	2,367,000	2,636,000
Net operating costs for the year		(2,611,596)	(524,753)
Balance at 31 March 2024		12,475,875	12,720,471

27 Events after the Reporting Date

1) Adjusting Events:

There were no events after the reporting date which would require adjustment to the financial statements.

2) Non-adjusting Events:

There were no events after the reporting date which would require disclosure in the financial statements.

The Accounting Officer authorised the issue of these financial statements on 29 October 2024.

The Armagh Observatory and Planetarium

Northern Ireland - Charity number 103948

Annual report

Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2024

Laid before the Northern Ireland Assembly

under clause 8 of The Armagh Observatory and Planetarium (Northern Ireland) Order 1995,

as amended by Schedule 1, clause 6 of the Audit and Accountability (Northern Ireland)

Order 2003, by the Department for Communities

on

18 November 2024

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Any enquiries regarding this publication should be sent to
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Armagh Observatory and Planetarium

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The Trustees' Annual Report for the year ended 31 March 2024

The Board of Governors and Management Committee, who are the Trustees for Armagh Observatory and Planetarium (AOP) have pleasure in presenting the annual report and financial statements for this charity for the year ended 31 March 2024. These financial statements have been prepared in accordance with the accounting policies set out in note 1 to the accounts, with the guidance issued by the Department of Finance on the form and contents of the Annual Reports and Accounts of Executive Non-Departmental Public Bodies, *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* and Accounting and Reporting by Charities: Statement of Recommended Practice (SORP) applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102). The Remuneration and Staff report is prepared in accordance with the direction set out in The Government Financial Reporting Manual (FRM) 2023-24.

The sponsor Department for Armagh Observatory and Planetarium is the Department for Communities (DfC) (the Department).

Background to Charitable Status

Historically the Armagh Observatory and the Armagh Planetarium were treated as being distinct institutions; being two component divisions of a single statutory corporation and arms-length body (ALB), 'The Governors of The Armagh Observatory and Planetarium' as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*.

The principal function of the Armagh Observatory, founded in 1789 as part of Archbishop Richard Robinson's vision to see the creation of a university in the City of Armagh, is to undertake original research of a world-class academic standard that broadens and expands our understanding of astronomy and related sciences.

The Armagh Planetarium was founded by Dr Eric Mervyn Lindsay, the seventh director of the Armagh Observatory, and was officially opened on 1 May 1968. The Planetarium's primary activity is to disseminate scientific and technical knowledge of a wide range of science, technology, engineering, arts and mathematics (STEAM) subjects, and to promote public understanding of astronomy and science through its programme of educational services for schools and the wider public.

From 1 April 2016 the Charity Commission for Northern Ireland registered *The Governors of The Armagh Observatory and Planetarium*, (changed to *The Armagh Observatory and Planetarium* in 2023) as a charity under reference number NIC 103948.

Objectives and Activities

The organisation's statutory functions are set out at Article 4 of *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* (the Order). The Order requires that '*the Governors shall, for the purpose of developing and improving the knowledge, appreciation and practice of astronomy and related sciences, maintain and manage the Armagh Observatory and Planetarium and may take such other action as the Governors may think proper for the purpose of acquiring or disseminating knowledge relating to astronomy and related sciences*'.

In accordance with Paragraph 8(1) of Schedule 1 of the Order, the Armagh Observatory and Planetarium (AOP) Board of Governors has delegated the primary responsibility for the governance and management of AOP to a Management Committee with the statutory purpose of 'developing and improving the knowledge, appreciation and practice of astronomy and related sciences'.

The AOP Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department for Communities (our sponsor Department) and approved by the Minister and for promoting the efficient, economic and effective use of resources.

As the primary responsibility for the governance and management of AOP has been delegated to a Management Committee, the Governors considered the role of Charity Trustees would more appropriately align with their remit too. The Board of Governors agreed in principle to this. The Charity Commission of Northern Ireland recommended that the Members of the Management Committee be appointed as Trustees for the Charity alongside the Members of the Board of Governors. Accordingly, both the Members of the Board of Governors and the Members of the Management Committee are Charity Trustees.

Armagh Observatory is the oldest scientific institution in Northern Ireland, and the longest continuously operating astronomical research institute in the UK and Ireland. Armagh Planetarium is also the oldest operating planetarium in the UK and Ireland.

Our Mission:

“Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.”

Our Vision:

“Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.”

The organisation operates on the international stage and is underpinned by core funding from the Department and the receipt of external grants from the UK Science and Technology Facilities Council (STFC), and other grant-awarding bodies.

A Strategic Plan for 2021-26 was launched in September 2021 and this is now being implemented. The strategy is built around four strategic themes – Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

As at 31 March 2024, there were 29.8 full time equivalent permanent employees which comprised approximately one-third Research, one-third Education and one-third Corporate. Additionally, there were 3.6 full time equivalent temporary employees, some of whom were engaged on short term temporary projects. AOP also employs a number of casual staff on an ad hoc basis to meet operational needs. In addition, there is an Emeritus Director, an Emeritus Research Astronomer and 8 external research associates and academic visitors who are unpaid.

Public Benefits

The Trustees confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under Section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2024. This is demonstrated in the following summary of Principal Activities which provides detail on how the organisation has delivered against its objectives and the public benefit which has flowed from this.

Principal Activities

Introduction to AOP Research and its International Standing

AOP is one of the oldest scientific research institutes in the UK and Ireland with a long-established reputation of research excellence. It is also one of very few astronomical institutions in the world to have a modern planetarium through which its research can be effectively communicated and where a research-informed outreach and public engagement activity can be sustained.

AOP is strategically engaged in front-line research in several key areas of astrophysics. These range from the study of our Sun and the Solar System to that of distant galaxies, in keeping with the long and varied history of scientific achievements of the Armagh Observatory and with the desire to be perceived by the public as leaders in of all strands of astronomical research that are communicated through the Planetarium.

Typically, around a third of AOP research is funded by the award of project-specific external grants mainly from the STFC, together with several ad hoc grants. These grants support projects led by individual research astronomers with the provision of PhD scholarships, post-doctoral research assistant salaries, computing equipment and observation/conference travel funding. Early in 2024, AOP researchers secured one new STFC grant providing funding for one Post-Doctoral Research Assistant (PDRA) plus salary staff contribution and estate costs until March 2027. AOP researchers also secured Leverhulme Trust funding to support an additional PDRA who will be dedicated to solar-system studies based on the use of immersive technologies and AOP's data visualisation laboratory.

AOP research requires the use of state-of-the-art observing and computing facilities internationally in order to obtain new astronomical data and allow their analysis. STFC and UK government support provides access to world-class international facilities, and AOP research staff regularly win telescope time on some of the best and most sought-after telescopes in the world such as the European Southern Observatory (ESO) Very Large Telescope (VLT) or the Hubble Space Telescope (HST).

In addition, through the AOP's membership of the UK SALT Consortium, its research staff have access to the 11-metre diameter Southern African Large Telescope (SALT). Similarly, AOP is also a founder member of the international Gravitational-wave Optical Transient Observer (GOTO) project; a member of the UK consortia involved

in building the detectors for Inouye Solar Telescope (IST); LOFAR (Low Frequency Array) radio telescope project and a consortium member of the Cherenkov Telescope Array (CTA) gamma-ray observatory and the BlackGem project which conducts optical surveys from Chile. Finally, AOP is in a leadership position for nearly a quarter of all the observing time dedicated to Large Programs run by the 15-meter diameter James Clerk Maxwell Telescope (JCMT) in Hawaii which detects sub-mm radio waves.

These facilities can be extremely expensive to run (e.g., the running cost of one observing night at VLT is about £40,000 and a mid-size observing program with HST would be ten times more) so that through the award of their use, the international astronomical community essentially entrusts astronomers at Armagh to make effective use of the data. On average AOP researchers secure telescope time corresponding to a value of more than £300,000 per year, and the value of the telescope time obtained at facilities to which AOP has unique access far outweighs the costs of such arrangements.

AOP research staff also play a full role in the international astronomical community. For instance, they serve on committees of bodies such as the Royal Astronomical Society (RAS), the UK Science and Technology Facilities Council, the International Astronomical Union (IAU) - with three commission vice-presidents and two former presidents, ESO time allocation panels, assess grant and research proposals on behalf of external funding agencies, review scientific papers and edit international academic journals, and act as external PhD examiners in the UK and beyond. AOP researchers also sit on scientific advisory panels or lead specific projects with future ground-based observing facilities (Vera Rubin Observatory, ELT-METIS, VLT-BlueMUSE), space satellites and missions (European Space Agency's future Plato and Comet Interceptor missions) and large-scale surveys (MOONS).

The international reputation of AOP research staff is also testified by their ability to attract their international peers to Armagh either on research visits or organising international conferences and workshops at the Planetarium. This year was rather exceptional as regards the latter, as AOP welcomed over 120 delegates during three back-to-back research conferences in September 2023, which were delivered thanks to the concerted efforts of AOP staff and students and to funding from both the Armagh, Banbridge and Craigavon Council and the RAS.

Finally, AOP research staff are involved in the training of PhD students who also play a key part in AOP outreach and public engagement activity. AOP students are usually registered at Queen University Belfast (QUB), through an advantageous student fee arrangement that over time has allowed AOP to attract students from all over the world and achieve a vibrant diversity in our cohort that in turn prepares our students to be STEM champions, promoting equal opportunities in physics when they help at the Planetarium. This year AOP underwent a quinquennial review of the memorandum of agreement with QUB for the supervision of PhD students. This had a positive outcome, commending the AOP PhD program, the quality of our underlying research and the unique research environment, with a recommendation to setup an AOP/QUB studentship to further joint research opportunities.

Research Highlights

To provide a practical understanding of how the work of AOP research contributes to the region's international reputation and understanding of the cosmos, the following provides some highlights of the research undertaken at AOP in the financial year. This draws from international collaborations and the award of observing time on highly competitive facilities, as well as direct support from the Department allowing AOP to participate in several key international projects (such as SALT, GOTO, IST, I-LOFAR, Comet Interceptor, CTA and BlackGem). Full bibliographic references can be found in the publication list appended to this report.

Stellar and Galaxy Evolution

Introduction

When we look up on a dark night, we may think that stars are immutable and isolated. Yet, although stars can live for as long as the age of the Universe, they can also undergo dramatic changes in matter of seconds. They are also not isolated from other stars. Some are found in pairs or tight groups and more generally stars are related to each other through the very way in which they form and evolve. Stars are born from giant clouds of gas and return matter to those clouds, seeding the birth of new stars as they fade away or sometimes explode in dramatic events. Furthermore, stars produce the heavy elements necessary for the formation of rocky planets and of life as we know it.

In turn, the formation history of stars relates to the formation and evolution of the galaxies that contain them. Some galaxies no longer appear to form stars, unlike the case of the Milky Way. This may depend on whether fresh gas is available around them, on whether they have collided with other galaxies in the past or possibly also on whether their central supermassive black hole suddenly becomes active and pours out tremendous amounts of energy capable of clearing its host galaxy of any star-forming gas material. Finally, galaxies are carried by the general expansion of the Universe and the evolution of the dominant, yet unknown dark-matter material in which they themselves are embedded. Understanding the formation and evolutions of stars and galaxies therefore ultimately means understanding our origin in relation to the very fabric of the Universe.

Recent results

AOP stellar studies range from the most massive and brightest young stars to the faintest and ageing stars or stellar remnants such as white dwarfs and black holes.

The research in the group of Professor Jorick Vink is both theoretical and observational and is supported by STFC grants run in collaboration with Keele and York Universities. The theoretical work focuses on understanding of the formation of the heaviest stars and stellar black holes in the Universe. These stars are up to 10 million times brighter than the Sun. Key science questions involve the production of pair instability supernovae, where the entire star is disrupted, and one such event enriching galaxies with more heavy elements than all the lower mass stars combined. Recent studies lead by Vink's students and post-doctoral research assistants uncovered that the most massive stars undergo strong wind mass loss (e.g. *Sablahit et al. 2023*; *Higgins et al. 2023*). On the observational side, Vink is leading an ESO-VLT Large Programme called X-Shooting ULLYSES (XShootU; *Vink et al. 2023*) with a team of ~100 massive stars experts from around the globe trying to understand the stellar and mass-loss properties of massive star in pristine low-metallicity environments of the Large and Small Magellanic Clouds. These environments provide a key stepping stone to understand the very first stars in the distant Universe, which were likely very massive. Based on observations with the James Webb Space Telescope (JWST) of the discovery of huge amounts of Nitrogen in the distant Universe, Vink suggested that very massive stars (VMS) are the key sources (Vink 2023). Together with Gautham Sablahit, Vink developed a new mass-loss framework for how the most massive stars evolve until they collapse into a black hole (Vink and Sablahit 2023). In collaboration with Drs Aline Vidotto and Luca Fossati, the proceedings of IAU Symposium 370 with the Topic: "Winds from Stars and Exo-planets" were published (Vidotto, Fossati and Vink 2023).

The vast majority of stars will end their life as a "white dwarf", a very compact object with a mass comparable to that of the Sun but a size similar to that of the Earth. Stefano Bagnulo, working with AOP Visitor John Landstreet, led an international team of scientists in discovering a unique signature of the process by which white dwarf stars cannibalise their planetary systems. The research was conducted using the ESO's Chile-based VLT and outlines how a scar has been found imprinted on the surface of a magnetic white dwarf called WD0816-310. This object is an Earth-sized remnant of a star in the neighbourhood of our Solar System. The scar is a visible by-product of the process by which white dwarfs ingest the surrounding planets and asteroids that they are born with them. The scar is composed of a concentration of metals that originate from a planetary fragment as large as, or possibly larger than, the asteroid Vesta, which is about 500 kilometres across. The observations also provide clues as to how the star got its metal scar. The strength of the metal detection in the star changes as the star rotates, suggesting that the metals are concentrated on a specific area on the star's surface. The team found that these changes were synchronised with fluctuations of the white dwarf's magnetic field and discovered that the metal scar is located at one of the star's magnetic poles. This shows that the metals were funnelled onto the star by its magnetic field, so creating the scar. This research was the subject of an ESO press release (<https://www.eso.org/public/news/eso2403/>) that has attracted media attention at international level. Bagnulo has capitalised on the impact of his research by the organisation of a 4-week workshop in Garching (Germany) on stellar magnetic fields at the Munich Institute for Astro and Particle Physics (MIAPP) in October 2023 (<https://www.munich-iapp.de/magnetic-fields>).

Stars may pass through a number of stages after leaving the long-lived hydrogen-burning phase and becoming white dwarfs. Many become red giants, and a few become hot subdwarfs. Professor Simon Jeffery and his team study the latter, including stars that are in transition from one to another. By studying their distribution in the Galaxy, the team has shown that the extreme helium stars must come from both old and recent star formation (*Philip Monai et al. 2023*). Some hot subdwarfs evolving to become white dwarfs show large-amplitude pulsations, but their precise histories remain obscure (*Zhang et al. 2023*). Other hot subdwarfs have surface which are excessively rich in unusual elements such as lead. The team is working to discover whether this excess is of nuclear origin or due to the formation of thin clouds in their atmospheres (*Scott et al. 2024, in press*).

Linking to external galaxies, Marc Sarzi's main research focus remained the impact of galactic environment of galaxy evolution, particularly in dense cluster such as the Fornax cluster. For this he is pursuing follow up studies stemming from his past Fornax3D survey and relating to the evolution of cold-gas reservoirs around galaxies in Fornax while connecting this information to their star-formation formation history. The work led by his PDRA (*Loni et al. 2023*) exemplifies this approach, as it showed how the particular morphology of the peculiar galaxy NGC1436 is the result of a recent stripping of its outer gas reservoirs as this galaxy flew by the centre of the Fornax cluster, a process that also triggered a tremendous amount of star formation in the inner part of this galaxy. This is causing NGC1436 to gradually transform from a spiral to a lenticular galaxy, through an environmental process that may indeed contribute to explain the prominent lack of spiral galaxies in cluster environments. Future work combining Fornax3D MUSE data with S-PLUS imaging data (*Smith Castelli et al. 2024, in press*) will lead to even better reconstructions for the star-formation history of Fornax galaxies. The formation history of galaxies in dense environment is also dominated by direct interactions between galaxies. The impact of such encounters can be particularly well traced when focussing on the most fragile structures in galaxies, such as stellar disks. This was done by Sarzi's PhD student Pablo Galan de Anta through two sophisticated computer simulation studies (*Galan de Anta et al. 2023 a,b*)

A landmark survey of the molecular gas distribution in along the plane of Galaxy has been published by AOP. The programme was conceived by the Director in 2009 with the first observations taken in 2011 (following a near-catastrophic fire that engulfed, but fortunately didn't destroy, the telescope). Observations were completed in 2018 and the data then reduced leading to its publication in August 2023 (led by recently graduated Armagh PhD student Kerem Osman Çubuk) with the data being made publicly available through a data repository; see <https://mopracosurvey.wordpress.com>. The survey used the Mopra radio telescope in Australia and measured the millimetre-wavelength line emission from 4 isotopic variants of the CO molecule in its fundamental $J=1-0$ transition, achieving a spectral and spatial resolution of 0.1 km/s and 0.6 arcmin respectively, and covering 215 square degrees of the sky. The survey charts the distribution of the emission from the carbon monoxide molecule (the second most abundant molecule in space) across the southern Galactic plane. It covers approximately one-third of the great circle drawn around the celestial sphere that passes along the plane of the Milky Way.

This work is also close to the research of AOP's Öpik fellow, Dr David Eden who, by using the data from multiple JCMT Large Programs, is investigating the causes of star formation in the Milky Way. These Large Programs investigate multiple stages of the star-formation process from the formation of new molecular clouds (the sites of star formation; Rani, Moore, Eden *et al.*, 2023) to the role dense-gas (the gas most closely aligned to star formation) takes in the earliest stages of star formation (Xu, Wang, Liu, Eden *et al.*, 2024). Rani *et al.* (2023) identified a number of molecular clouds in the Galactic Plane, finding that the conditions for star formation are fairly uniform across the Inner Galaxy, regardless of whether they are located in or out of spiral arms. Xu *et al.* (2023) investigated the lack of dense gas outside of the Galactic Plane and found that the scarcity of it favours turbulence as the driving force behind star formation across the Universe, as opposed to supernovae.

The role of SALT

The Southern African Large Telescope (SALT) is the largest telescope in the Southern Hemisphere, providing unparalleled access to the skies for its shareholders, of whom AOP through its membership of the UK SALT Consortium is one. Participation in this major international facility brings visibility throughout the worldwide research community and allows AOP and just a few other UK universities to engage in collaborations with other SALT international partners. In turn, through such partnerships, AOP receives a return in terms of telescope time allocation that is equivalent to roughly 10 times its contribution. In 2023, a long-standing program led by Professor Simon Jeffery at AOP was awarded 130 hours and obtained over 290 unique astronomical observations, targeting some of the most exotic stars in the Universe. Indeed, 123 observations were made during one week in May alone. These contribute to a growing series of discovery papers and to the training of postgraduate research students at AOP. Participation in SALT also allows AOP to explore opportunities through the SALT Collateral Benefits Programme to develop links between local schools in Northern Ireland and in South Africa. AOP carries out the administration function for the UK SALT Consortium, which includes four other academic partners – Keele University, Open University, University of Central Lancashire and University of Southampton.



The 10-metre diameter Southern African Large Telescope (SALT), in the semi-desert region of the Karoo, South Africa.

Using SALT, Simon Jeffery leads a survey of chemically peculiar subdwarf stars in the southern sky. These are stars that are in the final stages of their lives but their histories from birth to the present are very diverse. By exploring the abundances of key elements such as hydrogen, helium, carbon, oxygen, and iron, and of exotic elements such as lead and zirconium, these histories and internal physics can be explored. These AOP-led SALT observations have already led to a first data-release and are now building towards a second data-release, including classifications, coarse analyses and kinematics for over 600 hydrogen-deficient hot subdwarfs. A treasure trove of data for exotic

stars is yielding exciting new discoveries. EC 19529-4430 is the most carbon-poor and metal-poor extreme helium star discovered to date (*Jeffery et al. 2024*); although it must have formed recently from the merging of two white dwarf stars, the original binary star system probably formed some 11 billion years ago. Meanwhile, the hot subdwarf Ton S 415 was discovered to be a double star system containing a white dwarf and a hot subdwarf spinning around each other every 84 minutes, separated by only 5 times the radius of the subdwarf (*Snowdon et al. 2023*). Jorick Vink and a team of international astronomers are using SALT to study the long-term polarised light from the most famous Luminous Blue Variable Eta Carina, which is quite possibly the most massive star in the Milky Way.

Transient and Periodic Variable Stars

Introduction

Apart from the bright planets and the occasional comet, the night sky might appear to be unchanging, with stars appearing to be the same brightness and place as they always are. However, astronomers from the ancient world detected new stars, “novae” or “supernovae”, which suddenly appeared in the night sky and then gradually faded from view over weeks or months. We now know that many of these “transient” events occur when one star circling a companion star unloads enough matter through the process of “accretion” to its companion to make it explode. Supernovae have now been used to show the universe is expanding at an accelerating rate. Other “variable stars” were first detected in the early 17th century when a star now called “Mira” was observed to change in its brightness on a timescale of nearly a year. We now know that Mira is a star several hundred times as large as the Sun, and contracts and expands in size over time. In fact, practically all stars are variable at some level. However, in many cases it is only recently that astronomers have been able to detect this variability.

By studying the brightness of stars in detail we can test physical models which set out to explain their observed behaviour. However, the diversity of variable stars requires different observing strategies. Explosive events can be extremely rare and short-lived, so that in order just to catch their initial rise to outburst it is necessary to observe the entire sky every night. On the other hand, targeted monitoring lasting many months is necessary to unravel the tiny vibrations of Sun-like stars. Professors’ Simon Jeffery and Gavin Ramsay have been using data from the *Kepler* and *TESS* satellites to better understand both the interior of stars and the accretion process. Further, Armagh astronomers have access to the GOTO, BlackGem and other telescopes which are used for many research areas including transients and variable stars.

Recent results

In the study of periodic phenomena, long continuous monitoring with extremely high accuracy has proved necessary to discover the signals due to exoplanets, star spots and gentle vibrations present in or around many stars. For these, space craft are essential to overcome poor weather and day light, with *Kepler/K2* (NASA 2000-2018), *TESS* (NASA 2018-ongoing) and *Plato* (ESA, from 2026) being pivotal missions. Using *TESS* data, Ramsay was a co-author of a study (*Hawthorn et al. 2024*) using *TESS* data which reported the discovery of 85 candidate exo-planets which have orbital periods (the planets year) longer than 20 days, with a number having periods longer than 100 days. Even today, planets with longer periods are difficult to detect. Ramsay was also a co-author of two studies (*Moulton et al. 2023*, *Smith et al. 2023*), which used data obtained from the New Generation Transient Survey (NGTS located in Chile) to study the rotation period and disc structures of very young stars in the Orion nebula.

GOTO and Transients and Variable stars

AOP became a founding partner of the international project the *Gravitational-wave Optical Transient Observer* (GOTO) through a successful bid for funds from the Northern Ireland Executive in January 2015. Its prime goal is to detect the optical counterpart of gravitational wave events such as the neutron star binary merger GW170817. The prototype GOTO node of telescopes was built in 2017 on the summit of the island of La Palma in the Canaries. Early in 2020 GOTO was awarded £3.2m by STFC to allow a second node to be built on La Palma and two nodes in Australia which were installed in April 2023. GOTO now images the whole observable sky every few nights and is ready and waiting for new gravitational wave events made by Ligo and Virgo. The current Ligo observing run started in May 2023 and is expected to continue until the Spring of 2025. GOTO was awarded £1.1M by STFC in March 2024 to cover the costs of operations and support over the next three years.



The two sites of the Gravitational-wave Optical Transient Observer (GOTO) at La Palma, the Canaries and Siding Spring Observatory, Australia.

As GOTO images the sky every night, many new transients and variable stars are discovered. It is now one of the most productive surveys for discovering supernovae in the world. In the current reporting period, GOTO and BlackGem (which targets nearby galaxies) reported more than two hundred new supernovae discoveries. In August 2023 and February 2024, GOTO had dedicated time on the Isaac Newton Telescope in La Palma to take spectra of newly discovered events by GOTO. For one event, the team obtained a spectrum just an hour or so after discovery and only six hours after the stellar explosion took place. Very early observations are key to revealing the nature of these events. GOTO has also been very productive in identifying the optical counterpart of Gamma-ray bursts which are caused by distant neutron stars or black holes events. As data continues to be obtained over the next few years, we expect many new galactic compact binaries to be discovered – these are expected to be the verification sources for LISA, the space based gravitational wave observatory, due to be launched in the mid-2030s.

Solar and Stellar Flares

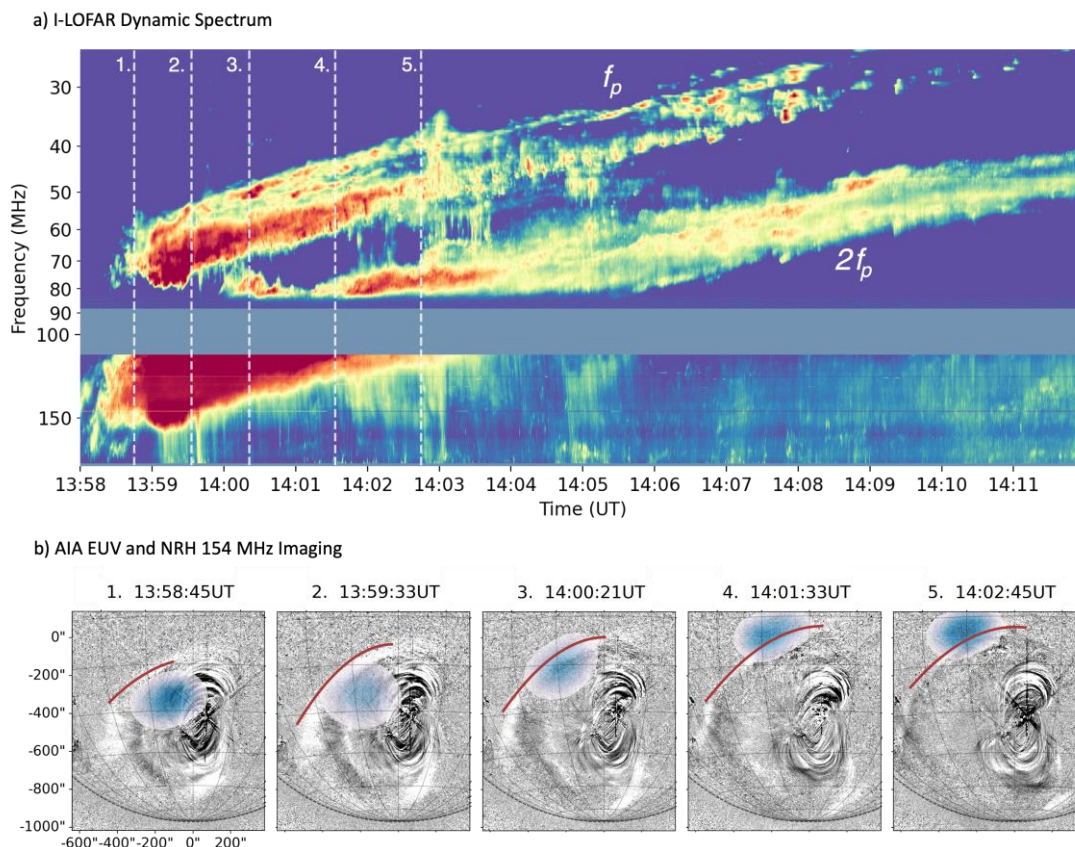
Introduction

Aurora, or Northern Lights in the northern hemisphere, were seen over much of the UK and Ireland in the first few months of 2024. The link between aurora and flares from the Sun date back to Richard Carrington who observed a white light flare on the Sun from England in 1859, which was followed by aurora only 18 hours later that were recorded in Armagh. We now know that flares are caused by regions of strong magnetic activity on the Sun whose intensity varies over the course of the ~11 year *Solar Cycle*. Although one of the wonders of the natural world, these auroral storms can also cause disruption to human activity: in 1989 the electricity grid in Canada was disrupted by a flare causing widespread blackouts. More recently, in February 2022, a solar storm caused forty newly launched Starlink satellites to prematurely enter the Earth's atmosphere costing up to \$20m. The first flares from stars other than the Sun were seen from low-mass dwarf stars nearly a century ago. With space missions such as *Kepler* and *TESS* which can study many stars continuously for many days or months, we can now study flares from many types of stars which can be used to help us determine how often the Sun can release intense flares.

Solar Physics

Solar Physics at AOP is led by Leverhulme Emeritus Fellow Gerry Doyle, whose student Nived Vilangot Nhalil obtained his PhD in Solar Physics in 2023 and now works at the Inter-University Centre for Astronomy and Astrophysics, India. Doyle's research uses data obtained from ground-based telescopes and satellites. One of these telescopes is the LOFAR array which observes the sky at low frequency radio waves. AOP joined I-LOFAR, the Irish consortium which now includes nine partners, in 2016 through capital funding from the NI Executive. The Irish station at Birr Castle links up with stations in ten European countries and strengthens Irish North-South collaboration and the more recent formal links made between AOP, Dunsink Observatory and Birr. It's a prime example of 'big-data' science with all stations in Europe being recently upgraded to LOFAR 2.0 which allows faster data transfer and more rapid data reduction.

In collaboration with colleagues in Dublin Institute for Advanced Studies (DIAS), Gavin Ramsay and Gerry Doyle supervise Jeremy Rigney (Lindsay PhD Scholar) who used data from I-LOFAR to study the intense solar storm of 10 May 2022. These data allowed them to investigate a moving source of low frequency radio emission as a Coronal Mass Ejection and associated Extreme Ultra-Violet wavefront, which was channelled along a region of lower density in the solar corona. Observations like these give insight to the physics processes in the Sun which can cause space weather which can be detected on Earth. Rigney, Ramsay and Doyle are also using the full LOFAR array to search for flares in other stars using simultaneous optical data from the TESS satellite.



Observations of an intense Solar radio flare on 10 May 2022 using I-LOFAR in Birr, Ireland. The top panel shows how the radio spectrum changed over the course of time, with the lower panels showing in grey, ultra-violet images made using the Solar Dynamic Observatory. The blue region shows radio emission obtained from the Nancay telescope in France, while the solid curved line shows the position of the shock front obtained from the I-LOFAR data (Rigney *et al.* 2024).

Stellar Activity

Gavin Ramsay and Gerry Doyle continue to study flares from low-mass stars and Solar type stars. Stars with a wide range of masses and age can produce flares whose energy can be millions of times greater than events from the Sun. Over the last few years, Ramsay and Doyle found a population of very rapidly rotating low mass stars which appear to be flare inactive. Since we expect rapidly rotating stars to be very active this was a great surprise. We have obtained spectroscopic observations of rapidly rotating stars and stars which are rotating much slower. These include data using the SAAO 1.9m telescope in South Africa and the 10.4m Gran Telescopio Canarias (GTC) which are being used to search for evidence of stellar activity using different spectral features. Ramsay and Doyle also obtained high speed observations of a low mass star using HiPERCAM on the GTC to search for short duration low amplitude flares from one of these rapidly rotating apparently inactive stars and are using TESS data to search for evidence of activity cycles in low mass stars.

Solar System Studies

Introduction

Our Solar System is an extraordinary natural laboratory to study the formation and evolution of planetary systems around the Sun and other stars. Our work here feeds into fundamental questions about how the Solar System and the Earth formed and the development of life in the Universe. Our study of comets, asteroids and planets impacts on models of solar system formation, the ever-present hazard to civilization if asteroids or comets hit our planet and

on the origin of water and organic compounds necessary for life to exist. The space industry benefits from improved detailed knowledge and understanding of the near-Earth and interplanetary environment.

Recent results

Apostolos Christou reports that significant progress has been made in the ongoing collaboration with Professor Stanley Dermott (University of Florida at Gainesville, FL, USA) and Dr Dan Li (NSF NOIRLab, Tucson, AZ, USA) to understand the origin and early evolution of our solar system. During this reporting period, Christou applied for and secured a £135k grant from the Leverhulme Trust to help develop advanced statistical methods designed to sift through the huge volume of data from the latest sky surveys to help identify the original planetesimal building blocks from which the rocky planets, including the Earth, came to be. The project focus is the asteroid belt between Mars and Jupiter, the broken-up fragments of leftover planetesimals. A continuous flow of asteroid data from ground-based telescopes and space missions will soon be complemented by the most comprehensive survey of the sky to-date by the Vera Rubin telescope currently under construction at the Atacama Desert in Chile. Existing analytical tools are not suited for the very high volume and complexity expected in the Rubin data. The grant will allow to advance the state-of-the-art in asteroid data analysis tools by hiring a professional data scientist and by borrowing methods and techniques from the emerging new field of Artificial Neural Networks, the ultimate aim being to reconstruct the original form and number of asteroids present in the primordial solar system.



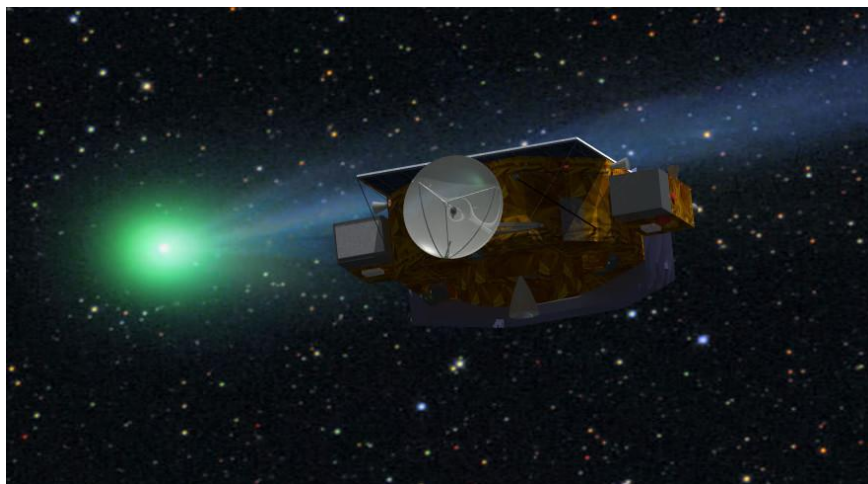
The Rubin telescope, seen here under the glittering light of the Milky Way at the Atacama Desert in Chile. The facility is expected to begin commissioning operations in 2025.

Another international collaboration, this time with Dr Auriane Egal (Paris Observatory, France; U. Western Ontario, Canada) and with Nick Georgakarakos (New York U., United Arab Emirates) succeeded in advancing our understanding of how the streams of material left behind by comets can interact with planetary bodies and measurably affect their environment. Observations in the Earth's atmosphere and in near-Earth space show that the Earth is subject to a continuous flow of particles or meteoroids raining down from space, the debris from comets and asteroids that cross our planet's path around the Sun. Since the time of Ernst Öpik, Armagh has been a leading centre of research to understand the Earth's meteoroid environment and in extending that understanding to other planetary bodies. Past work by Christou and by former Armagh astronomer Dr David Asher, had identified a meteor stream that appears both at the Earth and at the planet Mercury, helping to maintain a tenuous atmosphere around the planet made up of calcium atoms ejected from the surface. The new research that appeared in *Monthly Notices of the Royal Astronomical Society* in January 2024 (Christou, Egal and Georgakarakos, 2024) shows that some denser parts of the stream ("clumps") rich in large, fireball-producing meteoroids identified in the Earth observations also reach Mercury at certain times in the past and in the future. Significantly, the next encounter between the clump and Mercury will occur as the ESA/JAXA BepiColombo (BC) probe and its suite of instruments will be entering orbit around the planet. The fortuitous timing of the encounter presents a rare opportunity to document the effect of the clump in the Hermean environment during BC's short tenure at the solar system's innermost planet.

Stefano Bagnulo and his PhD student Zuri Gray secured telescope time at the ESO VLT to study the consequences of the impact of Double Asteroid Redirection Test (DART), a planetary defence mission to test a method of deflecting an asteroid on course to hit Earth. DART arrived at near-Earth asteroid Didymos on 26 September 2022. The spacecraft crashed into the asteroid's small moon Dimorphos, testing whether the kinetic impactor technique works. Because of the impact, dust clouds were ejected from Dimorphos, which was studied by Bagnulo and Gray from ground-based telescopes using polarimetric techniques (Bagnulo, Gray and Granvik 2023). Their work formulated two distinct scenarios for the formation of the dust on the surface of the impacted asteroid and has attracted international interest including through an official ESO press release.

Finally, AOP work on our Solar system links also to extra-solar planetary systems and in particular to ESA's Plato mission, which is due to be launched towards the end of 2026, has a prime goal of identifying Earth sized planets around Solar type stars in its habitable zone. Gavin Ramsay is one of two ESA Plato Community Scientists and member of the ESA Plato Science Working Team. At the start of the mission, Plato will point at region in the southern hemisphere covering 2,250 square degrees for at least two years.

The COMET INTERCEPTOR Space Mission



Artist impression of COMET INTERCEPTOR Space Mission

ESA recently approved a space mission to encounter a comet coming from the edge of our Solar System; the launch is expected in 2028. A novel idea sets this mission apart. So far, spacecraft have approached comets that are already well known and have gone around the Sun already several times. Therefore, it is very likely that the comet material has been “processed” by solar radiation and the space environment, and it is no longer in pristine condition. By contrast, here we are interested in comets on their first trip around the Sun, made of unprocessed material preserved in the cold outer parts of the solar system. To achieve the goal of visiting such a new comet, the spacecraft will be launched before the comet is found and will wait in deep space for instructions. Once a suitable target comet is found, instructions will be sent from the ground to guide the spacecraft to the comet (hence the name **Comet Interceptor**). Studying the material brought for the first time to the heat and light of the Sun will give us the opportunity to look at the solar system as it was when it formed. AOP is contributing to the development of the instrument that will send to Earth comet images (including polarimetric images) obtained with a fish-eye lens. Stefano Bagnulo is an expert in polarimetric observations and is one of the co-Investigators of the project, and his PhD student Zuri Gray is also involved in the mission team. Most recently, Bagnulo has officially become a Co-Investigator of the EnVisS instrument on-board Comet Interceptor, and member of the Comet Interceptor “Near Environment” working group. He has participated to the second CI Working Group meeting at the European Space Research and Technology Centre in March 2023.

Researcher Development Concordat

In February 2023 AOP became a signatory of the Concordat to Support the Career Development of Researchers, which is an aspirational Concordat that aims at increasing the appeal and sustainability of researcher careers in the UK. The Researcher Development Concordat focuses primarily on the rights and responsibilities of researchers who are employed solely or largely to conduct research (e.g. PDRAs and Research Fellows) and is often part of the eligibility criteria for securing research grants. The Concordat has three defining principles covering *Environment and Culture* (for a supportive and inclusive research culture), *Employment* (to ensure that researchers are recruited, employed and managed under conditions that recognise and value their contributions), and *Professional and Career Development*. The Concordat outlines key responsibilities for institutions in each of these areas and expect them to publish an action plan and to report progress in annual reports to their governing bodies.

Considering AOP's strong governance structure, in terms both of its comprehensive set of policies as well as its appraisal, recruitment and induction procedures – all of which reflect the Northern Ireland Civil Service (NICS) ethical and equal-opportunities principles. The following actions have been identified:

On Environment and Culture

- Ensure awareness of the Concordat for managers and researchers, including at the outset during the recruitment process and following induction.

- Continue to support staff and students' mental health and well-being through the Inspire Wellbeing employee assistance framework from NICS.
- Provide Equality, Diversity and Inclusion training to all AOP staff including managers of researchers.
- Avail of AOP agreement with QUB for the supervision of PhD student to train AOP managers on research integrity through the QUB Epigeum online courses.
- Supplement the periodical formal Research Excellence Framework (REF) and QUB reviews of AOP research environment with specific queries in annual staff surveys.

On Employment

- Continue to offer our dedicated Öpik fellowship as an opportunity for progression towards independent research.
- Promote researcher contribution to AOP research through presentations for AOP governing bodies and dedicated sections in AOP annual reports.

On Professional and Career Development

- Promote the commitment to ten annual career development days to researchers and their managers, including using existing reserved AOP training budget and by ensuring managers allow time for career development or researchers.
- Monitor the appetite and uptake on career development opportunities and training through appraisals and the subsequent annual meeting of researchers with the Head of Research (as already implemented through a Juno project action).
- Increase awareness of careers outside academia through dedicated seminars sessions, including from AOP or QUB alumni.

Research Integrity Concordat

The UK Committee on Research Integrity (UKCORI) was established in 2022, following the signing of the Concordat to Support Research Integrity, in order provide a national framework for good research conduct and its governance. The signatories of the Concordat include UK Research and Innovation (UKRI) and Department for the Economy for NI (DfE NI). UKCORI wish to raise awareness at Board level of the principles and importance of Research Integrity. Research integrity is also referenced in the Concordat for Researcher Development. AOP participated in a workshop held in the Ulster Museum that was organised by UKCORI this year designed to raise awareness of the importance of research integrity in Northern Ireland.

Research has integrity when it is carried out in a way that is trustworthy, ethical and responsible.

Research integrity is, therefore, about doing research that not only leads to findings and outcomes that people can trust, and have confidence in, but is carried out in an ethical manner with care and respect for those involved in the process.

When research is carried out with a high degree of integrity, other researchers, those who wish to apply the research, and members of the public have confidence in the findings. While the nature of our understanding of the conclusions drawn from research may change in time, if the research was conducted with high integrity people will still feel able to trust the findings and outcomes as they were understood at the time.

Education and Community Outreach

Planetarium

AOP is a special place that brings together fundamental research and public curiosity about the nature of the cosmos, all within a heritage environment that is rich in scientific history. Four pillars underlie and support the public programme of AOP - education, inspiration, entertainment and outreach. The Planetarium was established in 1968 and is world-renowned as an innovative centre of excellence in promoting the public understanding of science.

At the Planetarium, the primary activity is the education and the dissemination of scientific and astronomical knowledge. The Planetarium also promotes an understanding of astronomy and science to a large audience base of all ages, from nursery to seniors via a school's educational programme and science offering to the wider public through both onsite and outreach means.

In 2022/23 financial year we achieved a record breaking 72,000 visitors to AOP and it was encouraging to maintain this benchmark in 2023/24 having 71,905 visitors through our doors. This year we did not have a stand-out exhibition during the summer, but instead, we held themed weeks which maintained our visitor numbers at that high level. Our

stargazing evening and music shows have also been popular with sell-out events. All credit to our education team for delivering and maintaining a high level of customer service and educational learning for our visitors this year.

One of the largest visitor increases came towards the end of this year in the form of our off-site or outreach visitors. Thanks to funding from Science Foundation Ireland (SFI) and the UK Space Agency we had the opportunity to develop a dedicated outreach programme delivered by Dr Rok Nežič. The funding has allowed us to reach many rural schools that typically cannot engage with us in Armagh due to distance. The programme is fully funded for schools.

The education team also facilitated two Stranmillis College placement students this year, which supports the teaching college and also benefits us as we get students coming with different ideas and angles to help in our education programme. While our school pupil numbers held strong it must be noted that we had many cancellations due to both teachers strikes and Translink transport strikes during this year which did affect our school visitors.

A focus for 2024/25 will be our afternoon visits which we want to grow with afterschool and community groups. This year we made steps towards this goal of increasing afternoon visits through an IAU funded programme where we set up an after-school STEM club. A youth forum of children with additional needs was developed to advise us on programme changes required to make the centre more assessable, thanks to funding from the Association of Science and Discovery Centres (ASDC). The team delivered a pre-school club called "Little Astronomers" which was a monthly sold-out event. We participated in global events such as One Hundred Hours of Astronomy where we held afternoon solar viewing sessions. This has shown us the potential and possibilities we have for increasing that afternoon slot for many groups and families.

Accessibility is always a focus for us at AOP on how we can be as inclusive as possible to ensure that every person gets to experience the stars making us a "space for all". We hold monthly dome shows in British Sign Language (BSL) and Irish Sign Language (ISL). Our screening is of our popular dome show "CapCom Go" and this year we also extended the dome show interpretation to a children's tour of the planets called "Perfect Little Planet". This will be of benefit to schools and to the public as well. We also provided a BSL and ISL interpretation of our live Christmas experience "Mission Santa" and our dome show this year "The Alien who Stole Christmas" was interpreted into BSL and ISL. We added Makaton signing to our "Astronaut George" dome show which is due to be launched in May 2024.

Monthly relaxed dome show sessions are now standard in our programme as well as relaxed event sessions for workshops. We have also renewed our JAM (Just A Minute) Card registration with all front-line staff JAM Card trained and our staff received Level one Makaton training. Our sensory bag provision which was worked on by the Bold Futures forum and made possible through an ASDC Bold Futures fund have been really well received and used by many schools and families.

To enhance the outdoor grounds, we installed and launched a new kids Eco trail with a workbook, sculptures, clues and an augmented reality (AR) app around the grounds. There is also an adult app focusing on a tour of the grounds and Observatory. A lot of work across the organisation went into this new experience over the last year and these outdoor trails have already increased dwell time and been popular with visitors and locals, especially during the sunny days.

This year we held four scientific conferences at the Planetarium during September 2023. This month is the only time when demand on our Copernicus Hall is at a low level which allowed us the opportunity to hold back-to-back meetings. The conferences held were the British Association of Planetaria (BAP) annual conference, 31 August to 2 September, 5th International Workshop on AM CVn Binaries (AMCVn5), 5 to 8 September, 11th International Conference on Hot Subdwarf Stars and Related Objects (sdOB11), 11 to 15 September and, 42nd European Symposium on Occultation Projects (ESOP42), 16 to 17 September.

Successful funding opportunities this year include:

- ASDC: Explore your Universe – £9,500;
- ASDC: Bold Futures – £22,000;
- ASDC: Missions and Mindsets – £2,000;
- ASDC: Our World from Space – £9,500;
- IAU OAD: After Schools – €5,000;
- SFI – Discover Programme – €60,000 "Cosmic Explorers: Igniting STEM and Astronomy in Schools";
- UK Space Agency – Space for All – £66,075.

Other events to note this year were:

- British Orienteering Championships, which took place in Armagh (including AOP's grounds) in May 2023, we held an event for participants;
- Engineers Open House weekend of rocket making;
- Outdoor Creation NI Conference;

- Our World from Space Saturday Club (monthly);
- Events with the ABC Council for the Food and Cider Festival;
- Orienteering in the Astropark during February Half-Term;
- First Light: 230 Years of Observations from Armagh;
- European Open Heritage Day: Experience the Calver Telescope;
- Our Planet and the Universe: IAU 100 Hours of Astronomy;
- Data Visualisation Laboratory (DVL) sessions held during busy school holidays where the researchers and students delivered a presentation on their work in the DVL;
- Our Director who developed and delivered "Director's Cut" planetarium shows to audiences;
- We opened the Calver dome for special occasions and hope to build upon this with training for the education team this year;
- We held a scouts take-over day where the association booked the Planetarium for the whole day and provided shows and workshops for their members;
- Our staff participated in and delivered presentations at the ASDC annual meeting showcasing the great work being done at AOP;
- Our education team have opened a world of opportunity with dome show development, which started late in the year but is a programme that we would like to develop.

History and Heritage

History and Heritage Policy

AOP boasts a collection of over thirty-three thousand historic documents, rare and antiquarian books, scientific instruments and photographs. This collection is unique on the Island of Ireland and one of the best-preserved observatory collections in the United Kingdom. The heritage policies implemented ensure that the collection is cared for in accordance with best practice and has allowed ongoing historical research. AOP is now represented on the Board of Directors of the Northern Ireland Museums Council by the Museum Collections Officer who began their three-year term in September 2023.

During 2023-24 the Observatory has continued to be open to the public for the 'Legendary Telescope Tour' package, which has been well received. In 2023 the King George III collection was put on display for the first time in its entirety for the Armagh Georgian Festival in November. The eMuseum has 9,003 objects available for public viewing on the armagh.space website. The Planetarium display cases have hosted one loaned in exhibition 'The life of William John Roberts', and three additional exhibitions based on the AOP Historical Collection, 'Technology Past and Present', 'The Planetarium' and 'Navigation'. One temporary exhibition off-site was hosted in Dublin at the Bank of Ireland building and Dunsink Observatory for the Robinson Lecture and launch of the Astronomical Observatories of Ireland network. AOP accepted one donation in 2023-24, which was a functional late Victorian 'Magic Lantern' projector system from the Ulster Aviation Society.

In accordance with AOP's policy of making our collection available for the public and researchers to use we have continued to facilitate public information requests. The 2023-24 financial year brought twenty requests facilitated by the Museum Collections Officer. AOP hosted the British Association of Planetaria Annual Conference in September 2023 and a Study Visit by the Scientific Instrument Society in March 2024. Both events were showcases of the outstanding Historical Collection and provided opportunities for sessions delivered by the staff of AOP.

2023-24 saw the second year of the National Lottery Heritage Fund project. This project, 'Wisdom Begins with Wonder' is funded to run from May 2022 and it has now been extended to run until August 2024 and has seen the successful implementation of a volunteer program. Since launching, the volunteer program has facilitated over eight hundred hours of voluntary work in AOP, with more volunteers awaiting projects. The project has also funded the position of Museum Collections Officer from June 2022 - August 2024, on a part time basis. At present the five active volunteers are working on varied projects including academic research, archival work, and preventative conservation. In total volunteers have accessioned 1,809 new objects to the AOP Historical Collection in 2023-24.

AOP has also continued to publish historical research, and staff have been involved in a project to publish a book with the International Planetarium Society and have published three papers. The team also provided access to the operated collection of historic scientific instruments. Over the winter observation period, five successful observation sessions were held with the Grubb 10-Inch telescope, and two students were trained in its use. The Grubb 15 Inch and Troughton Equatorial have also undergone successful preventative conservation, and the Earnshaw Number 2 regulator has been returned to operational condition.

Library and Archives

AOP's suite of technical equipment is complemented by one of the finest astronomical study libraries on the Island of Ireland. The library provides an essential reference resource for AOP research, and especially for its student and young researcher cohort. It contains approximately 3,400 textbooks, monographs, special reports, and conference proceedings covering nearly all disciplines in astronomy. Some 17,000 volumes from nearly two hundred scientific

journal titles include nearly complete runs of all the major astronomy journals, as well as journals of significant historical interest.

During 2023-24 the collection has been supplemented by forty-eight new books on topics relevant to AOP research. Work continues binding the backlog of unbound journals, including all held copies of the Scientific Instrument Society Bulletin. A scoping audit of the remaining backlog has been conducted to inform future funding requirements. 51 loans have been processed and returned, and 60 volumes are currently on loan to the staff and students. To encourage greater engagement with the loans process, every researcher and student has been provided with a physical copy of the Loans Form QR code.

Whilst still under enormous pressure for space, the AOP library is now an attractive space and a more effective research tool, with potential for further development and revenue generation, and increasingly demonstrating its potential for historical discovery as well as astronomical research. It has been used weekly for the Student Discussion, and the Research Seminar. It has been used monthly by the Armagh and District History group for their meetings and will be opened to the public for the first time in April 2024.

Meteorological Record

As part of AOP's primary research role, staff and students take daily readings of a wide range of meteorological parameters at Armagh and maintain the Observatory's unique 229-year meteorological record and databank. This is believed to be the longest daily climate series in the UK and Ireland from a single site (though the log book for the period June 1825 to December 1832 appears to have been lost), as well as being one of the longest in the world. The climate station has been continuously maintained since July 1795 with readings currently taken every day at 09:00 (GMT). The World Meteorological Organisation (WMO) has recognised Armagh with Centennial Station status for its longevity and importance in contributing to the climate record.

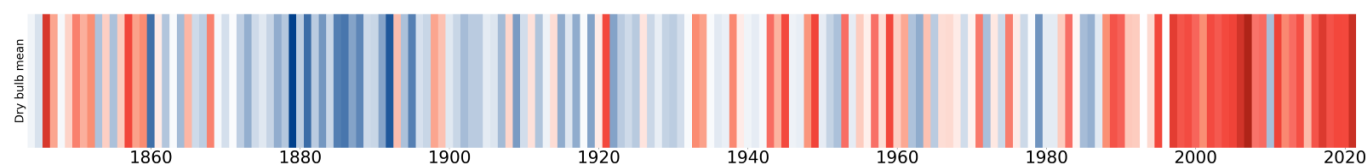
The automated weather station (AWS) was installed by the Met Office in 2019, sampling the weather every minute. This now provides the primary source of weather data in the Met Office records (e.g., temperature, pressure, rain fall, windspeed) since it is automatically uploaded to the Met Office. The instruments are inside a second Stevenson Screen within an expanded meteorological enclosure to ensure that the AWS enclosure is identical to those used by the Met Office in their UK-wide network. In October 2023 a grass minimum thermometer was added to the AWS to complement the similar sensor in the manual station. Manual collection still continues and provides the only source for some of the data collected (e.g. sunshine) at Armagh.

Calibration of these data has enabled researchers and government agencies to use the Armagh series for reports and research into global warming. The data contributes to the UK Meteorological Office's main climate database and are released to the general public on a monthly basis through press releases and on our climate website (<https://weather.armagh.space>) whilst also contributing to the UK Meteorological Office's main climate database.

Climate change is a subject of strategic importance for Northern Ireland in this era of climate variability. Armagh's unique climate record provides an exceptionally long historical baseline, enabling better informed judgements to be made as to how Northern Ireland's climate has responded and is responding to climate change world-wide. AOP has a movable exhibition on the climate change in the Copernicus Hall, centred around an interactive Puffersphere presentation, together with supporting exhibits around the room which expand on local impacts.

We developed a series of python scripts to store, analyse and provide access to the weather data base via the weather webpage listed above. This includes both the manual data as well as the automated weather station data. This takes the monthly observers log, provides a means of entering the information via an online log, and in addition automatically downloads the data received from the automated station, to ingest these data sets into a new database. Analysis scripts then allow this database to be interrogated, e.g. to find climate extrema over any date range of interest. This includes enquiring about weather on any single day (as might be used in a visitor display in the Planetarium), as well as examining the data set over any period of interest and searching for climate records (extrema) over a period of interest. The automated weather station data is now also available to inspect online, in addition to the manual data. Plotting tools allow the user to see the weather over any time period, as well as to find when extrema in the various measured parameters occurred.

The two new PhD students (Kyriakos Trakakis and Arjun Chawla) were trained in 2023 on weather observations, and then accredited as Level 1 Met Observers by the Director. This forms part of their PhD training in the techniques of scientific data measurement and analysis.



Armagh's version of the famous climate stripes that were used at COP26 in Glasgow to graphically demonstrate global warming has been extended to include new data. The colour of the stripes reflects the difference between the mean temperature that year compared to the long-term average. They are a superb example of science communication, for it is not necessary to understand the detail of how it made, the warming trend in the current millennium is clear. AOP's climate stripes extend back to 1844 when Armagh started measuring maximum and minimum temperatures.

Until 2023 for the month of September the hottest day in Armagh since 1838 (when daily temperature max readings began) had stood at 27.6°C, as measured on 1 September 1906. The 10th ranked hottest September day had been 24.9°C, as measured on 4 September 1898. However, the sequence of 5 successive days from 4th to 8th of September 2023 now feature in the top ten of all September highs for Armagh, with the new hottest September temperature being 28.5°C, as measured on 8 September 2023.

In October 2023, the record for rainfall in a single month in Armagh was broken since measurements began in 1838. A total of 195.4mm of rain was recorded in our manual weather station, breaking the previous record month, which was October 1870, when 193.8mm of rain fell.

Support

AOP is committed to ensuring fit for purpose governance and support services to support the delivery of organisational objectives.

Information and Communications Technology (ICT)

The comprehensive research computer facilities are used primarily for numerical analysis, computer modelling and data reduction. Update and renewal of computers and peripherals is mainly provided through a planned capital development plan funded by DfC and occasionally by external research grants. Research staff require access to high-end Apple Mac and Linux workstations. In addition to this, Corporate and Education is serviced within a Microsoft environment.

An ICT Strategy was approved in October 2022. Continuous focus and short, medium and long-term activities are considered by the Audit and Risk Assurance Committee (ARAC) each quarter.

AOP continues to modernise and improve its centralised ICT hub. All devices are now managed using Intune and are secured using multi-factor authentication and device registration. Auto patching of all Linux, Windows and Mac devices has reduced our exposure to cyber-attack. The focus now moves to software run on the devices as the next level of risk develops.

The biggest risk to AOP still remains user error through clicking on malicious links in emails. AOP mitigates this through regular reinforcement of messaging and a focus on continuing to educate users in best practice and system etiquette.

Finance

AOP has a well-established finance function. Financial policies and procedures are continually being enhanced to ensure that AOP meets the governance standards required. This includes the application of public sector procurement controls, meeting prompt payment targets and providing regular and ad hoc financial information within AOP and to DfC.

AOP continues to experience significant cost pressures within a core budget that has remained relatively static for 7 years. In 2023-24 it was able to mitigate some of the cost of the 2023 public sector pay award through an additional resource allocation and income from admissions and trading sales which exceeded expectations.

Human Resources

A Human Resources Strategy 2022-26 has been developed and approved and is supported by an annual Human Resources Action Plan. The 2023-24 plan has been implemented to include:

- Maintaining a Fit for Purpose Organisation Structure – review of the skills-gap paper and workforce planning papers in light of available budget and future needs; completion of necessary recruitment and training in a timely matter and identifying short term opportunities to plug skills gaps with short term projects or engagements;
- Continual review of Operating Models – supporting the Education Operations Manager with employee working arrangements and reviewing staffing needs in the context of budgets and affordability;
- Employing and Investing in Motivated and Engaged Staff – supporting annual appraisal process; completing/revising a rolling training plan; reviewing implementation of training plans in the context of

available budget; preparing a case for award of a special bonus scheme; preparing for engagement events and supporting the health and wellbeing of PhD students;

- Fair and Equitable Employment Policies and Procedures – completion of the annual Fair Employment return; retention of Bronze Diversity Mark Award; review of policies and induction and refresher training as required.

Diversity and Inclusion

AOP has an obligation under Section 75 of the Northern Ireland Act to ensure that equality of opportunity and good relations are central to policy making, policy implementation and review as well as service delivery. AOP monitors the composition of its workforce in terms of community background and sex and uses an equal opportunities monitoring form questionnaire. AOP submits an annual Fair Employment Monitoring return to the Equality Commission detailing staff composition and that of job applicants to AOP posts.

In the AOP Strategic Plan 2021-26 we state that having Fair and Equitable Employment Policies and Procedures is one of our key elements in delivering high standards. AOP has a number of policies in place including an Equal Opportunities Policy.

AOP retained the Bronze Diversity Mark Accreditation in July 2023. The three Equality, Diversity and Inclusion targets set for the next year are:

- To develop an Equality, Diversity and Inclusion Strategy;
- To increase the number of female research staff at AOP from 2 to 4; and
- To increase female representation on the AOP Management Committee from 3 to 5.

AOP retained Juno Practitioner status in August 2023. This is an award scheme that recognises and rewards university physics departments, schools of physics, and related institutes and organisations that can demonstrate they have taken action to address gender equality at all levels and to foster a more inclusive working environment. An application to become a Juno Champion in April 2023 was unsuccessful. A new Juno award is currently being developed and once launched AOP will assess its suitability against that scheme.

Governance

Governance and accountability continue to be strengthened and improved and risks reduced as demonstrated by external and internal audit reviews. Actions arising from effectiveness reviews undertaken by both ARAC and the Management Committee have also resulted in enhanced arrangements.

One outstanding Internal Audit recommendation, relating to Record Management, is currently being progressed. A Retention and Disposal schedule is actively under consideration by the Public Record Office of Northern Ireland (PRONI). The organisation has moved towards paperless record management systems which will be easier to manage and control in accordance with the approved Retention and Disposal Policy.

Future Redevelopment Project

AOP manages an extensive property estate which includes nine separate buildings, including the Grade A listed Observatory and a circa 20-acre historic estate. There are also several leases associated with land and property.

During the year AOP submitted a draft Outline Business Case (OBC) for redevelopment to the Department and has provided responses to queries raised in respect of same. The OBC is still under consideration with active engagement on final amendments ongoing. AOP views this project as imperative to future proof its role into the next generation. The case for change is predicated by an estate that is outdated and misaligned to expectations of modern-day visitors and future opportunities. On 29 March 2024 AOP was awarded circa £1.3m grant towards the development phase of the project, representing 25% of the funding required to bring the plans to RIBA stage 3. Another funding application to PeacePlus is still under consideration and a bid to DfC for capital match funding for this phase is also being considered.

NetZero

AOP's international research standing, and unique record of uninterrupted meteorological observations has allowed it to effectively communicate on the issue of climate change (CC) to the general public, thanks also to the design and installation of a temporary CC exhibition in the Planetarium and of a CC Puffersphere display given AOP's own commitment to reducing its carbon footprint by 50% by 2030.

Moving in this direction, in the last financial year Department for the Economy (DfE) capital funding was obtained to change the external lighting on AOP grounds to more efficient LED lights and following the standards of the International Dark Sky Association. In fact, one of AOP's key objectives is to achieve Urban Night Sky Place (UNSP)

accreditation through the International Dark-Sky Association and with it serve as beacon for promoting and informing local councils in Northern Ireland on how to reduce their own light pollution and corresponding energy waste.

Along the same line, two new green energy power generation stations based on wind and solar power, the Windtree and the Smartflower (see figure below), have been installed on AOP's grounds using previously allocated DfE funding. While this installation will not generate sufficient power to cover all the needs of the Planetarium, it will serve to illustrate the role that renewable energy technologies can play in harnessing energy from wind and the Sun, also adding to AOP's education offering.



AOP's Smartflower and Windtree, the only ones of their kind in Britain and Ireland

Achievements and Performance

The targets set for AOP in the 2023-24 Business Plan are shown in the following table. Actual performance achieved is shown along with the corresponding achievement in the previous financial year, where applicable.

Targets were achieved or exceeded in many areas; however, three targets were not met. Whilst the total visitors target was exceeded the target in respect of school visitors was not achieved due to a number of school cancellations as a result of education and bus strikes and also snow. Failure to meet the remaining two targets is beyond AOP's control in that they are reliant upon external factors.

KPI	Description	Target	As at 31 March 2024	As at 31 March 2023 (where applicable)	Comments
1	Attract 67,000 visitors (to include 55,000 public visitors and 12,000 school visitors)	67,000	Public 60,097	62,793	Total 71,905 visitors
			School 11,808	9,381	There were a number of school cancellations due to teacher and bus strikes and also snow.
2	Achieve 150 number bed nights from a collaboration with local accommodation providers	150	158	182	
3	Achieve bronze level certification to be a Makaton friendly business			New KPI	Award changed by Makaton Society and there have been delays in getting the new award live. KPI unachievable and beyond AOP's control.
4	Achieve £568,000 income from admissions and sales	£568,000	£592,494	£570,851	
5	Achieve an 80% satisfaction rating of 4 or above out of 5	80%+ evaluation ratings $\geq$ 4	90.83%	88.67%	
6	Provide in-reach or outreach visits to at least 10 special schools (25%)	10	23	New KPI	
7	Deliver 4 dedicated educational days: 2 for GCSE and 2 for Junior Cycle	4	2	New KPI	
			2		
8	Deliver 4 events focused on the work of astronomers and PhD students	4	22	7	
9	Deliver 2 events on Climate Change and AOP green agenda	2	2	New KPI	
10	Deliver one event to raise awareness of the Armagh-Birr-Dunsink partnership	1	1	1	
11	Achieve recognition as an Urban Dark Sky Place			Unachievable	The capital project encountered difficulties at procurement stage.
12	Publish 50 articles in referenced scientific journals	50	63	85	
13	Scientific Outreach:	12	35	39	

	12 scientific talks at international conferences 12 public talks by scientists	12	40	43	
14	Admit 2 new PhD students in October 2023	2	2	3	
15	Attract 8 external bookings for events or seminars	8	10	14	
16	Facilitate 6 onsite scientific visits	6	28	26	
17	Delivery of 3 astronomy conferences hosted by AOP	3	3	New KPI	
18	Develop one non-astronomy partnership in the use of DVL facilities	1	1	1	
19	Develop one new Puffersphere application around AOP research	1	1	2	
20	Submit one major funding application in pursuance of AOP future development	1	2	0	
21	Achieve £323,000 funding from scientific sources to support AOP research	£323,000	£380,732	£359,339	

Progress Key: Complete, Not Achieved

Financial Review

Operating Results

In the financial year to 31 March 2024, the value of charity funds increased by £2,111m, summarised below.

	2024 £	2023 £
Total incoming resources	3,354,210	3,730,874
Total outgoing resources	(3,978,546)	(4,285,869)
Net expenditure	(624,336)	(554,995)
Gains on the revaluation of fixed assets	500,740	255,242
Actuarial gains on defined benefit pension scheme	(121,000)	2,411,000
Net movement in funds for the year	(244,596)	2,111,247
Movement in Unusable Funds		
Capital financing		
Capital grants received	435,000	549,000
Government grant fund	(826,567)	(858,746)
Revaluation reserve	271,372	1,904
Pension reserve	(158,000)	2,035,000
Movement in Usable Funds		
Restricted	(100,091)	(26,080)
Unrestricted	133,690	410,169
	(244,596)	2,111,247

The total income for the year was £3.354m, a decrease of £0.377m from 2022-23, mainly due to a decrease in DfC resource and capital grant income of £0.269m, and the end of the Tourism NI supported capital project, offset by an increase in operating income of £0.036m.

Expenditure was £3.979m, a decrease of £0.307m from the previous year. Staff costs continue to be the largest component of operational expenditure, comprising 63% of all direct costs.

Unrestricted operating costs are funded primarily by DfC grant-in-aid. The balance of such unrestricted operating costs is funded by contributions from external grants, operating income, trading activities and miscellaneous income. We continue to seek other funding streams to maintain this important source of funds. In 2023-24 the Department provided 71% of the total income through recurrent and capital grant allocations (2022-23: 71%).

Net Assets

Net assets at 31 March 2024 were £12.476m (31 March 2023: £12.720m).

Reserves

The AOP reserves policy is included in note 1 of the accounts. Total accumulated funds are as follows:

Funds at 31 March	2024 £	2023 £
Restricted funds	47,937	148,028
Unrestricted funds	4,752,692	5,010,569
Revaluation Reserve	7,675,246	7,403,874
Pension Reserve	-	158,000
Total Charity Funds	12,475,875	12,720,471

Going Concern

The Trustees are satisfied that the organisation is a going concern on the basis that it has a reasonable expectation that it will continue in operation for the foreseeable future. The financial statements are therefore prepared on a going concern basis.

Pension Reserve

AOP is a member of Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) which manages Local Government Pension Scheme (LGPS) Northern Ireland, which in turn provides a defined benefits pension to employees. At 31 March 2024 the surplus was calculated by independent actuaries at £1,175,000 (2023: surplus £158,000). The assets, defined benefit obligation and current service cost shown in note 19 to the accounts have been calculated based on the data and results of the 2022 triennial actuarial valuation. AOP has applied the principles of IFRIC14 in relation to pension surplus restriction. IFRIC14 requires allowances to be made for a minimum funding requirement, which limits the amount of economic benefit available to the excess of the value of prospective current service costs above the funding requirement.

Key Risks and Uncertainties

At year end, the key risks were identified as:

- Reputation – loss of confidence in AOP's ability to deliver acceptable level of research of international value;
- Engagement:
 - Visitors – failure to provide experiences that attract new and returning visitors and/or failure to engage local pride in AOP as a cherished asset;
 - Partners and collaborators – failure to attract support and commitment from key stakeholders to be able to deliver future vision;
- Resources:
 - Staff - failure to maintain an appropriately skilled, highly motivated and engaged workforce of sufficient capacity to satisfactorily deliver AOP objectives;
 - Budget – insufficient or poor management of budget could result in objectives not being met and/or value for money not being achieved;
- Asset Management:
 - Buildings and Heritage – failure to plan for the long term development needs of the estate and assets resulting in increasing reliance on remedial intervention and failure to protect heritage assets from irreparable decline;
 - Other physical assets including ICT – failure to plan for the upkeep and renewal of plant and equipment resulting in reduced service delivery; and
- Governance and Planning:
 - Failure to embed best practice approaches to corporate governance and risk management resulting in loss of confidence and reputational damage and/or legal challenge;
 - Inadequate information/data security measures resulting in information breaches and/or cyber security breaches.

As part of the Risk Management Strategy, management regularly review the inherent level of risk for each of the above and how the risk is currently managed. An Action Plan is documented to reduce the level of risk, mindful of the risk appetite of the organisation. This Risk Register is reviewed on a quarterly basis by the Audit and Risk Assurance Committee and approved by the Management Committee. Many of the above risks derive from the uncertainty around funding. Until AOP has both a budget appropriate to its needs and long-term security of funding, this situation is likely to continue. In managing these funding risks, the organisation has developed and maintained close communication links with the Department and submitted in-year monitoring bids for additional funding while carefully monitoring spend and budgets. For many of the above risks all reasonable steps within AOP's control are being taken to manage the risk.

The above risks also take account of recommendations from internal and external audit exercises and reports. Significant progress has been made in addressing the weaknesses identified in previous years and considerable effort has been put into the management of these risks going forward.

Plans for Future Periods

In 2021, AOP published a Strategy for 2021-26 with the four key themes of Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

Leading on from this AOP has prepared a Business Plan for 2024-25 for consideration by the Department. The business plan has been developed in the context of an unclear and uncertain financial environment, however AOP remains focused and optimistic towards continued achievements within its key priority areas.

AOP, in conjunction with the Dublin Institute of Advanced Studies, Dunsink Observatory, and the Birr Science and Heritage Foundation, have embarked on a formal strategic process to develop an inter-institutional partnership for mutual benefit, the “Astronomical Observatories of Ireland”. This takes place in acknowledgement of the potential for strengthening the partner institutions’ collaborative working capacity and for our wider national and international impact. This also includes taking into account emerging opportunities for strengthening the long-standing North-South connections between Armagh, Dunsink and Birr in a way which maintains the integrity of each partner’s core mission, and also promotes the intrinsic value of scientific knowledge and heritage represented by the body of work carried out over the three sites since their establishment and ongoing collaborative activities. This will continue to be a key area of work in 2024-25 and will include an application to be included in the Republic of Ireland Tentative List for UNESCO World Heritage Status as a transnational bid with the UK.

Following on from the submission of an Outline Business Case for future development AOP will continue to work with partners and stakeholders to identify funding opportunities and other resources to move the project forward to the next phase of planning.

Structure, Governance and Management

Armagh Observatory and Planetarium is a single statutory corporation and arms-length body (ALB). ‘The Governors of The Armagh Observatory and Planetarium’ are as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*.

This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled ‘*An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever*’, and an Amendment of 1938 (‘The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938’).

AOP is a registered charity under the title “The Armagh Observatory and Planetarium”.

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one Department nominee;
- one Queen’s University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

The Order places a statutory duty on “the Governors of Armagh Observatory and Planetarium” to maintain and manage AOP with the purpose of “developing and improving the knowledge, appreciation and practice of astronomy and related sciences.”

The Board of Governors (the Board) has retained a role to ensure that the culture and character, history and patrimony embodied in AOP are protected and preserved and that the institution is managed in line with the statutory purpose outlined in the Order. This role will normally be fulfilled through an Annual Review meeting (visitation) where the Board will receive assurance as to the management and performance of AOP from the Management Committee.

Management Committee of Armagh Observatory and Planetarium

The Board has delegated primary responsibility for the governance and management of AOP to a Management Committee. The Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department and approved by the Minister and for promoting the efficient, economic and effective use of resources. The Management Committee provides leadership, challenge, oversight, support and encouragement to the Director and staff.

The Management Committee comprises:

- three nominees from the Board of Governors;
- six nominees from the Department appointed through open competition;
- one nominee of Queen’s University, Belfast;
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS);
- a Chair appointed through open competition; and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

The following committees are established as sub-committees of the Management Committee.

Audit and Risk Assurance Committee (ARAC)

The ARAC is a sub-committee of the Management Committee established in accordance with DAO (DFP) 06/13 - Corporate governance in central government departments: Code of Good Practice NI 2013, and in line with the HM Treasury Audit and Risk Assurance Committee Handbook (DoF 03/18) to advise the Board of Governors, the Management Committee and the Director of AOP as Accounting Officer and to support them in their responsibilities

for issues of organisational risks, internal control, governance and their associated assurances and in reviewing the reliability and integrity of these assurances.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is a sub-committee of the Management Committee and provides advice and recommendations to the Management Committee on employment issues.

Research and Education Advisory Committee

The Research and Education Advisory Committee is a sub-committee of the Management Committee and advises it on research and education issues.

Redevelopment Committee

The Redevelopment Committee is a sub-committee of the Management Committee and was established to develop an Outline Business Case for redevelopment proposals.

Further details on the membership of these Committees are set out in the Governance Statement on pages 31 to 40.

Reference and Administrative Details

Name of the Charity

The charity is registered and operates under the title of The Armagh Observatory and Planetarium.

Charity number

Registered with the Charity Commission for Northern Ireland 103948.

Principal Office

College Hill, Armagh, BT61 9DG

Trustees

Archbishop J McDowell, (Board Chair)
The Very Revd S Forster
The Venerable E Cairns
The Venerable Dr P Thompson
Revd Canon W M Adair BEM
Revd Canon W J A Dawson (to 31 December 2023)
Revd Canon M Hagan MBE
Revd Canon D Hilliard
Revd Canon B Paine
Revd Canon R J N Porteus
Mr G Cox
Professor A Fitzsimmons
Mr R Wilson
Archbishop E Martin
Mr J Briggs (Management Committee Chair)
Professor L Harra (to 30 April 2024)
Mr S Brown (to 30 April 2024)
Mr P McGurgan (to 30 April 2023)
Professor M Mathioudakis
Professor C Jackman
Professor M Darnley
Mr P Kennedy
Dr K Lemon
Mr E Rooney
Ms S Leslie

Director and Accounting Officer

Professor Michael Burton

Auditors

Northern Ireland Audit Office, 106 University Street, BELFAST, BT7 1EU

Internal Auditors

Cavanagh Kelly, 36-38 Northland Row, Dungannon, BT71 6AP

Bankers

Danske Bank, Donegal Square West, Belfast, BT1 6JS

Register of Interests

A Register of Interests is maintained for Board and Committee Members and Senior Management and is available for inspection at the Principal Address. Declared Interests by Board and Committee Members and the Director are available on the AOP website – www.armagh.space.

Related party transactions are shown in note 23 of the accounts.

Gifts

AOP adheres to the limits and rules laid out in its Partnership Agreement approved by the Department and the guidance in Managing Public Money Northern Ireland (MPMNI). There were no gifts made or accepted during the 2023-24 financial year that exceeded these limits.

Personal Data Related Incidents

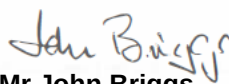
AOP has considered the requirement to report personal data related incidents. It is content that there were no such incidents in the year ended 31 March 2024.

Disclosure of Audit Information

So far as the Accounting Officer is aware, there is no relevant audit information of which AOP's auditors are unaware. The Accounting Officer has taken all necessary steps to make himself aware of any relevant audit information and to establish that AOP's auditors are aware of that information.

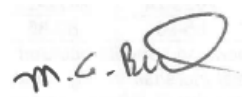
Events after the end of the reporting period

There have been no events since the end of the financial year requiring disclosure.



Mr John Briggs
Trustee

Date: 21 October 2024



Professor Michael Burton
Director / Accounting Officer

Date: 21 October 2024

Remuneration and Staff Report

The remuneration and staff report sets out AOP's remuneration policy for Board members and senior managers, reports on how that policy has been implemented and sets out the amounts awarded to the Director. In addition, the report provides details on remuneration and staff that users see as key to accountability.

Remuneration Policy

The pay remit for the Northern Ireland Civil Service (NICS), including senior civil servants (SCS), is normally approved by the Minister of Finance. Following the Secretary of State for Northern Ireland's 27 April 2023 Written Ministerial Statement (WMS) on the budget, the NI public sector pay policy guidance was published on 31 May 2023 in FD (DoF) 05/23. This was subsequently updated on 12 March 2024 in FD (DoF) 04/24 to reflect the return of Executive Ministers and revised departmental budgets.

Annual NICS pay awards are made in the context of the wider public sector pay policy. The pay award for NICS non-industrial staff, including SCS, for 2023/24 has been finalised and was paid in June 2024.

AOP staff remuneration is aligned with NICS pay scales. The Accounting Officer is authorised by DfC to approve its pay remit and business case, notifying same to DfC, prior to implementation of the pay award. Staff received he pay award, including backpay, in June 2024.

Trustees

Trustees do not receive any remuneration. They receive travel and subsistence allowances at rates and on conditions determined by AOP, subject to Departmental approval. No Trustee receives pension benefits or makes pension contributions in their capacity as a Board member. Management Committee members who were not trustees during the financial year received travel and subsistence expenses of £2,287 (2023: £1,766).

Service Contracts

The Director of AOP, Professor Michael G. Burton, is the person in a senior position having authority and responsibility for directing and controlling the activities of the organisation. The service contract of the Director commenced on 1 August 2016.

Current terms and conditions for staff are those set out in various policies and individual employment contracts. Senior staff are permanent employees of AOP. The notice period for senior staff is three months. Termination payments are in accordance with contractual terms and those of the principal Civil Service Pension Scheme (NI).

Director's Remuneration (including Salary and Pension Entitlements) (Audited Information)

The following tables provide details of the remuneration and pension entitlements of the Director of the organisation.

Single Total Figure of Remuneration of Director							
	Salary (£'000)		Pension Benefits* (£'000)		Total (£'000)		Percentage Change
Official	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	
M.G. Burton	85-90	80-85	35	14	120-125	95-100	(9.7%)

**The value of pension benefits accrued during the year is calculated as (the real increase in pension multiplied by 20) plus (the real increase in any lump sum) less (the contributions made by the individual). The real increases exclude increases due to inflation and any increase or decrease due to a transfer of pension rights.*

'Salary' includes gross salary (on an accruals basis) to the extent that it is subject to UK taxation. There was no overtime, benefit-in-kind, bonus or other allowances. The salary of the Director shown above is based on the Northern Ireland Senior Civil Service Grade 5 pay scale.

Compensation on early retirement or for loss of office

No payment for compensation on early retirement or for loss of office has been made (2022-23: £nil).

AOP Fair Pay Disclosures (Audited Information)

AOP is required to disclose the relationship between the remuneration of the Director and the lower quartile, median and upper quartile remuneration of the organisation's workforce. The banded remuneration of the Director in the financial year 2023-24 was £85,000 - £90,000 (2022-23: £80,000 - £85,000). The relationship between the mid-point of this band and the remuneration of AOP's workforce is disclosed below.

2023-24	25 th percentile	Median	75 th percentile
Total remuneration	£21,053	£27,913	£33,780
Pay ratio	4.2:1	3.1:1	2.6:1

2022-23	25 th percentile	Median	75 th percentile
Total remuneration	£18,783	£29,731	£37,373
Pay ratio	4.4:1	2.8:1	2.2:1

Total remuneration includes salary, overtime and performance-related bonuses. It does not include severance payments, employer pension contributions and the cash equivalent transfer value of pensions. Remuneration ranged from £14,189 to £87,500. The 25th percentile remuneration increased following a 12% increase in the NICS AA pay scale. Because overall employment numbers are low, small changes in the staffing structure can appear disproportionate.

The percentage changes in respect of AOP are shown in the following table. It should be noted that the calculation for the Director is based on the mid-point of the band within which their remuneration fell in each year.

Percentage change for:	2023-24 v 2022-23	2022-23 v 2021-22
Average employee salary and allowances	8.6%	2.4%
Director's salary and allowances	6.1%	-5.7%
Average employee performance pay and bonuses	-7.2%	14.9%

No performance pay or bonus was payable to the Director in these years.

Pension Entitlements (Audited Information)

Official	Accrued pension at pension age as at 31/03/24	Real increase in pension at pension age	Accrued Lump Sum at 31/03/24	Real Increase in Lump Sum	CETV at 31/03/24	CETV at 31/03/23	Real Increase in CETV
	£'000	£'000	£'000	£'000	£'000	£'000	£'000
M.G. Burton	14	2	-	-	247	194	33

The figures enclosed are based on last year's guidance from the Department of Finance on the pension information that should be disclosed in accounts for 2022/23 i.e. these figures exclude the McCloud Remedy from the calculations for any eligible members. The real increase in CETVs is based on the factors in force at 31 March 2024. Due to changes to the non-club transfer factors, provided by the Government Actuary's Department during the year the CETV calculations for the 2022/23 year have been re-run and provided as the starting input CETV value for the start of the 2023/24 year. When calculating the real increase in CETV and the pension benefits accrued during the year 2023-24 for the single total figure of remuneration, NILGOSC takes account of inflation. The CPI increase for September 2023 was 6.7%. The in-service revaluation rate for the Career Average Revalued Earnings Scheme was also 6.7%.

Pension Scheme

Pension benefits are provided through the Northern Ireland Local Government Officers' Superannuation Committee Pension Scheme (NILGOSC). For members, 1/49th of pensionable pay will be added to their pension account each year and retirement pension is based on career average earnings. Details can be obtained at <http://www.nilgosc.org.uk>.

Active members of the pension scheme will receive an Annual Benefit Statement. The accrued pension quoted is the pension the member is entitled to receive when they reach their scheme pension age, or immediately on ceasing to be an active member of the scheme if they are at or over pension age.

Employee contribution rates for all members for the period covering 1 April 2023 to 31 March 2024 are as follows:

Pensionable Pay	Contribution Rate
£0 to £16,900	5.5%
£16,901 to £26,000	5.8%
£26,001 to £43,400	6.5%
£43,401 to £52,800	6.8%
£52,801 to £104,700	8.5%
More than £104,700	10.5%

Employer contribution rates are determined by the Scheme's actuary every three years. Following the results of the 2022 actuarial valuation, the Committee agreed with its actuary the employer contributions of 19% for the following three years, effective from 1 April 2023. The next valuation is due as at 31 March 2025.

Cash Equivalent Transfer Values

A Cash Equivalent Transfer Value (CETV) is the actuarially assessed capitalised value of the pension scheme benefits accrued by a member at a particular point in time. The benefits valued are the member's accrued benefits and any contingent spouse's pension payable from the scheme. A CETV is a payment made by a pension scheme or arrangement to secure pension benefits in another pension scheme or arrangement when the member leaves a scheme and chooses to transfer the benefits accrued in their former scheme. The pension figures shown relate to the benefits that the individual has accrued as a consequence of their total membership of the pension scheme, not just their service in a senior capacity to which disclosure applies. The CETV figures include the value of any pension benefit in another scheme or arrangement which the individual has transferred to the NICS pension arrangements. They also include any additional pension benefit accrued to the member as a result of their purchasing additional years of pension service in the scheme at their own cost. CETVs are calculated in accordance with The Occupational Pension Schemes (Transfer Values) (Amendment) Regulations 2015 and do not take account of any actual or potential benefits resulting from Lifetime Allowance Tax which may be due when pension benefits are taken.

Real increase in CETV

This reflects the increase in CETV effectively funded by the employer. It does not include the increase in accrued pension due to inflation, contributions paid by the employee (including the value of any benefits transferred from another pension scheme or arrangement) and uses common market valuation factors for the start and end of the period. However, the real increase calculation uses common actuarial factors at the start and end of the period so that it disregards the effect of any changes in factors and focuses only on the increase that is funded by the employer.

Total Permanently Employed Staff Costs (Audited Information)

	Permanent staff £	Others ¹ £	2023-24 £	2022-23 £
Wages and salaries	1,305,600	141,083	1,446,683	1,341,618
Social security costs	137,506	13,316	150,822	142,108
Employer's pension contributions	233,129	26,111	259,240	250,805
Defined benefit pension additional service cost	51,000	-	51,000	327,000
	1,727,235	180,510	1,907,745	2,061,531

¹ "Others" includes £13,501 for agency staff

Average staff numbers (Audited Information)

	Permanent staff	Others ²	2023-24 Total Number	2022-23 Total Number
Average staff numbers	28.5	6.7	35.2	35.3

² "Others" includes 4.1 fixed term, 2.3 casuals and 0.3 agency staff

Staff Composition – permanent employees (full time equivalent)

	Male	Female
Directors/senior managers	2.6	2.0
Other employees	10.7	13.2

Staff Turnover

	2023-24	2022-23
Leavers as a percentage of average staff in post	1.5%	3.1%

Sickness Absence (Audited Information)

Staff sickness for the period 1 April 2023 to 31 March 2024 totalled 94 days (2023: 126 days) which equates to an average per FTE of 1.24% (2023: 1.66%).

Expenditure on External Consultancy (Audited Information)

Expenditure on external consultancy during the year was £nil (2022-23: £nil).

Off-payroll Engagements (Audited Information)

There were no “off-payroll” engagements in place as at 31 March 2024, nor were any arrangements entered into between 1 April 2023 and 31 March 2024.

Exit Packages (Audited Information)

Exit package cost band	No of compulsory redundancies	No of other departures agreed	Total no. of exit packages by cost band	Total no. of exit packages by cost band
	2023-24	2023-24	2023-24	2022-23
Total no. of exit packages	-	-	-	-
Total resource cost	Nil	Nil	Nil	Nil

Statement of the Responsibilities of the Governors and Accounting Officer

In accordance with The Armagh Observatory and Planetarium (Northern Ireland) Order 1995, The Governors shall prepare and submit to the Department a statement of accounts in respect of each financial year, and that statement shall be in such form and contain such information as the Department may direct and shall give a true and fair view of the state of the Governors' affairs at the end of the financial year and of the income and expenditure of the Governors in the financial year.

In preparing the accounts, the Accounting Officer is required to comply with the requirements of the Government Financial Reporting Manual and in particular to:

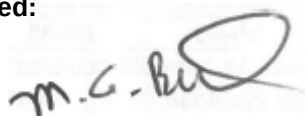
- apply suitable accounting policies on a consistent basis;
- make judgements and estimates on a reasonable basis;
- state whether applicable accounting standards as set out in the Government Financial Reporting Manual have been followed, and disclose and explain any material departures in the accounts;
- prepare the accounts on a going concern basis; and
- confirm that the Annual Report and Accounts as a whole is fair, balanced and understandable and take personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

The Department for Communities has appointed Professor M.G. Burton as Accounting Officer of AOP. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding AOP's assets, are set out in Managing Public Money Northern Ireland.

Statement of Disclosure of Information to the Auditors

As the Accounting Officer, I have taken all the steps that I ought to have taken to make myself aware of any relevant audit information and to establish that Armagh Observatory and Planetarium's auditors are aware of that information. So far as I am aware, there is no relevant audit information of which the auditors are unaware.

Signed:



Professor Michael Burton
Accounting Officer for Armagh Observatory and Planetarium

Date: 21 October 2024

Governance Statement

AOP is a Non-Departmental Public Body established under The Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

1. Compliance with Corporate Governance Code

In 2013 the Department of Finance and Personnel published Corporate Governance in Central Government Departments: Code of Good Practice NI. The Code draws on best practice in the public, private and charity sectors by: reinforcing the importance of corporate governance as a pre-requisite to achieving good financial management; reflecting changes in governance best practice, including increased emphasis on good leadership; and promoting better governance arrangements within departmental families.

The Code is written for departments, concentrating throughout on key principles which will have wider application for other parts of the public sector. Such bodies (including arms-length bodies (ALBs)) are encouraged to consider and adopt the practices set out in the Code wherever it is relevant and practical and suits their business needs.

AOP in so far as they are relevant for an arms-length body, complies with the principles of good practice in the Corporate Governance Code.

2. Governance Framework

Accounting Officer

Name	In post
Professor Michael Burton – Director and Chief Executive	From 1 September 2016 onwards

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one DfC nominee;
- one Queen's University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

During 2023-24 one new Member was appointed to the Chapter of the Church of Ireland Cathedral of Armagh and one Member retired. There are currently two vacant positions.

BOARD OF GOVERNORS			
GOVERNOR	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 1)
Archbishop J McDowell (Chair)	28 April 2020	None	1
The Very Revd S Forster Dean of Armagh	14 February 2021	None	1
The Ven E Cairns Archdeacon of Ardboe	13 December 2020	None	1
The Ven Dr P Thompson Archdeacon of Armagh	13 January 2019	None	1
Revd Canon W M Adair BEM	10 September 2008	None	0
Revd Canon W J A Dawson	1998	31 December 2023 (Retired)	0
Revd Canon D Hilliard	13 March 2016	None	1
Revd Canon W B Paine	7 May 2017	None	0
Revd Canon R J N Porteus	1998	None	0
Revd Canon M Hagan MBE	23 April 2023	None	1
VACANT (from Feb 2023)			
VACANT (from 1 January 2023)			
Professor A Fitzsimmons	18 April 2019	1 May 2024	1

Mr R Wilson	1 December 2019	30 November 2024	0
Archbishop E Martin	1 January 2021	31 December 2025	0
Ms S Leslie	From 1 June 2021	31 May 2026	0
Mr G Cox	1 March 2021	28 February 2026	1

At the annual meeting on 16 May 2023 the Board of Governors endorsed the continuing membership of Messrs Cox and Wilson as its nominees on the Management Committee and afforded the Archbishop time to consider a replacement for Revd Canon Adair as a nominee on the Management Committee. Revd Canon Hagan was subsequently appointed as the third nominee.

The Board considered a paper regarding the Charity Name and Delegation of Charity Trustee Status, which had been prepared following discussions with the Charity Commission for Northern Ireland, and agreed to include the Members of the Management Committee as Charity Trustees (alongside Members of the Board of Governors) and to change the name of the Charity from 'The Governors of Armagh Observatory and Planetarium' to 'Armagh Observatory and Planetarium.'

The Board approved the draft Outline Business Case for AOP Redevelopment Project for submission to DfC.

The Chairs of the Management Committee and Audit and Risk Assurance Committees provided verbal reports to the Board and the minutes of both meetings between June 2022 and April 2023 (draft) were provided.

The Board formally retrospectively approved the Annual Report and Accounts 2021-22 and approved the draft Annual Report and Accounts 2022-23.

The Board noted the Management Report for 2022-23 which included the Director's Report; Corporate Plan Objectives; Key Performance Indicators and the Risk Register as at 31 March 2023 and approved the draft Business Plan 2023-24.

The Board confirmed that it was satisfied that comprehensive arrangements were in place to ensure that high-quality information was received to enable it to make informed decisions. Internal controls were in place to validate the accuracy and completeness of information presented to the Board.

Minutes of the meeting record the business carried out and actions agreed.

Management Committee of Armagh Observatory and Planetarium

The Management Committee comprises:

- a Chair appointed through open competition;
- three nominees from the Board of Governors;
- six nominees from DfC;
- one nominee of the Queen's University Belfast (QUB);
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS); and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

During 2023-24 there were three changes to the Membership of the Management Committee. Mr McGurgan retired on 30 April 2023 and Revd Canon Hagan replaced Revd Canon Adair as one of the Board of Governors' nominees to the Management Committee. The term of appointment for both Professor Harra and Mr Brown was extended by one year from 30 April 2023 to 30 April 2024.

There is currently one vacant position, with two further vacancies arising on 30 April 2024. A public appointment process to fill all three of these positions completed in June 2024.

MANAGEMENT COMMITTEE			
MEMBER	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 6)
Mr J Briggs (Chair)	1 January 2018	31 December 2027	6
Professor L Harra	1 November 2014	30 April 2024	4
Mr S Brown	1 November 2014	30 April 2024	6
Mr P McGurgan	1 November 2014	30 April 2023	1 from 1
Professor M Mathioudakis	11 November 2016	10 November 2026	5

Mr R Wilson	1 December 2019	30 November 2024	2
Professor C Jackman	1 January 2021	31 December 2025	3
Professor M Darnley	1 January 2021	31 December 2025	4
Mr P Kennedy	1 March 2021	28 February 2026	6
Dr K Lemon	1 March 2021	28 February 2026	5
Mr E Rooney	1 March 2021	28 February 2026	5
Mr G Cox	19 May 2021	18 May 2026	5
Revd Canon W M Adair BEM	15 September 2021	16 May 2023	0 from 1
Revd Canon M Hagan MBE	17 May 2023	NONE	1 from 3
VACANT (from 1 May 2023)			

A special meeting of the Management Committee was held in May 2023 to consider the draft Outline Business Case for AOP Redevelopment Project and in April 2023 the Management Committee recommended the final draft for Board approval at a Special Meeting held on Thursday 4 May 2023.

On 17 April 2023, the Committee noted an Armagh City, Banbridge and Craigavon Borough Council Notice of Motion acknowledging, endorsing and supporting the work of AOP and its international linkages and partnership with Birr and Dunsink – the Astronomical Observatories of Ireland.

The draft 2023-24 Business Plan was approved for submission to DfC in April 2023. It was approved by the Permanent Secretary on 14 November 2023.

In April the Management Committee considered a number of papers relating to Whistleblowing/Raising a Concern and approved AOP's updated Policy; reaffirmed its commitment to an ethical culture where all concerns were taken seriously; undertook to provide assurance to the Permanent Secretary regarding staff awareness of the Policy and appointed Mr Greg Cox as AOP's Designated Officer (Whistleblowing Champion).

The Management Committee considered an update on discussions with the Charity Commission for Northern Ireland in relation to changing the Charity Name and the Delegation of Charity Trustee Status in April 2023. In June 2023 it noted that the Charity Commission was comfortable with changing the registered name from 'The Governors of Armagh Observatory and Planetarium' to 'Armagh Observatory and Planetarium' and unanimously agreed that the Management Committee Members take on the responsibility of Charity Trustee alongside the Members of the Board.

A two-day meeting took place in June 2023. In addition to routine business over the two days the Management Committee received a presentation on Carbon Reduction and Action Plan; held an interactive session with staff; undertook practical taster sessions; received a presentation and discussion with the Council in relation to Armagh Place Strategies; received a presentation on DfC's Building Inclusive Communities Strategy and a reviewed the draft Memorandum of Understanding (MoU) which would formally establish the Astronomical Observatories of Ireland. The MoU was signed on Thursday 21 September 2023 in Dunsink, Dublin.

The Committee considered and was content with the summary of its annual Effectiveness Review in September 2023.

In September, on the Chair's recommendation, it approved the establishment of a Liaison Committee between Management Committee and key SMT officers to ensure all issues relating to the redevelopment project were aligned and addressed. The first meeting took place on 17 November 2023.

At the December meeting the Management Committee received a Mid-Term Review of the Strategic Plan. A sub-committee was also established to consider the 2024-25 budget.

At each of its meetings throughout the year the Committee received a report from the Director, a presentation on Research from an Astronomer, updates from each of its standing sub-committees and approved relevant reports. Regular governance reports such as the Bi-Annual Assurance Statement, the Corporate Risk Register, ICT Risk Register, Key Performance Indicators and Finance reports were reviewed and approved. The Committee considered and noted amendments to policies that had been reviewed in line with the policy review process and approved new policies as appropriate.

Throughout the year, the Management Committee also considered progress on AOP's Vision and redevelopment which included updates from the Redevelopment Sub-Committee.

Internal controls are in place to validate the accuracy and completeness of information presented to the Management Committee.

Minutes of the meetings record the business carried out and actions agreed.

Audit and Risk Assurance Committee

The Audit and Risk Assurance Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members. A special meeting took place in June 2023 to discuss the Internal Audit Strategy with the reappointed Internal Audit provider.

AUDIT AND RISK ASSURANCE COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 5)
Mr S Brown Chair (from June 2021)	5
Professor L Harra	3
Mr P McGurgan (to 30 April 2023)	1 from 1
Mr P Kennedy	5
Mr E Rooney	5
Dr K Lemon (from June 2023)	4 from 4

During 2023-24 the Audit and Risk Assurance Committee considered the Internal Audit Charter; the Internal Audit Strategy 2023-2026, Internal Audit Plan 2023-24; reports from Internal Audit on progress against the audit plan and on outstanding recommendations; a revised Report to Those Charged With Governance in respect of the 2021-22 Accounts and reports from external auditors on the 2022-23 Annual Report and Accounts; review of the Accounting Officer's Assurance Statement and review of the Risk Register. In view of the severity of ICT related risks, including data/cyber security, a separate ICT Risk Register was developed.

The Committee is satisfied that the integrated approach, the frequency of meetings, the breadth of the business undertaken, the skills of Members and the range of attendees at meetings of the Committee has allowed the Committee to meet the governance requirements of the organisation and assisted the Management Committee to demonstrate its stewardship of the public resources with which it is charged.

The Committee is satisfied that the organisation has robust risk management arrangements in place which are in line with the good practice in the HM Treasury 'Orange Book' and are reviewed regularly by the Management Committee.

There were 4 Internal Audit recommendations from prior years outstanding, 2 of which have been completed. The Committee is satisfied that progress is being made to complete the remaining outstanding recommendations. There were 6 new internal audit recommendations identified during 2023-24, 3 of which have been implemented.

Minutes of the meetings record the business carried out and actions agreed.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members. Special Meetings took place in October 2023 and January 2024 to discuss Strategic Workforce Planning and PDRA pay scales respectively.

STAFFING POLICY AND REMUNERATION COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 6)
Mr E Rooney (Chair)	6
Mr S Brown	6
Mr J Briggs	6
Dr K Lemon	6
M P Kennedy	6

In 2023-24, amongst other matters, the Committee considered:

- staffing and recruitment, including Skills Gaps Analysis and Strategic Workforce Planning;
- updates to staff related policies, including review of Hybrid Working Policy; and
- a range of Human Resources issues including progress against the Human Resources Strategy and Action Plan.

AOP retained its Diversity Mark (Bronze Award) and Project Juno Practitioner Status. The application for Juno Champion did not meet the standard.

Research and Education Advisory Committee

The Research and Education Advisory Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

RESEARCH AND EDUCATION ADVISORY COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 2)
Professor L Harra (Chair)	2
Professor M Darnley	2
Dr K Lemon	1
Professor M Mathioudakis	1

In 2023-24, amongst other matters, the Committee considered:

- education and outreach activities, including visitor reports;
- research activities, including changes to the publication environment; Research Excellence Framework (REF) updates; funding opportunities; PDRA Salaries; UK Committee on Research Integrity; Commentary on AOP Research Strategy; and
- an Intellectual Property Paper.

A Local Organising Committee (LOC) comprising members from across AOP ensured the smooth delivery of 4 Conferences held at the Planetarium in September 2023.

Redevelopment Sub-Committee

The Redevelopment Sub-Committee's membership is drawn from the Management Committee and comprises of six members.

REDEVELOPMENT SUB-COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 3)
Mr S Brown (Chair)	3
Mr J Briggs	2
Mr G Cox	1
Mr P Kennedy	3
Dr K Lemon	2
Mr E Rooney	2

The primary purpose of the Sub-Committee was to drive the 'Development of AOP Science and Education Park' Project forward, and oversee the delivery of the outcomes and benefits, most notably initially an Outline Business Case (OBC) by March 2023. It was a very ambitious and challenging timetable and there was a little slippage. The OBC, which was submitted to DfC on 1 June 2023, remains under consideration.

Since submission of the OBC in June 2023, this 'task and finish' Sub-Committee, which will continue until the OBC is approved, has met twice and considered a range of issues associated with project governance including the Business Case, planning / design issues, funding packages and stakeholder engagement.

Finance Sub-Committee

An interim finance sub-committee was established in December to consider the potential budget constraints faced for 2024/25 and possible actions to be taken. The sub-committee met three times, taking a detailed look at budget proposals and determining cost priorities. This culminated in a letter from the Accounting Officer to the DfC Permanent Secretary in May 2024 setting out identified savings and inescapable costs.

Conflicts of Interest

The organisation maintains a register of interests to ensure that potential conflicts of interest can be identified and addressed in advance of Board, Management Committee and other Committee discussions. The register is formally revisited on an annual basis. Where conflicts exist, they are recorded in the Committee minutes and the Chair of the meeting decides the most appropriate way of managing the conflict. This may include that member not taking part in discussions or making decisions on certain matters or being excluded for part or all of that meeting.

The Register of Interests for Board of Governors, Management Committee and senior staff is published on the AOP website in accordance with central government guidance.

Directors and Secretary

Professor Michael Burton is Director and Chief Executive.

The Corporate Manager provides a range of secretarial support services to the Board of Governors, Management Committee and Audit and Risk Assurance Committee; the HR and Policy Officer provides secretarial support to the Staffing Policy and Remuneration Committee, and Executive Officers support the Research and Education Advisory Committee and Redevelopment Sub-Committee.

3. Business Planning and Risk Management

Business Planning

'Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.'

'Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.'

The pillars that support us are – Knowledge, Legacy, People and Engagement.

The five-year strategy is built around four strategic themes - Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

The Strategic Plan aligns closely with the aims and objectives of the Observatory and Planetarium's sponsor - the Department for Communities (DfC) – and with the broader aims and objectives of the Northern Ireland Executive's Programme for Government. The organisation's Strategic Plan 2021-26 received Departmental approval on 17 August 2021.

The work of the Observatory encompasses both internationally acclaimed research and a unique cultural heritage — scientific, historical, architectural — as well as maintaining the unique daily climate series (the longest daily series from a single site in the UK and Ireland) and undertaking a world-class programme of science in the community, which complements the Planetarium's main business of education.

The Planetarium's main business is education, and all age and social groups are welcome to visit. The educational programmes and demonstrations are designed to include participation by children of pre-nursery age up to senior citizens and all age groups in between. The primary educational aim of the Planetarium is to endorse and promote the Science, Technology, Engineering, Arts and Mathematics (STEAM) agenda which promotes scientific careers to young people. All of the ancillary activities support the primary aim, with the additional target of offering excellent value for money, both to the visitors taking part and to the public purse. The Planetarium maintains a focus on being inclusive so that all children can enjoy the Planetarium experience.

Full details of all the Observatory and Planetarium's activities are provided in comprehensive Annual Reports which are available online at: www.armagh.space.

No Ministerial Directions have been given regarding the work of AOP.

Risk Management

Risk Management is an essential element of AOP's corporate governance framework and is closely linked to the system of internal control and business planning process. HM Treasury Orange Book establishes the concept of risk management and provides a basic introduction to its concepts, development and implementation of risk management processes in government organisations. A robust risk management process assists AOP in identifying and managing issues which may hinder the achievement of objectives. The arrangements are regularly reviewed.

As well as ensuring that there is an effective system in place to deal with threats to AOP's aims and objectives, the organisation encourages a proactive approach to innovation and well-managed risk taking where there is potential to realise sustainable improvements in the organisation's research and educational services. For this reason, the organisation's Risk Appetite is 'Open'.

The Management Committee sets the risk appetite for AOP. The Accounting Officer, Senior Management and other staff are responsible for ensuring that residual risks are reduced to a level as low as reasonably practicable and wherever possible consistent with the level of risk appetite established by the Management Committee.

Updates are provided to the Audit and Risk Assurance Committee on the development and implementation of the risk management process across AOP. The Audit and Risk Assurance Committee provides the Accounting Officer with objective advice on issues concerning the risk, control and governance of the organisation and the associated assurances. An update on the main points considered by the Audit and Risk Assurance Committee is provided to the Management Committee following each meeting and the Management Committee has access to all papers for the Audit and Risk Assurance Committee.

4. Fraud and Information Risk

The Accounting Officer has overall responsibility for managing the risk of fraud including:

- developing a fraud risk profile and undertaking a regular review of the fraud risks associated with each of the key organisational objectives in order to keep the profile current;
- establishing an effective fraud prevention policy and fraud response plan, commensurate with the level of fraud risk identified in the fraud risk profile;
- designing an effective control environment to prevent fraud commensurate with the fraud risk profile;
- operating appropriate pre-employment screening measures;
- establishing appropriate mechanisms for reporting fraud risk issues, reporting significant incidents of fraud, and coordinating assurances about the effectiveness of fraud prevention policies to support the Governance Statement;
- liaising with the Audit and Risk Assurance Committee;
- ensuring that all staff are aware of the organisation's fraud prevention policy and know what their responsibilities are in relation to combating fraud;
- ensuring fraud awareness training is provided as appropriate and, if necessary, more specific fraud prevention training and development is provided to relevant staff;
- ensuring that vigorous and prompt investigations are carried out if fraud occurs, is attempted or is suspected by the establishment of a Fraud Investigation Oversight Group;
- ensuring, where appropriate, legal and/or disciplinary action against perpetrators of fraud;
- ensuring, where appropriate, disciplinary action against supervisors where supervisory failures have contributed to the commission of fraud;
- ensuring, where appropriate, disciplinary action against staff who fail to report fraud;
- taking appropriate action to recover assets and losses;
- ensuring that appropriate action is taken to minimise the risk of similar frauds occurring in future; and
- ensuring that an anti-fraud culture is promoted throughout the organisation in line with the seven Nolan Principles of Public Life.

Risks to data and information held by the organisation are owned and managed by individuals designated as information asset owners. The Corporate Policy and HR Officer responds to requests for information under the Data Protection and Freedom of Information Acts following consultation with the Accounting Officer and the organisation's governing Committees, as appropriate.

AOP operates a Whistleblowing Policy which informs all members of the organisation of the standards of behaviour expected of them in carrying out their duties, and to provide information on the procedures to follow if a situation arises in which they are required to act in a way which is believed by them to be illegal, improper, or in breach of the Nolan Principles.

5. Governance and Accountability

AOP seeks to achieve excellence in good governance, in particular the precepts: (1) leadership; (2) effectiveness; (3) accountability and (4) sustainability.

The Chair of the Board of Governors has a particular leadership responsibility for securing the sustainability and vitality of the organisation in the long term; giving advice and direction in formulating AOP's forward look and overall strategy; ensuring that account is taken of guidance provided by the Minister or the Department; promoting the efficient and effective use of staff and other resources; encouraging high standards of probity amongst staff and Board and Committee members alike; and ensuring that the Board and its Committees meet at regular intervals throughout the year and that the Minutes of meetings accurately record the decisions taken and, where appropriate, the views of individual Board members.

Within AOP, the Director, supported by his Senior Management team, has responsibility for the management and effective operation of their organisation. Their operational responsibilities include:

- developing, implementing and monitoring the strategic and operational plans;
- undertaking financial management and Accounting Officer responsibilities;
- managing and developing a team of highly qualified professional and administrative staff;
- identifying and attracting sources of external income;
- promoting their respective organisations in relevant local, national and international arenas; and
- promoting Public Understanding of Science with the objective of improving the level of scientific literacy in the community and to ensure a strong link with government policy and the STEM agenda.

Members of the Board of Governors and of the Management Committee and their various Sub Committees exercise an effective challenge function on the leadership team in accord with their respective roles in the organisation. They also provide guidance and advice on strategic and operational matters such as Human Resource issues, accountability and relationships with stakeholders.

The members of these Committees are drawn from a very wide community background within, and beyond, Northern Ireland, and provide the organisation with a correspondingly wide range of expert knowledge and advice. All the Committees of AOP operate with full transparency and accountability, and over the last year have proved effective in the discharge of their duties and responsibilities.

It was agreed by the Board of Governors and the Management Committee that the governance arrangements in place removed the need for the current Board of Governors to complete an internal self-assessment of its effectiveness.

The Board of Governors and supporting Committees receive assurances from the Director and his Senior Management and Internal Audit that the governance and accountability processes are being managed effectively.

6. Sources of Independent Assurance

Internal Audit

CavanaghKelly was reappointed as Internal Auditors for the 3 years 2023-24 – 2025-26 using CPD as the Centre of Procurement Expertise. Their work was carried out in accordance with the Public Sector Internal Audit Standards.

The three year Audit Strategy was approved by the Audit and Risk Assurance Committee in June 2023.

The Audit and Risk Assurance Committee considered reports on the following areas:

Audit Assignment	Assurance Rating
Governance including Whistleblowing and Risk Management	Satisfactory
Budgetary Control	Satisfactory
Health and Safety and Safeguarding	Satisfactory
Internal Audit Follow Up 2023-24	N/A

An overall satisfactory internal audit assurance opinion has been provided.

External Audit

The Comptroller and Auditor General (C&AG) is required to audit the financial statements under *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. The C&AG is responsible for reporting whether in her opinion the financial statements give a true and fair view and whether they and the part of the Remuneration Report to be audited have been properly prepared in accordance with the Order and DfC directions made thereunder and applicable law and United Kingdom accounting standards. The C&AG is required to report whether, in her opinion, in light of the knowledge and understanding of AOP and its environment obtained in the course of the audit, she has identified any material misstatements in the Trustees' Annual Report and whether the information which comprises the Statement of the Responsibilities of the Governors and Accounting Officers and Governance Statement, as included within the Annual Report, is consistent with the financial statements. She also reports on whether, in her opinion, in all material respects, the expenditure and income presented in the financial statements have been applied to the purposes intended by the Assembly and whether the financial transactions conform to the authorities which govern them.

A representative from the Northern Ireland Audit Office is invited to all Audit and Risk Assurance Committee meetings.

7. Review of the Effectiveness of the System of Internal Governance

The system of internal governance is designed to manage risk to a reasonable level, rather than to eliminate all risk of failure to achieve certain policies, aims and objectives; it can therefore only provide reasonable and not absolute assurance of effectiveness. The system of internal governance is based on an ongoing process designed to identify and prioritise risks to the achievement of the AOP policies, aims and objectives; to assess the likelihood of the events occurring and the impact should they be realised; and to manage the risks effectively, efficiently and economically. The system of internal governance has been in place in AOP for the year ended 31 March 2024 and up to the date of approval of the annual accounts, and accords with Department of Finance guidance.

As previously detailed in Section 2, the responsibilities of the Accounting Officer include the need to maintain a sound system of internal control which supports the achievement of the organisation's policies, aims and objectives. The review of the effectiveness of the system of internal governance has been informed by the assurances provided by relevant parties such as: Internal Audit and the Senior Management team. Where weaknesses have been identified these have been promptly drawn, through normal reporting mechanisms, to the attention of the Audit and Risk Assurance Committee, Management Committee and/or Board of Governors, as appropriate.

The main procedures in place to monitor the effectiveness of the system of internal governance are as follows:

- ongoing independent assessment of the Observatory's research outputs;
- regular reports by financial staff on progress against principal financial targets and the projected financial outcome for the year and progress reports by staff responsible for major projects;
- detailed progress reports to the Management Committee and Board of Governors at their regular meetings and inclusion of performance measures and results against targets in the annual operating plan;
- annual reports on the system of internal control from internal auditors to the Audit and Risk Assurance Committee;
- regular Accountability meetings with officials from the Sponsor Department to consider operational and strategic issues and matters relating to the system of internal control;
- Bi-Annual Assurance Statements submitted to the Sponsor Department;
- periodic review of the AOP Risk Register by the Audit and Risk Assurance Committee, the Management Committee, the Accounting Officer and Senior Management and the Sponsor Department;
- continuous assessment of the quality of research through peer review of grant applications, applications for telescope time, and the submission of scientific papers to academic journals of international standing by AOP staff and students;
- peer review of the research quality, capability and output of the Observatory, and through participation in an objective external Assurance Committee, which provide an opinion on the adequacy and effectiveness of the system and contain recommendations for improvement; and
- annual reports from Northern Ireland Audit Office to the Audit and Risk Assurance Committee, the Management Committee and the Board of Governors on the Annual Report and Accounts, providing an opinion on the state of affairs of the organisation and its total incoming resources and expenditure of resources.

All reports based on the internal and external audits include opinions on the adequacy and effectiveness of risk management and the control framework in place. These matters are considered by the Audit and Risk Assurance Committee and are reported by the Audit and Risk Assurance Committee Chair to the Management Committee and the Board of Governors.

Weaknesses identified in AOP's control systems and internal governance are set out within the next section. Upon identification, plans were immediately put into place to address these issues.

8. Internal Governance Divergences

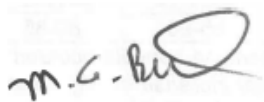
During its audit for 2023-24, NIAO identified no priority 1 issues to be addressed by management in their areas of responsibility.

9. Conclusion

AOP has an effective governance structure and is operating to a high standard of integrity and probity. In signing this report, I have taken assurances, where available, from the Audit and Risk Assurance Committee and I will continue to monitor the Internal Audit and Northern Ireland Audit Office recommendations to ensure that all issues are appropriately addressed.

To the best of my knowledge this report provides a fair and accurate reflection of the business of AOP and of the status of the controls and checks that have been put in place to regulate and inform the organisation's committees.

Signed:

A handwritten signature in dark ink, appearing to read 'm.c. Burton', written over a faint, light-colored rectangular stamp.

Date: 21 October 2024

Professor Michael Burton
Accounting Officer
Armagh Observatory and Planetarium

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Armagh Observatory and Planetarium

Non Refereed Journal Publications: April 2023 – March 2024

Bailey M. E., Christou A. A., Finnegan J. A., 2023, The Flying Fish Fireball of 2014 July 17, WGN, Journal of the International Meteor Organization, 51, 38, <https://ui.adsabs.harvard.edu/abs/2023JIMO...51...38B>

Belkin S., et al., inc. **Ramsay G.**, 2024, GRB 230911A: The First Discovery of a Fermi GRB Optical Counterpart with the Gravitational-wave Optical Transient Observer (GOTO), Research Notes of the American Astronomical Society, 8, 6, doi:10.3847/2515-5172/ad1876, <https://ui.adsabs.harvard.edu/abs/2024RNAAS...8....6B>

Christou A., Gritsevich M., 2023, in EGU General Assembly Conference Abstracts. Meteor phenomena in the atmosphere of Venus, EGU General Assembly Conference Abstracts. pp EGU–4306, doi:10.5194/egusphere-egu23-4306

Dermott S., Li D., **Christou A.**, 2023, in AAS/Division of Dynamical Astronomy Meeting. Do HED meteorites originate from two large craters on asteroid Vesta?. p. 202.04

McMahon, M., 2023, Herschel Family Papers held at Armagh Observatory and Planetarium. Journal of the Herschel Society 22, 4–13

McMahon, M., 2024, Hugh Breen, Father of Astronomers. History Armagh 5, 38–40

McMahon, M., Black, A., 2024, The Armagh Observatory Troughton Equatorial Telescope (1795) Network. Scientific Instrument Society Bulletin 27–40 (2024).

McMahon M., Nežič R., 2024, Archival research in a planetarium: The first projector at Armagh Planetarium, Communicating Astronomy with the Public Journal, 34, 37, <https://ui.adsabs.harvard.edu/abs/2024CAPJ...34...37M>

Morgan L., Law C. Y., Tan J., **Eden D.**, 2024, in American Astronomical Society Meeting Abstracts. Filaments All the Way Down: Examining the hierarchical nature of the ISM. p. 156.05

Stricklan A., **Shetye J.**, 2023, in American Astronomical Society Meeting Abstracts. What do coronal hole jets eat: A look at these beasts and the mechanisms that feed them. p. 103.02

During the reporting year, G Ramsay published many reports related to the discovery of transients and is directly related to his work on the GOTO and BlackGem projects. The Transient Name Server (TNS) is an IAU supported service which reports newly discovered extragalactic transients. He led or was co-Investigator on 201 TNS Discovery Reports and 14 TNS AstroNotes. In addition, he was co-Investigator on 11 GRB Coordinates Network Circular Services (GCNs), which report the results of optical follow-up of Gravitational Wave and Gamma-ray Burst events. He led 1 Astronomical Telegram (ATel) reporting the outburst of a CV candidate.

Armagh Observatory and Planetarium **Presentations: April 2023 – March 2024**

Date	AOP Speaker	Title	Location/Mode	Category
03 Apr 2023	G. Ramsay	Key Tools, Techniques and Methods Over Last 20 Years	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
06 Apr 2023	J.S. Vink	Mixing and Mass Loss in Massive Stars	SDSS-V/IReNA Science Festival, KU Leuven, Belgium (virtual)	Research
16 Apr 2023	J. Rigney	From the Leviathan to LOFAR	Birr Castle, Co. Offaly, Ireland	Outreach
17 Apr 2023	A. Philip Monai	Recap: The Formation of the Solar System	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
17 Apr 2023	J.S. Vink	The Heaviest Stars and Black Holes in the Universe	AOP Management Committee Meeting, Armagh Observatory and Planetarium, Armagh	Outreach
28 Apr 2023	G. Ramsay	Stellar Activity and NGTS	NGTS Consortium Meeting, Queen's University Belfast	Research
29 Apr 2023	M.E. Bailey	Giant Comets and Their Impacts Through Time: The Most Recent Giant Comet and its Impact on Civilization	Society for Interdisciplinary Studies Spring Meeting, Watford, England	Outreach
03 May 2023	J.S. Vink	Space	St Teresa Primary School, Belfast	Outreach
05 May 2023	M. Burton	The Director's Cut – Orienteering the Cosmos	A Special Planetarium Show for Participants in the British Orienteering Championships in Armagh, Armagh Planetarium, Armagh	Outreach
13 May 2023	J. Rigney	From the Leviathan to LOFAR	Birr Castle Co. Offaly, Ireland	Outreach
16 May 2023	M. Sarzi	The Fornax3D Survey	Galaxy Groups and Clusters III Conference, La Serena, Chile	Research
24 May 2023	J. Rigney	Single Station Science	LOFAR Science Summer School Workshop, Sofia, Bulgaria	Teaching
24 May 2023	J. Rigney	Pulsars and Fast Radio Bursts	LOFAR Science Summer School Workshop, Sofia, Bulgaria	Teaching
30 May 2023	D. Eden	MAJORS: Massive, Active, JCMT-Observed Regions of Star Formation.	JCMT Users' Meeting 2023, University College London, London	Research
02 Jun 2023	C.S. Jeffery	The SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Science Highlights from SALT Conference, Nicolas Copernicus Astronomical Centre, Warsaw, Poland	Research
06 Jun 2023	C.S. Jeffery	The SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Institut für Physik und Astronomie, Universität Potsdam, Germany	Research
08 Jun 2023	M. Burton	Armagh – Exploring the Cosmos	Lisburn Probus Club, Lisburn Golf Club, Lisburn, Co. Antrim	Outreach
09 Jun 2023	M. Burton	The Director's Cut – The Planets	Armagh Planetarium, Armagh	Outreach
12 Jun 2023	C.S. Jeffery	Shocks and Chaos in Pulsating Helium Stars	Department of Applied Mathematics and Theoretical Physics, University of Cambridge, England	Research
12 Jun 2023	J.S. Vink	Why are the Most Massive Stars not the Largest?	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
13 Jun 2023	J. Rigney	Low Frequency Radio Emission Associated with a CME and EUV Wave	LOFAR Family Meeting 2023 Conference, Olsztyn, Poland	Research

14 Jun 2023	G. Ramsay	Stellar Activity and BlackGem	BlackGem Consortium Meeting, Nijmegen, The Netherlands	Research
15 Jun 2023	M.E. Bailey	Using Kinesthetic Learning to Bring Heaven Down to Earth in a Practical Way	U3A Summer School, Greenmount College, Antrim	Outreach
19 Jun 2023	J.S. Vink	The Fundamentals of the WR Phenomenon	The Wolf-Rayet Phenomenon in the Universe Meeting, Morelia, Michoacán, Mexico	Research
21 Jun 2023	Z. Gray	The Aftermath of the DART Impact: A Polarimetric Study of Didymos-Dimorphos	Asteroids, Comets and Meteors (ACM) Conference 2022, Flagstaff, Arizona, USA	Research
22 Jun 2023	R. Nežič	Sungrazers Through Space and Time: Polarimetric Behaviour of Selected Sungrazing Comets Near Perihelion	Asteroids, Comets, Meteors (ACM) Conference 2023, Flagstaff, Arizona, USA	Research
29 Jun 2023	M. McMahon	Science and Spectacle	Crossing Frontiers: Elements and Environment in the Middle Ages, International Research Conference, Queen's University Belfast	Research
29 Jun 2023	M.E. Bailey	How Astronomy Impacts Our Understanding of the Middle Ages and Its Changing Environment	Panel Discussion, Crossing Frontiers: Elements and Environment in the Middle Ages, International Research Conference, Queen's University Belfast	Research
30 Jun 2023	M. Sarzi	The SAURON Survey and the Oxford Years	Conference Celebrating the Retirement of Prof Roger Davies, Oxford, England	Research
07 Jul 2023	J. Rigney	Stellar Activity	STELLAR BG Final Meeting, Plovdiv, Bulgaria	Research
11 Jul 2023	M. Sarzi	Artificial Intelligence and Data Visualisation in Astronomy	UKRI Summer School in Artificial Intelligence and Astronomy, Canterbury University, England	Teaching
18 Jul 2023	M. McMahon	First Light: 230 Years of Observing in Armagh	Armagh Planetarium, Armagh	Outreach
23 Aug 2023	L. Scott	Heavy Metal Subdwarfs: Testing Chemical Stratification	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
24 Aug 2023	M. Burton	UNESCO and the Astronomical Observatories of Ireland	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
24 Aug 2023	J. Rigney	Low Frequency Radio Emission Associated with a CME Shock and EUV Wave	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
24-Aug-23	C.S. Jeffery	The SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Irish National Astronomy Meeting (INAM), University College Cork, Co. Cork, Ireland	Research
31 Aug 2023	M. Sarzi	The Fornax3D and Meerkat Fornax Surveys	MeerKAT Fornax Workshop, Cagliari, Italy	Research
01 Sep 2023	M.E. Bailey	Near-Earth Objects: Origins, Impacts and Risk	North Down and Ards U3A, Bangor, Co. Down	Outreach
02 Sep 2023	M. Burton, H. Alexander, S. Mackle, M. Grimley, M. McMahon	The Armagh Experience Compere [Heather] Small Changes, Big Impact [Sinead] Our Solar System [Mark] Historical Research [Matthew] Present and Future [Michael]	British Association Planetaria Annual Conference, Armagh Planetarium, Armagh	Research and Education

04 Sep 2023	S. Schlagenhauf	Using Adaptive-Optics Assisted MUSE Observations to Measure Galaxy Distances with the Planetary Nebulae Luminosity Function	IAU Symposium, Krakow, Poland	Research
06 Sep 2023	J.S. Vink	Wind and Mass Loss in Hot Stars	Symposium on Chemical Yields, Heidelberg, Germany	Research
08 Sep 2023	M. Burton	The Director's Cut – A Cosmic Journey	AMCVn5 Workshop, Armagh Planetarium, Armagh	Outreach
11 Sep 2023	L. Scott	Surface Abundances of Hot Subdwarfs	Annual Meeting of the UK BRIDGCE and IReNA Network, The University of Edinburgh, Scotland	Research
15 Sep 2023	C.S. Jeffery	Highlights from the SALT Survey of Helium-Rich Hot Subdwarfs	11th Workshop on Hot Subluminous Stars and Related Objects, Armagh Planetarium, Armagh	Research
15 Sep 2023	G. Ramsay	Plato Complementary Science and the Guest Observer Programme	Plato UK Meeting, University of Warwick, England	Research
15 Sep 2023	L. Scott	Modelling Lead Stratification in Heavy Metal Subdwarfs Atmospheres	11th Workshop on Hot Subluminous Stars and Related Objects, Armagh Planetarium, Armagh	Research
19 Sep 2023	G. Ramsay	Report from the Executive Board	GOTO Science Meeting, University of Warwick, England	Research
25 Sep 2023	J.S. Vink	Introduction	The Second XShootU In-Person Meeting, Prague, Czech Republic	Research
01 Oct 2023	K.O. Çubuk	One Planet and the Universe - 100 Hours of Astronomy	Armagh Observatory and Planetarium, Armagh	Outreach
02 Oct 2023	M.E. Bailey	Earth's Place in Space: A Brief Introduction to Astronomy	Causeway U3A, Portstewart, Co. Antrim	Outreach
05 Oct 2023	M.E. Bailey	The Human Orrery: Ground-Based Astronomy for All! (Zoom)	Online Across Scotland: Across Scotland U3A Astronomy Group, Scotland	Outreach
06 Oct 2023	M. Burton	The Director's Cut – Star Formation	Armagh Planetarium, Armagh	Outreach
12 Oct 2023	J. Landstreet	The Magnetic Attraction of White Dwarfs	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
12 Oct 2023	J. Rigney	The Sun and the (Low Mass) Stars, Searching for Radio Flares and CMEs on M Dwarfs	Seminar, Armagh Observatory and Planetarium, Armagh	Research
13 Oct 2023	A. Humpage, A. Marshall Lee, A. Philip Monai, E. Winch, K. Trakakis, S. Schlagenhauf	PhD Flash Talks	Armagh Planetarium, Armagh	Outreach
18 Oct 2023	J. Landstreet	What is an Ap Star?	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
20 Oct 2023	D. Eden	Astronomy: From Large to Small	DJK House, Liverpool, England	Outreach

20 Oct 2023	S. Bagnulo	Plus or Minus	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
22 Oct 2023	M. Sarzi	Italian Stars in Armagh	Event about research and sustainability organised with the Italian Consulate, Armagh Planetarium, Armagh	Outreach
25 Oct 2023	M.E. Bailey	Near-Earth Objects: Origins, Impacts and Risk	University of Northumbria, Newcastle upon Tyne, England	Research
26 Oct 2023	S. Bagnulo	No So fast, Not So Furious, Just Magnetic	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
27 Oct 2023	M. Burton	Geographies of Outer Space at the Armagh Observatory and Planetarium	"Geographies of Outer Space" QUB Course, Armagh Observatory and Planetarium, Armagh	Teaching
27 Oct 2023	S. Bagnulo	Magnetically Driven Accretion at the Surface of a Metal Polluted White Dwarf	Stellar Magnetic Fields from Protostars to Supernovae, Munich Institute for Astro-, Particle and Bio Sciences (MIAPbP), Garching, Germany	Research
31 Oct 2023	L. Scott	Diffusion in Stars and Stratified Atmosphere Models	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Armagh	Research
02 Nov 2023	G. Sabhahit	Massive Stars Near the Eddington Limit	Seminar, Armagh Observatory and Planetarium, Armagh	Research
03 Nov 2023	M. Burton	The Director's Cut – Star Death	Armagh Planetarium, Armagh	Outreach
05 Nov 2023	J. Rigney	The Sun and the (Low Mass) Stars	Mayo Dark Skies Festival 2023, Co Mayo, Ireland	Outreach
06 Nov 2023	J.S. Vink	First Light from JWST	Northern Ireland Amateur Astronomy Society (NIAAS), Ballyclare, Co. Antrim	Outreach
10 Nov 2023	D. Eden	MAJORS: First Results from W49A	New Eyes on the Cold Universe: Star Formation in the Milky Way and Beyond in the Era of JWST and ALMA, Royal Astronomical Society, London, England	Research
15 Nov 2023	L. Scott	Heavy Metal Subdwarfs	Astrophysics Seminar, Queen's University Belfast	Research
22 Nov 2023	K.O. Çubuk	Engaging Space Facts and Future Space Missions	UK Space Conference, ICC, Belfast	Outreach
01 Dec 2024	M. Burton	The Director's Cut – Galaxies	Armagh Planetarium, Armagh	Outreach
07 Dec 2023	C.S. Jeffery	The Secret Lives of Ancient Stars	AOP Management Committee Meeting, Armagh Planetarium, Armagh	Governance
15 Dec 2024	J.S. Vink	How Heavy is the Most Massive Star	Seminar, University of Leeds, England	Research
09 Jan 2024	C.S. Jeffery	A Brief Tour of the Universe	Presbyterian Women's Association, First Presbyterian Church, Armagh, Armagh	Outreach
10 Jan 2024	M. McMahon	UNESCO	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
11 Jan 2024	J.S. Vink	Mass loss History of Very Massive Stars	Supermassive Stars Workshop, University of Geneva, Switzerland	Research

24 Jan 2024	Z. Gray	Placement in La Palma	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
25 Jan 2024	E. Higgins	Nucleosynthesis, Winds and Chemical Yields of Very Massive Stars	Seminar, Armagh Observatory and Planetarium, Armagh	Research
26 Jan 2024	C.S. Jeffery	Highlights from the SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Institute of Astronomy, Cambridge, England	Research
07 Feb 2024	L. Scott	Heavy Metal Stars	Irish Astronomical Association Seminar, Queen's University Belfast	Outreach
08 Feb 2024	A. Christou	Introduction to Orbital Motion	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
08 Feb 2024	J. Rigney	Radio Astronomy	Transition Year Workshop, Dunsink Observatory, Co Dublin, Ireland	Outreach
13 Feb 2024	J.S. Vink	Introduction	XShootU Virtual VII	Research
15 Feb 2024	S. Bagnulo	Night Time Astronomy	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
16 Feb 2024	M. Burton	The Director's Cut – The Lives of Stars	Armagh Planetarium, Armagh	Outreach
21 Feb 2024	M.E. Bailey	Using Kinesthetic Learning to Help Understand Our Place in Space: From Solar System to Near Universe	Irish Astronomical Association, Queen's University Belfast	Outreach
21 Feb 2024	C.S. Jeffery	Highlights from the SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	"Next Generation of Binary Population Synthesis Models for Hot Subdwarf Stars: Theory Meets Observations" Workshop, Bamberg, Germany	Research
22 Feb 2024	M. Burton	Our Galaxy: Gas, Dust and Surveys	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
22 Feb 2024	D. Eden	Molecular Clouds and Star Formation in the Milky Way	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
22 Feb 2024	M. Burton	Armagh, Birr and Dunsink: Research and Education Entwined with History and Heritage	Royal Geographical Society, Queen's University Belfast	Outreach
22 Feb 2024	Z. Gray	Careers in Astronomy (4 x talks)	W5, NI Science Festival, Belfast	Outreach
23 Feb 2024	Z. Gray	Careers in Astronomy (4 x talks)	W5, NI Science Festival, Belfast	Outreach
28 Feb 2024	L. Scott	Stars	Astrobytes, Armagh Observatory and Planetarium, Armagh	Internal Outreach
29 Feb 2024	J.S. Vink	Radiative Transfer and Stellar Winds, Massive Stars, Black Holes a GWs	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
04 Mar 2024	M.E. Bailey	Earth, Moon, and Space: From Planet Earth to the Stars	Carolside Primary School, Clarkston, East Renfrewshire, Scotland	Outreach
04 Mar 2024	M.E. Bailey	Earth, Moon, and Space: From Planet Earth to the Stars	Carolside Primary School, Clarkston, East Renfrewshire, Scotland	Outreach

05 Mar 2024	M.E. Bailey	Earth, Moon, and Space: From Planet Earth to the Stars	Carolside Primary School, Clarkston, East Renfrewshire, Scotland	Outreach
06 Mar 2024	J.S. Vink	Discussion Sample Selection	1st Binarity at LOw Metallicity (BLOeM) Collaboration Meeting, KU Leuven, Belgium	Research
07 Mar 2024	C.S. Jeffery	Topics in Stellar Pulsation	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
07 Mar 2024	J. Rigney	The Scale of Telescopes	Visitor Night, Dunsink Observatory, Co Dublin, Ireland	Outreach
09 Mar 2024	M. Burton	The Director's Cut – Scientific Instrument Society	Scientific Instrument Society Study Tour, Armagh Observatory and Planetarium, Armagh	Outreach
10 Mar 2024	C.J. Butler	The Armagh Observatory Weather and Climate Record	Scientific Instrument Society Study Tour, Armagh Observatory and Planetarium, Armagh	Research and Heritage Outreach
10 Mar 2024	J.S. Vink	Massive Star Science Goals, Importance of UV	Ulysses: Continuing the Voyage of Discovery Research, Space Telescope Science Institute, Baltimore, USA	Research
13 Mar 2024	D. Eden	What Causes Stars to Form?	University of Leeds, England	Research
14 Mar 2024	C.S. Jeffery	Highlights from the SALT Survey of Hydrogen-Deficient Stars and Hot Subdwarfs	Seminar, Armagh Observatory and Planetarium, Armagh	Research
14 Mar 2024	M. McMahon	The Imagined Planetarium - Building Armagh Planetarium 1937-1968	Armagh and District History Group, Armagh Observatory and Planetarium, Armagh	Outreach
14 Mar 2024	G. Ramsay	1. Super-flares from the Sun and other stars. 2. Multi-Messenger Astronomy and wide-field optical surveys	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
18 Mar 2024	M. Sarzi	St Patrick Green Day, Climate Change	Armagh Observatory and Planetarium, Armagh	Outreach
19 Mar 2024	K.O. Çubuk	Our Solar System	Ballycraig Primary School, Antrim, Co. Antrim	Outreach
19 Mar 2024	A. Philip Monai	Groups in the SALT Dample	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Armagh	Research
21 Mar 2024	M. Sarzi	Galaxy Formation and Evolution, The Use of Integral-Field Spectroscopy	Topics in Astrophysics, AOP/QUB PhD Programme, Armagh Observatory, Armagh	Research
22 Mar 2024	J. Rigney	Leviathan to I-Lofar	UL Conference for Undergraduate Women in Physics, Birr Castle, Co. Offaly, Ireland	Outreach
26 Mar 2024	C.S. Jeffery	Project Sirius	PhD Student Discussion Meeting, Armagh Observatory and Planetarium, Armagh	Teaching
26 Mar 2024	G. Ramsay	Activity on M dwarfs	BlackGem Consortium Meeting, Nijmegen, The Netherlands	Research
27 Mar 2024	K.O. Çubuk	The Distribution of Molecular Clouds Along the Southern Galactic Plane	Seminar, Armagh Observatory and Planetarium, Armagh	Research
29 Mar 2024	S. Bagnulo	Observations of Magnetic White Dwarfs	Current Challenges in the Physics of White Dwarfs Stars Conference, Santa Fe, USA	Research

Armagh Observatory and Planetarium

Education and Outreach: April 2023 – March 2024

Date	Event Description
Apr 2023 – Mar 2024	The Legendary Telescope Tours at Armagh Observatory
Apr 2023 – Mar 2024	Little Astronomers (Monthly)
Apr 2023 – Mar 2024	Our World from Space Club (Monthly)
April 2023 – Mar 2024	STEM Cadets Afterschools Club (Weekly)
5 May 2023	Orienteering the Cosmos – A Special Planetarium Show for the Orienteers attending the 2023 British Championships in Armagh
27 May 2023	2023 Robinson Lecture “From Mars to the Multiverse” by Professor Martin Rees, Astronomer Royal. Hosted by the Astronomical Observatories of Ireland at Armagh, Birr and Dunsink and held in Dunsink Observatory.
29 May 2023	Wee Critters – Interactive Animal Education
4 – 9 Jul 2023	Jurassic Arc – Interactive Workshop
11 – 16 Jul 2023	Bricks 4 Kidz Workshop
18 Jul 2023	First Light: 230 Years of Observatories in Armagh
18 – 23 Jul 2023	Planet Roar – Live Dinosaur Show
26 – 27 Jul 2023	The Ultimate Bubble Show – Live Science Show
15 – 17 Aug 2023	The Science of Dragons with Scientific Sue
3 Aug 2023	Bakineering in Space with Andrew Smyth
Jul – Aug 2023	DVL Summer Public Demonstrations Every Thursday in July and August
9 Sep 2023	Armagh Food and Cider Weekend 2023 Event. Planet Cookies
9 Sep 2023	European Heritage Open Day: Experience The Calver Telescope
12 Sep 2023	Conferences 2023 Public Lecture – The Exciting Lives of Double Stars with Dr Stephen Geier
1 Oct 2023	One Planet and the Universe. IAU 100 Hours of Astronomy Event.
13 Oct 2023	PhD Flash Talks at the Planetarium
18 Oct 2023	Rocket Routes: Navigating with Math with the AmmA Creative Learning Centre. Maths Week Workshop
21 Oct 2023	International Observe the Moon Day
27 Oct 2023	Stargazing Evening at Armagh Planetarium
30 – 31 Oct 2023	Tall Tales and Terror at Armagh Observatory
30 – 31 Oct 2023	The Witches Are Back – Live Show
23 Nov 2023	Stargazing Evening at Armagh Planetarium
25 Nov – 23 Dec 2023	Mission Santa
12 and 14 Dec 2023	Christmas Lecture Live Stream with the Royal Institution
24 – 25 Nov 2023	Armagh Georgian Festival: A Very Georgian Collection Tour
29 Dec 2023	Stargazing Evening at Armagh Planetarium
26 Jan 2024	Stargazing Evening at Armagh Planetarium
15 – 16 Feb 2024	NI Science Festival 2024 Event: Orienteering at the Planetarium
15 – 16 Feb 2024	NI Science Festival 2024 Event: Data Visualisation Laboratory
15 Feb 2024	NI Science Festival 2024 Event: Experience the Calver Dome
16 – 17 Feb 2024	NI Science Festival 2024 Event: The Ultimate Bubble Show
16 Feb 2024	NI Science Festival 2024 Event: Director's Cut – This Month in Astronomy

23 Feb 2024	NI Science Festival 2024 Event: Little Astronomers
23 – 24 Feb 2024	NI Science Festival 2024 Event: Pink Floyd Dome Show
23 Feb 2024	NI Science Festival 2024 Event: Stargazing Evening
24 Feb 2024	NI Science Festival 2024 Event: Legendary Telescopes Tour
24 Feb 2024	NI Science Festival 2024 Event: Our World from Space Family Club
25 Feb 2024	NI Science Festival 2024 Event: CapCom Go – Dome Show
15 Mar 2024	Stargazing Evening at Armagh Planetarium

Armagh Observatory and Planetarium

Intergalactic Craic Podcasts: April 2023 – March 2024

Date	Podcast Title
21 Apr 2023	S3Ep3 – Wee Bitta Craic: Bout Ye Ethan?
26 May 2023	S3Ep4 – Wee Bitta Craic: Bout Ye Alice?
16 Jun 2023	S3Ep5 – Craic with all these moons?
27 Oct 2023	S3Ep6 – Intergalactic Craic On The Road

Presenters: H Alexander, E Wince, A Humpage and Z Gray

All published via anchor.fm/intergalacticcraic

See also: <https://podcasters.spotify.com/pod/show/intergalacticcraic>

THE CERTIFICATE AND REPORT OF THE COMPTROLLER AND AUDITOR GENERAL TO THE NORTHERN IRELAND ASSEMBLY

Opinion on financial statements

I certify that I have audited the financial statements of the Armagh Observatory and Planetarium for the year ended 31 March 2024 under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995. The financial statements comprise: the Statement of Financial Activities, the Balance Sheet, the Cash Flow Statement; and the related notes including significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom accounting standards including Financial Reporting Standard (FRS) 102, the Financial Reporting Standard applicable in the UK and Republic of Ireland (United Kingdom Generally Accepted Accounting Practice).

I have also audited the information in the Trustees' Annual Report that is described in that report as having been audited.

In my opinion the financial statements:

- give a true and fair view of the state of Armagh Observatory and Planetarium's affairs as at 31 March 2024 and of its total incoming resources and expenditure of resources for the year then ended;
- have been properly prepared in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102); and
- have been properly prepared in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995 and Department for Communities directions issued thereunder.

Opinion on regularity

In my opinion, in all material respects the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Basis for opinions

I conducted my audit in accordance with International Standards on Auditing (ISAs) (UK), applicable law and Practice Note 10 'Audit of Financial Statements and Regularity of Public Sector Bodies in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of my certificate.

My staff and I are independent of Armagh Observatory and Planetarium in accordance with the ethical requirements that are relevant to my audit of the financial statements in the UK, including the Financial Reporting Council's Ethical Standard, and have fulfilled our other ethical responsibilities in accordance with these requirements.

I believe that the audit evidence obtained is sufficient and appropriate to provide a basis for my opinions.

Conclusions relating to going concern

In auditing the financial statements, I have concluded that Armagh Observatory and Planetarium's use of the going concern basis of accounting in the preparation of the financial statements is appropriate.

Based on the work I have performed, I have not identified any material uncertainties relating to events or conditions that, individually or collectively, may cast significant doubt on the Armagh Observatory and Planetarium's ability to continue as a going concern for a period of at least twelve months from when the financial statements are authorised for issue.

The going concern basis of accounting for Armagh Observatory and Planetarium is adopted in consideration of the requirements set out in the Government Financial Reporting Manual, which require entities to adopt the going concern basis of accounting in the preparation of the financial statements where it anticipated that the services which they provide will continue into the future.

My responsibilities and the responsibilities of the Trustees and the Accounting Officer with respect to going concern are described in the relevant sections of this certificate.

Other Information

The other information comprises the information included in the Trustees' annual report other than the financial statements, the parts of the Trustees' Report described in that report as having been audited, and my audit certificate and report. The Trustees and the Accounting Officer are responsible for the other information included in the annual report. My opinion on the financial statements does not cover the other information and except to the extent otherwise explicitly stated in my certificate, I do not express any form of assurance conclusion thereon.

My responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or my knowledge obtained in the audit or otherwise appears to be materially misstated. If I identify such material inconsistencies or apparent material misstatements, I am required to determine whether this gives rise to a material misstatement in the financial statements themselves. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact.

I have nothing to report in this regard.

Opinion on other matters

In my opinion based on the work undertaken in the course of the audit:

- the parts of the Trustees' Report have been properly prepared in accordance with Department for Communities directions made under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995; and
- the information given in the Trustees' Annual Report for the financial year for which the financial statements are prepared is consistent with the financial statements.

Matters on which I report by exception

In the light of the knowledge and understanding of the Armagh Observatory and Planetarium and its environment obtained in the course of the audit, I have not identified material misstatements in the Trustees' Annual Report.

I have nothing to report in respect of the following matters which I report to you if, in my opinion:

- adequate accounting records have not been kept; or
- the financial statements and the parts of the Trustees' Report to be audited are not in agreement with the accounting records; or
- certain disclosures of remuneration specified by the Government Financial Report Manual are not made; or
- I have not received all of the information and explanations I require for my audit; or
- the Governance Statement does not reflect compliance with the Department of Finance's guidance.

Responsibilities of the Board of Governors and Accounting Officer for the financial statements

As explained more fully in the Statement of the Governors and Accounting Officer Responsibilities, the Governors and the Accounting Officer are responsible for:

- the preparation of the financial statements and for being satisfied that they give a true and fair view;
- ensuring such internal controls are in place as deemed necessary to enable the preparation of financial statements to be free from material misstatement, whether due to fraud or error;
- ensuring the Trustees' Annual Report, which includes the Remuneration and Staff Report, is prepared in accordance with the Government Financial Reporting Manual;
- assessing the Armagh Observatory and Planetarium's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Trustees and Accounting Officer anticipates that the services provided by Armagh Observatory and Planetarium will not continue to be provided in the future.

Auditor's responsibilities for the audit of the financial statements

My responsibility is to examine, certify and report on the financial statements in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

My objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error and to issue a certificate that includes my opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

I design procedures in line with my responsibilities, outlined above, to detect material misstatements in respect of non-compliance with laws and regulation, including fraud.

My procedures included:

- obtaining an understanding of the legal and regulatory framework applicable to the Armagh Observatory and Planetarium through discussion with management and application of extensive public sector accountability knowledge. The key laws and regulations I considered included the Armagh Observatory and Planetarium (Northern Ireland) Order 1995;
- making enquires of management and those charged with governance on Armagh Observatory and Planetarium's compliance with laws and regulations;
- making enquiries of internal audit, management and those charged with governance as to susceptibility to irregularity and fraud, their assessment of the risk of material misstatement due to fraud and irregularity, and their knowledge of actual, suspected and alleged fraud and irregularity;
- completing risk assessment procedures to assess the susceptibility of Armagh Observatory and Planetarium's financial statements to material misstatement, including how fraud might occur. This included, but was not limited to, an engagement director led engagement team discussion on fraud to identify particular areas, transaction streams and business practices that may be susceptible to material misstatement due to fraud. As part of this discussion, I identified potential for fraud in the following areas: revenue recognition and posting of unusual journals;

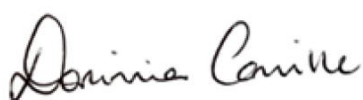
- engagement director oversight to ensure the engagement team collectively had the appropriate competence, capabilities and skills to identify or recognise non-compliance with the applicable legal and regulatory framework throughout the audit;
- documenting and evaluating the design and implementation of internal controls in place to mitigate risk of material misstatement due to fraud and non-compliance with laws and regulations;
- designing audit procedures to address specific laws and regulations which the engagement team considered to have a direct material effect on the financial statements in terms of misstatement and irregularity, including fraud. These audit procedures included, but were not limited to, reading board and committee minutes, and agreeing financial statement disclosures to underlying supporting documentation and approvals as appropriate; and
- addressing the risk of fraud as a result of management override of controls by:
 - performing analytical procedures to identify unusual or unexpected relationships or movements;
 - testing journal entries to identify potential anomalies, and inappropriate or unauthorised adjustments;
 - assessing whether judgements and other assumptions made in determining accounting estimates were indicative of potential bias; and
 - investigating significant or unusual transactions made outside of the normal course of business.

A further description of my responsibilities for the audit of the financial statements is located on the Financial Reporting Council's website www.frc.org.uk/auditorsresponsibilities. This description forms part of my certificate.

In addition, I am required to obtain evidence sufficient to give reasonable assurance that the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Report

I have no observations to make on these financial statements.



Dorinnia Carville
 Comptroller and Auditor General
 Northern Ireland Audit Office
 106 University Street
 BELFAST
 BT7 1EU

29 October 2024

The Armagh Observatory and Planetarium

Northern Ireland - Charity number 103948

Annual return

ARMAGH OBSERVATORY AND PLANETARIUM

THE CERTIFICATE AND REPORT OF THE COMPTROLLER AND AUDITOR GENERAL TO THE NORTHERN IRELAND ASSEMBLY

Opinion on financial statements

I certify that I have audited the financial statements of the Armagh Observatory and Planetarium for the year ended 31 March 2024 under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995. The financial statements comprise: the Statement of Financial Activities, the Balance Sheet, the Cash Flow Statement; and the related notes including significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom accounting standards including Financial Reporting Standard (FRS) 102, the Financial Reporting Standard applicable in the UK and Republic of Ireland (United Kingdom Generally Accepted Accounting Practice).

I have also audited the information in the Trustees' Annual Report that is described in that report as having been audited.

In my opinion the financial statements:

- give a true and fair view of the state of Armagh Observatory and Planetarium's affairs as at 31 March 2024 and of its total incoming resources and expenditure of resources for the year then ended;
- have been properly prepared in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102); and
- have been properly prepared in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995 and Department for Communities directions issued thereunder.

Opinion on regularity

In my opinion, in all material respects the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Basis for opinions

I conducted my audit in accordance with International Standards on Auditing (ISAs) (UK), applicable law and Practice Note 10 'Audit of Financial Statements and Regularity of Public Sector Bodies in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of my certificate.

My staff and I are independent of Armagh Observatory and Planetarium in accordance with the ethical requirements that are relevant to my audit of the financial statements in the UK, including the Financial Reporting Council's Ethical Standard, and have fulfilled our other ethical responsibilities in accordance with these requirements.

I believe that the audit evidence obtained is sufficient and appropriate to provide a basis for my opinions.

Conclusions relating to going concern

In auditing the financial statements, I have concluded that Armagh Observatory and Planetarium's use of the going concern basis of accounting in the preparation of the financial statements is appropriate.

Based on the work I have performed, I have not identified any material uncertainties relating to events or conditions that, individually or collectively, may cast significant doubt on the Armagh Observatory and Planetarium's ability to continue as a going concern for a period of at least twelve months from when the financial statements are authorised for issue.

The going concern basis of accounting for Armagh Observatory and Planetarium is adopted in consideration of the requirements set out in the Government Financial Reporting Manual, which require entities to adopt the going concern basis of accounting in the preparation of the financial statements where it anticipated that the services which they provide will continue into the future.

My responsibilities and the responsibilities of the Trustees and the Accounting Officer with respect to going concern are described in the relevant sections of this certificate.

Other Information

The other information comprises the information included in the Trustees' annual report other than the financial statements, the parts of the Trustees' Report described in that report as having been audited, and my audit certificate and report. The Trustees and the Accounting Officer are responsible for the other information included in the annual report. My opinion on the financial statements does not cover the other information and except to the extent otherwise explicitly stated in my certificate, I do not express any form of assurance conclusion thereon.

My responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or my knowledge obtained in the audit or otherwise appears to be materially misstated. If I identify such material inconsistencies or apparent material misstatements, I am required to determine whether this gives rise to a material misstatement in the financial statements themselves. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact.

I have nothing to report in this regard.

Opinion on other matters

In my opinion based on the work undertaken in the course of the audit:

- the parts of the Trustees' Report have been properly prepared in accordance with Department for Communities directions made under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995; and
- the information given in the Trustees' Annual Report for the financial year for which the financial statements are prepared is consistent with the financial statements.

Matters on which I report by exception

In the light of the knowledge and understanding of the Armagh Observatory and Planetarium and its environment obtained in the course of the audit, I have not identified material misstatements in the Trustees' Annual Report.

I have nothing to report in respect of the following matters which I report to you if, in my opinion:

- adequate accounting records have not been kept; or
- the financial statements and the parts of the Trustees' Report to be audited are not in agreement with the accounting records; or
- certain disclosures of remuneration specified by the Government Financial Report Manual are not made; or
- I have not received all of the information and explanations I require for my audit; or
- the Governance Statement does not reflect compliance with the Department of Finance's guidance.

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- the preparation of the financial statements and for being satisfied that they give a true and fair view;
- ensuring such internal controls are in place as deemed necessary to enable the preparation of financial statements to be free from material misstatement, whether due to fraud or error;
- ensuring the Trustees' Annual Report, which includes the Remuneration and Staff Report, is prepared in accordance with the Government Financial Reporting Manual;
- assessing the Armagh Observatory and Planetarium's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Trustees and Accounting Officer anticipates that the services provided by Armagh Observatory and Planetarium will not continue to be provided in the future.

Auditor's responsibilities for the audit of the financial statements

My responsibility is to examine, certify and report on the financial statements in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

My objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error and to issue a certificate that includes my opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

I design procedures in line with my responsibilities, outlined above, to detect material misstatements in respect of non-compliance with laws and regulation, including fraud.

My procedures included:

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- making enquires of management and those charged with governance on Armagh Observatory and Planetarium's compliance with laws and regulations;
- making enquiries of internal audit, management and those charged with governance as to susceptibility to irregularity and fraud, their assessment of the risk of material misstatement due to fraud and irregularity, and their knowledge of actual, suspected and alleged fraud and irregularity;
- completing risk assessment procedures to assess the susceptibility of Armagh Observatory and Planetarium's financial statements to material misstatement, including how fraud might occur. This included, but was not limited to, an engagement director led engagement team discussion on fraud to identify particular areas, transaction streams and business practices that may be susceptible to material misstatement due to fraud. As part of this discussion, I identified potential for fraud in the following areas: revenue recognition and posting of unusual journals;

- engagement director oversight to ensure the engagement team collectively had the appropriate competence, capabilities and skills to identify or recognise non-compliance with the applicable legal and regulatory framework throughout the audit;
- documenting and evaluating the design and implementation of internal controls in place to mitigate risk of material misstatement due to fraud and non-compliance with laws and regulations;
- designing audit procedures to address specific laws and regulations which the engagement team considered to have a direct material effect on the financial statements in terms of misstatement and irregularity, including fraud. These audit procedures included, but were not limited to, reading board and committee minutes, and agreeing financial statement disclosures to underlying supporting documentation and approvals as appropriate; and
- addressing the risk of fraud as a result of management override of controls by:
 - performing analytical procedures to identify unusual or unexpected relationships or movements;
 - testing journal entries to identify potential anomalies, and inappropriate or unauthorised adjustments;
 - assessing whether judgements and other assumptions made in determining accounting estimates were indicative of potential bias; and
 - investigating significant or unusual transactions made outside of the normal course of business.

A further description of my responsibilities for the audit of the financial statements is located on the Financial Reporting Council's website www.frc.org.uk/auditorsresponsibilities. This description forms part of my certificate.

In addition, I am required to obtain evidence sufficient to give reasonable assurance that the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Report

I have no observations to make on these financial statements.



Dorinnia Carville
 Comptroller and Auditor General
 Northern Ireland Audit Office
 106 University Street
 BELFAST
 BT7 1EU

29 October 2024

Accounts

Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2023

Laid before the Northern Ireland Assembly

under clause 8 of The Armagh Observatory and Planetarium (Northern Ireland) Order 1995,

as amended by Schedule 1, clause 6 of the Audit and Accountability (Northern Ireland)

Order 2003, by the Department for Communities

on

31 October 2023

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Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2023

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The Trustees' Annual Report for the year ended 31 March 2023

The Board of Governors, who are the Trustees for Armagh Observatory and Planetarium (AOP) has pleasure in presenting its annual report and financial statements for this charity for the year ended 31 March 2023. These financial statements have been prepared in accordance with the accounting policies set out in note 1 to the accounts, with the guidance issued by the Department of Finance on the form and contents of the Annual Reports and Accounts of Executive Non-Departmental Public Bodies, *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* and Accounting and Reporting by Charities: Statement of Recommended Practice (SORP) applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102). The Remuneration and Staff report is prepared in accordance with direction set out in The Government Financial Reporting Manual (FRM) 2022-23.

The sponsor Department for Armagh Observatory and Planetarium is the Department for Communities (DfC) (the Department).

Background to Charitable Status

Historically the Armagh Observatory and the Armagh Planetarium were treated as being distinct institutions; being two component divisions of a single statutory corporation and arms-length body (ALB), 'The Governors of The Armagh Observatory and Planetarium' as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled 'An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever', and an Amendment ('The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938').

The principal function of the Armagh Observatory, founded in 1789 as part of Archbishop Richard Robinson's vision to see the creation of a university in the City of Armagh, is to undertake original research of a world-class academic standard that broadens and expands our understanding of astronomy and related sciences.

The Armagh Planetarium was founded by Dr Eric Mervyn Lindsay, the seventh director of the Armagh Observatory, and was officially opened on 1 May 1968. The Planetarium's primary activity is to disseminate scientific and technical knowledge of a wide range of science, technology, engineering, arts and mathematics (STEAM) subjects, and to promote public understanding of astronomy and science through its programme of educational services for schools and the wider public.

From 1 April 2016 the Charity Commission for Northern Ireland registered *The Governors of The Armagh Observatory and Planetarium*, (changed to *The Armagh Observatory and Planetarium* in 2023) as a charity under reference number NIC 103948.

Objectives and Activities

The organisation's statutory functions are set out at Article 4 of *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. The Order requires that '*the Governors shall, for the purpose of developing and improving the knowledge, appreciation and practice of astronomy and related sciences, maintain and manage the Armagh Observatory and Planetarium and may take such other action as the Governors may think proper for the purpose of acquiring or disseminating knowledge relating to astronomy and related sciences*'.

In accordance with Paragraph 8(1) of Schedule 1 of *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*, the Armagh Observatory and Planetarium (AOP) Board of Governors has delegated the primary responsibility for the governance and management of AOP to a Management Committee with the statutory purpose of 'developing and improving the knowledge, appreciation and practice of astronomy and related sciences'.

The AOP Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department for Communities (our sponsor Department) and approved by the Minister and for promoting the efficient, economic and effective use of resources.

As the primary responsibility for the governance and management of AOP has been delegated to a Management Committee, the Governors consider the role of Charity Trustees would more appropriately align with their remit too. The Board of Governors has agreed in principle to this and discussions are currently ongoing with the Charity Commission of Northern Ireland to progress.

Armagh Observatory is the oldest scientific institution in Northern Ireland, and the longest continuously operating astronomical research institute in the UK and Ireland. Armagh Planetarium is also the oldest operating planetarium in the UK and Ireland.

Our Mission:

“Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.”

Our Vision:

“Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.”

The organisation operates on the international stage and is underpinned by core funding from the Department and the receipt of external grants from the UK Science and Technology Facilities Council (STFC), and other grant-awarding bodies.

A Strategic Plan for 2021-26 was launched in September 2021 and this is now being implemented. The strategy is built around four strategic themes – Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

As at 31 March 2023, there were 27.4 full time equivalent permanent employees which comprised approximately one-third Research, one-third Education and one-third Corporate. Additionally there were 5.4 full time equivalent temporary employees, some of whom were engaged on short term temporary projects. AOP also employs a number of casual staff on an ad hoc basis to meet operational needs. In addition, there is an Emeritus Director, an Emeritus Research Astronomer and 12 external research associates and academic visitors.

Public Benefits

The Trustees confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2023. This is demonstrated in the following summary of Principal Activities which provides detail on how the organisation has delivered against its objectives and the public benefit which has flowed from this.

Principal Activities

Impact of Brexit

Some issues have been encountered with recruiting European nationals, claiming certain European research grants and importing some goods from Great Britain. EU residents now need to apply for a visa and pay a healthcare surcharge to live in the UK. For Post Doctoral Research Assistants (PDRAs) funded by the Science & Technology Facilities Council (STFC) such visa costs can be charged to the grant, but it is still unclear if a similar support can be offered to PhD students. UK Research and Innovation (UKRI) is presently reviewing their position in this respect, as STFC studentships are no longer restricted only to UK residents. Despite these issues, so far the United Kingdom exit from the European Union has had no significant impact on the overall operation of AOP.

Introduction to AOP Research and its International Standing

AOP is one of the oldest scientific research institutes in the UK and Ireland with a long-established reputation of research excellence. It is also one of very few astronomical institutions in the world to have a modern planetarium through which its research can be effectively communicated and where a research-informed outreach and public engagement activity can be sustained.

AOP is engaged in front-line research in several key areas of astrophysics. These range from the study of our Sun and the Solar System to that of distant galaxies, in keeping with the long and varied history of scientific achievements of the Armagh Observatory and with the desire to be perceived by the public as leaders in all strands of astronomical research that are communicated through the Planetarium.

Around a third of AOP research is funded by the award of project-specific external grants mainly from the STFC, together with several ad hoc grants. These grants support projects led by individual research astronomers with the provision of PhD scholarships, post-doctoral research assistant salaries, computing equipment and observation/conference travel funding. Early in 2021 AOP researchers secured two new STFC grants providing funding for additional Post-Doctoral Research Assistants (PDRAs) plus salary staff contribution and estate costs until March 2024, which adds up to similar funding secured early in 2020 and that is already funding a third PDRA until July 2023.

AOP research also requires the use of state-of-the-art observing and computing facilities internationally in order to obtain new astronomical data and allow their analysis. STFC and UK government support provides access to world-class international facilities, and AOP research staff regularly win telescope time on some of the best and most sought-after telescopes in the world such as the European Southern Observatory (ESO) Very Large Telescope (VLT) or the Hubble Space Telescope (HST).

In addition, through the AOP's membership of the UK SALT Consortium, its research staff have access to the 11-metre diameter Southern African Large Telescope (SALT). Similarly, AOP is also a founder member of the international consortia involved with the Gravitational-wave Optical Transient Observer (GOTO) project, a member of the UK consortia involved in building the detectors for Inouye Solar Telescope (IST), LOFAR (Low Frequency Array (DKIST) radio telescope project and a consortium member of the Cherenkov Telescope Array (CTA) gamma-ray observatory. In early 2022, AOP was also able to join the BlackGem International consortium, which has built telescopes on La Silla in Chile. Like GOTO, its prime goal is the detection of the optical counterpart of gravitational wave events. Compared to GOTO, BlackGem has a smaller field of view, but is able to go deeper and fainter. The two surveys are therefore highly complementary in their reach.

These facilities can be extremely expensive to run (e.g. the running cost of one observing night at VLT is about £16,000 and a mid-size observing program with HST would be ten times more) so that through the award of their use, the international astronomical community essentially entrusts AOP to make effective use of the data. On average AOP researchers secure telescope time corresponding to a value of around £250,000 per year.

AOP research staff also play a full role in the international astronomical community. For instance, they serve on committees of bodies such as the Royal Astronomical Society, the UK Science and Technology Facilities Council, the International Astronomical Union (IAU, with three commission vice-presidents and two former presidents), ESO and Transiting Exoplanet Survey Satellite (TESS) time allocation panels, assess grant and research proposals on behalf of external funding agencies, review scientific papers and edit international academic journals, and act as external PhD examiners in the UK and beyond. AOP researchers also sit on scientific advisory panels or lead specific projects with future ground-based observing facilities (Vera Rubin Observatory, ELT-METIS, VLT-BlueMUSE), space satellites and missions (ESA's future Plato and Comet Interceptor missions) and large-scale surveys (MOONs).

This financial year has also seen AOP submitting six STFC grant applications for PDRA funding starting in April 2024, which will support all of AOP's current line of research and also bringing AOP staff salary contributions and estate costs. This is the first time since 2020 that AOP could apply for such a major source of funding, with AOP being one of the first UK institutions to participate in the newly remodelled STFC grant scheme that effectively replaces the previous consolidated grant, allowing researchers in practice to apply for grants every two years instead of every three years.

Research Highlights

To provide a practical understanding of how the work of AOP research contributes to the region's international reputation and understanding of the cosmos, the following provides some highlights of the research undertaken at AOP in the past financial year. This draws from international collaborations and the award of observing time on highly competitive facilities, as well as direct support from the Department allowing AOP to participate in several key international projects (such as SALT, GOTO, IST, I-LOFAR, Comet Interceptor, CTA and BlackGem). Full bibliographic references can be found in the publication list appended to this report.

Stellar and Galaxy Evolution

Introduction

When we look up on a dark night, we may think that stars are immutable and isolated. Yet, although stars can live for as long as the age of the Universe, they can also undergo dramatic changes in matter of seconds. They are also not isolated from other stars. Some are found in pairs or tight groups and more generally stars are related to each other through the very way in which they form and evolve. Stars are indeed born from giant clouds of gas and return matter to those clouds, seeding the birth of new stars as they fade away or sometimes explode in dramatic events. Furthermore, stars produce the heavy elements necessary for the formation of rocky planets and of life as we know it.

In turn, the formation history of stars relates to the formation and evolution of the galaxies that contain them. Some galaxies indeed no longer appear to form stars, unlike the case of the Milky Way. This may depend on whether fresh gas is available around them, on whether they have collided with other galaxies in the past or possibly also on whether their central supermassive black hole suddenly becomes active and pours out tremendous amounts of energy capable of clearing its host galaxy of any star-forming gas material. Finally, galaxies are carried by the

general expansion of the Universe and the evolution of the dominant, yet unknown dark-matter material in which they themselves are embedded. Understanding the formation and evolutions of stars and galaxies therefore ultimately means understanding our origin in relation to the very fabric of the Universe.

Recent results

AOP stellar studies range from the most massive and brightest young stars to the faintest and ageing stars or stellar remnants such as white dwarfs and black holes.

The research in the group of Professor Jorick Vink is both theoretical and observational and is supported by STFC grants run in collaboration with Keele and York Universities. The theoretical work focuses on understanding of the formation of the heaviest stars and stellar black holes in the Universe. These stars are up to 10 million times brighter than the Sun. Key science questions involve the production of pair instability supernovae, where the entire star is disrupted, and one such event enriching galaxies with more heavy elements than all the lower mass stars combined. Recent papers lead by Vink's student Gautham Sabhahit and post-doctoral assistant Dr Erin Higgins uncovered that the most massive stars in our Milky Way evaporate entirely due to strong wind mass loss (*Higgins et al. 2022; Sabhahit et al. 2022*). On the observational side, Vink is leading an ESO-VLT Large Programme called XShooting ULLYSES (XShooting) with a team of 100 massive stars experts from around the globe trying to understand the stellar and mass-loss properties of massive star in pristine low-metallicity environments of the Large and Small Magellanic Clouds. These environments provide a key stepping stone to understand the very first stars in the distant Universe, which were likely very massive. In collaboration with Dr Jonathan Mackey and others, an IAU Symposium with over 200 participants was organised in Ballyconnell in County Cavan with the Topic: "Massive stars Near & Far".

The vast majority of stars will end their life as a "white dwarf", a very compact object with a mass comparable to that of the Sun but a size similar to that of the Earth. Stefano Bagnulo and AOP visiting astronomer John Landstreet are investigating the reasons why many white dwarfs possess a magnetic field, sometime much stronger than anything that could be produced in an Earth laboratory. They have concluded that whereas most white dwarfs are very rarely magnetic when they are young but become magnetic as they get old, the rare class of ultra-massive white dwarfs are magnetic since the very beginning of their formation (*Bagnulo & Landstreet 2022*). Bagnulo & Landstreet have also offered some explanations for the physical origin of the magnetic field and are continuing their studies thanks also to the award of more than 100 hours of time with the VLT in Chile and several more hours of telescope time at smaller telescopes. Bagnulo is capitalising on the impact of his research by the organisation of a 4-week workshop in Garching (Germany) on stellar magnetic fields at the Munich Institute for Astro and Particle Physics (<https://www.munich-iapp.de/magnetic-fields>, MIAPP) in October 2023 and will provide logistic support and funding for the participation of up to 45 researchers from all over the world.

Linking to external galaxies, Marc Sarzi has effectively concluded his survey of galaxies in the Fornax cluster producing studies that also relates directly to our understanding the latest stages of stellar evolution, publishing a comprehensive report of the use of the considerable amount of VLT telescope time (107h) that went into this project in the ESO messenger journal (*Sarzi & Iodice 2022*). In particular, the last stages of this collaboration saw a particularly important investigation into the properties of thin stellar disks in cluster galaxies, including those that are not immediately visible in images, but which are revealed only after a careful modelling of maps for the average motions and metal abundance (e.g. *Poci et al. 2022*). In this respect, AOP student Pablo Galan de Anta investigated how the interactions with other galaxies would affect such disks, potentially destroying them. For this he used large-scale cosmological simulations, showing that indeed such state-of-the-art models do not fully reproduce the properties of galaxies in Fornax-like clusters (*Galan de Anta et al. 2022*) suggesting, in particular, that numerical spurious effect may still affect such state-of-the-art simulations.

Finally, closer to home, Professor Michael Burton advanced our detailed understanding of the interstellar medium of the Milky Way that is in turn our closest laboratory for understanding the formation of stars (*Roueff, Burton, Geballe & Abgrall 2023*). His work relates to his previous discovery of Hydrogen molecules in clouds of shocked gas in interstellar space that are at temperatures of around 5,000 degrees celsius. This is much higher than it was expected that such molecules could exist at. The discovery closes one mystery about how interstellar shock waves work but opens another about how the gas can get so hot and yet the molecules survive? The original discovery was made using the 8m Gemini telescope in Hawaii, with which Michael Burton and his colleague Tom Geballe measured two, extremely weak, high excitation infrared lines of the hydrogen molecule observed in a source known as Herbig Haro 7 (or HH7), a supersonic jet of gas coming from a newly forming star. These two lines remained unidentified until through correspondence with Evelynne Roueff in Paris it was realised that they came from energy levels lying above the hydrogen molecule's dissociation energy. Indeed, Evelynne had predicted the existence of such lines arising from quasi-stable levels that in classical physics should not exist, which is why Burton and Geballe could not understand the presence of such weak lines in the Gemini spectra. Yet, their detection provides clear evidence that the molecular gas must be dissociating, which led to the speculation that the very existence of ultra-hot, 5,000-degree molecular gas implies the constant formation of freshly formed hydrogen molecules.

This work is also close to the research of AOP's Öpik fellow, Dr David Eden who, by using the data from multiple James Clerk Maxwell Telescope (JCMT) Large Programs (a facility that AOP is a partner of), is investigating the

causes of star formation in the Milky Way and across the entire Universe. The first step to this is to determine on what scale the regulation of the star formation process is occurring. Previous work by Eden has identified that the regulation is on the scales of individual molecular clouds. As a result, the focus was placed on the individual molecular clouds in a large sample obtained from CHIMPS (CO Heterodyne Inner Milky Way Plane Survey). In *Rani, Moore, Eden & Rigby (2022)*, the star-formation efficiency was compared to the mode of turbulence, i.e., the driving force of the movement of the gas in these clouds, and it was determined that the star-formation efficiency increased if the turbulence was more compressive or collapsing, as opposed to solenoidal or swirling. The ramifications of this result are that simulations of astronomical systems need to take this into account when modelling star formation and shifts the focus on to the molecular cloud formation mechanisms as where the star-formation efficiency of a system is set.

The role of SALT

The South African Large Telescope (SALT) is the largest telescope in the Southern Hemisphere, providing unparalleled access to the skies for its shareholders, of whom AOP through its membership of the UK SALT consortium is one. Participation in this major international facility brings visibility throughout the worldwide research community and allows AOP and just a few other UK universities to engage in collaborations with other SALT international partners. In turn, through such partnerships, AOP receives a return in terms of telescope time allocation that is equivalent to roughly 10 times its contribution. In 2022 alone, over 230 AOP unique astronomical observations have been made, targeting some of the most exotic stars in the Universe. These contribute to a growing series of discovery papers and to the training of postgraduate research students at AOP. Participation in SALT also allows AOP to explore opportunities through the SALT Collateral Benefits Programme to develop links between local schools in Northern Ireland and in South Africa. AOP carries out the administration function for the UK SALT consortium, which includes four other academic partners – Keele University, Open University, University of Central Lancashire and University of Southampton.



The 10-metre diameter South African Large Telescope (SALT), in the semi-desert region of the Karoo, South Africa.

Using SALT, Simon Jeffery leads a survey of chemically peculiar subdwarf stars in the southern sky. These are stars that are in the final stages of their lives but their histories from birth to the present are very diverse. By exploring the abundances of key elements such as hydrogen, helium, carbon, oxygen, and iron, and of exotic elements such as lead and zirconium, these histories and internal physics can be explored. These AOP-led SALT observations have already led to a first data-release and are now building towards the second data-release, including classifications, coarse analyses and kinematics for nearly 400 hydrogen-deficient hot subdwarfs. A treasure trove of data for exotic stars is yielding exciting new discoveries. For instance, the hot subdwarfs BPS CS 22940-0009 and EC 20187-4939 are linked objects connecting extreme helium stars with hot subdwarfs (*Snowdon et al. 2022, Scott et al. 2023*). The survey has also discovered even more exotic stars – eight super-hot white dwarfs and pre-white dwarfs with surface temperatures between 100,000 and 200,000 degrees (*Jeffery et al. 2023*). Jorick Vink and a team of international astronomers are using SALT to study the long-term polarised light from the most famous Luminous Blue Variable Eta Carina, which is quite possibly the most massive star in the Milky Way. Thanks also to AOP's contribution SALT will continue to develop its instrumentation, and the introduction of a new near-infrared spectrograph will facilitate the study of star formation processes in nearby galaxies, with Sarzi already obtaining time to study star-forming galaxies in Fornax later in 2023. SALT has also proved essential in determining the nature of several short period binaries identified in the OmegaWhite Survey of the Galactic plane which set out to discover AM CVn binaries which can have orbital periods as short as 5 mins. Many were found to be short period pulsators, including four of the newly discovered class of Blue Luminous Variables (BLAPs), but one object was found to be a rare binary with an orbital period of 74 min containing a hot sdB star and a white dwarf (*Ramsay et al 2022*).

Transient and Periodic Variable Stars

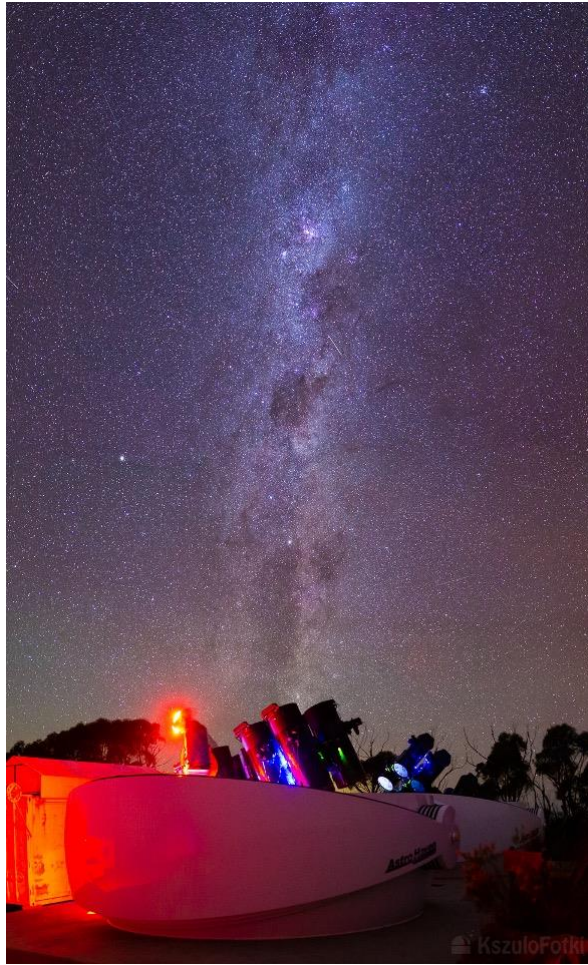
Introduction

Apart from the bright planets and the occasional comet, the night sky might appear to be unchanging, with stars being the same brightness and in the same place as they always are. However, astronomers from the ancient world detected new stars, “novae” or “supernovae”, which suddenly appeared in the night sky and then gradually faded from view over weeks or months. We now know that these “transient” events occur when one star circling a companion star unloads enough matter through the process of “accretion” to its companion to make it explode. Supernovae have now been used to show the universe is expanding. Other “variable stars” were first detected in the early 17th century when a star now called “Mira” was observed to change in its brightness on a timescale of nearly a year. We now know that Mira is a star several hundred times as large as the Sun, and contracts and expands in size over this “period” of one year. In fact, practically all stars are variable at some level. However, in many cases its only recently astronomers have been able to detect this variability.

By studying the brightness of stars in detail we can test physical models which are put forward to explain the observed behaviour. However, the diversity of variable stars requires different observing strategies. Explosive events can be extremely rare and short-lived, so that in order just to catch their initial rise to outburst it is necessary to observe the entire sky every night. On the other hand, targeted monitoring lasting many months is necessary to unravel the minute vibrations of Sun-like stars. Simon Jeffery and Gavin Ramsay have been using data from the Kepler and TESS satellites to better understand both the interior of stars and the accretion process. Further, Armagh astronomers have access to the GOTO and BlackGem telescopes (more of which below) which are used for many research areas especially transient sources.

Recent results

In the study of periodic phenomena, long continuous monitoring with extremely high accuracy has proved necessary to discover the signals due to exoplanets, star spots and gentle vibrations present in or around many stars. For these, space craft are essential to overcome poor weather and day light, with Kepler/K2 (NASA 2000-2018), TESS (NASA 2018-ongoing) and Plato (ESA, from 2026) being pivotal missions. Using TESS has discovered that the unseen companion stars in the four known hydrogen-deficient binaries all show a similar signature, either of a surface inhomogeneity or a low-order non-radial pulsation (*Jeffery 2023*). Using TESS data, Gavin Ramsay analysed optical data of 23 High Mass X-ray Binaries which contain a giant star and either a neutron star or Black Hole. His team found that all showed quasi-periodic behaviour on a timescale shorter than 1 day which typical of giant stars which are not in a binary. They also found evidence of two rare outbursts and showed the pulsation behaviour changed over the outburst (*Ramsay, Hakala & Charles 2022*). In another paper using TESS data the accretion flow in the magnetic accreting binary BY Cam was mapped as the flow rotated around the magnetic field of the white dwarf (*Mason et al 2022*). V652 Herculis is a large-amplitude pulsating extreme helium with a period of 0.1d and a significant shock at minimum radius (*Jeffery et al. 2015*). Simon Jeffery has developed new non-linear hydrodynamic models of the interior to show that a shock is generated whenever the pulsation amplitude is sufficiently large, and this is related to the luminosity of the star and its internal opacity (*Jeffery et al. 2022*). He has combined these hydro models with a radiative transfer code to model the time-varying spectrum of V652 Herculis, and to demonstrate how different parts of the star’s spectrum can be used to explore the behaviour of the shock as it travels through the stellar atmosphere (*Jeffery 2022*).



The new southern node of the Gravitational-wave Optical Transient Observer (GOTO) at Siding Spring Observatory, Australia (credit: Krzysztof Ulaczyk, University of Warwick).

AOP became a founding partner of the international project the *Gravitational-wave Optical Transient Observer* (GOTO) through a successful bid for funds from the Department of Culture, Arts and Leisure in January 2015. Its prime goal is to detect the optical counterpart of gravitational wave events such as the neutron star binary merger GW170817. The prototype GOTO node of telescopes was built in 2017 on the summit of the island of La Palma in the Canaries, which is one of the world's best sites to observe the night sky (Steeghs *et al* 2022). Early in 2020 GOTO was awarded £3.2m by STFC to allow a second node to be built on La Palma and two nodes in Australia which were installed in the first quarter of 2023. GOTO is now able to image the whole observable sky every few nights and is ready for the next gravitational wave observation run made by Ligo, Virgo and Kagara which is due to start late April 2023.

Using GOTO and other all-sky optical survey data, PhD student Chris Duffy investigated the long-term optical behaviour of a group of strongly magnetic cataclysmic variables called polars (Duffy *et al* 2022). Some of these systems can experience rapid fades in brightness which is due to the flow from the low mass star onto the more massive white dwarf. Different scenarios for why this happens were examined. This is just one example of the science which will be done using GOTO data over the years ahead which will include transients such as supernovae; galactic accreting binaries; pulsating variable stars and stars showing activity. Gavin Ramsay chairs the GOTO Executive Board that oversees and manages the project, including the development of the Australian node and the preparation of the next funding bid to STFC.

Solar Physics and Stellar Flares

Introduction

Aurora, or Northern Lights in the northern hemisphere, were seen over much of the UK and Ireland in the first few months of 2023. The link between aurora and flares from the Sun date back to Richard Carrington who observed a white light flare on the Sun from England in 1859, which was followed by aurora only 18 hours later that were recorded in Armagh. We now know that flares are caused by regions of strong magnetic activity on the Sun whose intensity

varies over the course of around 12 years. Although one of the wonders of the natural world, these auroral storms can also cause disruption to human activity: in 1989 the electricity grid in Canada was disrupted by a flare causing widespread blackouts. More recently, in February 2022, a solar storm caused 40 newly launched Starlink satellites to prematurely enter the Earth's atmosphere costing up to \$20m. The first flares from stars other than the Sun were seen from low-mass dwarf stars nearly a century ago. With space missions such as Kepler and TESS which can study many stars continuously for many days or months, we can now study flares from many types of stars which can be used to help us determine how often the Sun can release intense flares.

Solar Physics

Solar Physics at AOP is led by Leverhulme Emeritus Fellow Gerry Doyle who supervises final year PhD student Nived Vilangot Nhalii. In recent work, they report on properties of rapidly moving jets of plasma (called spicules) above the Sun's photosphere (its visible 'surface') with observations obtained with the highest time resolution using the CRisp Imaging Spectro-Polarimeter (CRISP) mounted on the Swedish 1m Solar Telescope on La Palma together with simultaneous observations made using Solar Dynamics Observatory satellite (*Nived et al 2022*). Nived found that at any one moment in time, there are nearly a million of these spicules on the Sun. It remains to be seen whether they are a significant heating source for the outer atmosphere of the Sun (the corona).

Stellar Flares

Gavin Ramsay and Gerry Doyle continue to study flares from low-mass stars and Solar type stars. We now know that many stars can produce flares which can be hundreds of times greater than events from the Sun. Over the last few years, we have found a population of very rapidly rotating low mass stars which appear to be flare inactive. Since we expect rapidly rotating stars to be very active this is a great surprise. Areas which we are pursuing include examining their emission in the ultra-violet; making more sensitive and rapid observations in the blue and examining specific spectral features. For instance, observations of a sample using the SAAO 1.9m telescope in South Africa revealed that one star show evidence of emission lines which appear to come and go. However, further investigations are continuing. Observations of the active star YZ CMi using Ultraspec on the Thai 2.4m national telescope revealed quasi periodic pulsations which allowed us to determine the size of the coronal loops which produced the flares. This gives insight to how flares are generated more generally.

The role of I-LOFAR



The Irish LOW Frequency ARray station (I-LOFAR) in Birr Castle, County Offaly (left) and a map of Europe showing all the various nodes of the LOFAR network (right).

The LOFAR (LOW Frequency ARray) array observes the sky at low frequency radio waves and is therefore complementary with the Square Kilometre Array being built in South Africa and Australia which observes at higher radio frequencies. In 2016 AOP joined I-LOFAR, the Irish consortium which now includes nine partners, through capital funding from DCAL. The Irish station at Birr Castle links up with stations in ten European countries and strengthens Irish North-South collaboration and the more recent formal links made between AOP, Dunsink Observatory and Birr. It is a prime example of 'big-data' science with all stations in Europe being recently upgraded to LOFAR 2.0 which allows faster data transfer and more rapid data reduction.

In collaboration with colleagues in Dublin Institute for Advanced Studies (DIAS), Gavin Ramsay and Gerry Doyle supervise Jeremy Rigney (the Lindsay studentship) who is using data from I-LOFAR and the full LOFAR array to study flares and outbursts from low mass stars and intense radio storms from the Sun. Rigney used radio observations made using the ASKAP array in Australia to study stars which were also being observed at the same time using the TESS satellite. By making the radio and optical observations simultaneously can reveal the physical processes at work. The resulting paper, *Rigney et al (2022)*, showed that four low mass stars were detected at radio wavelengths with two of them having shown very strong circular polarisation. These results give insight to what

causes the radio emission and the physical nature of their environment. Rigney is now analysing radio data obtained using I-LOFAR of an intense solar storm in May 2022.

Solar System Studies

Introduction

Our Solar System is an extraordinary natural laboratory to study the formation and evolution of planetary systems around the Sun and other stars. Our work here feeds into fundamental questions about how the Solar System and the Earth formed and the development of life in the Universe. Our study of comets, asteroids and planets impacts on models of solar system formation, the ever-present hazard to civilization if asteroids or comets hit our planet and on the origin of water and organic compounds necessary for life to exist. The space industry benefits from improved detailed knowledge and understanding of the near-Earth and interplanetary environment.

Recent results

Apostolos Christou reports on the ongoing investigation of small asteroids in Earth-like orbits, the so-called co-orbitals. These are among the most accessible targets for deep space exploration with some being easier to reach than the Moon, yet very little is otherwise known about them. Christou has been collaborating with Dr Galin Borisov, formerly a PDRA at AOP and now an Associate Professor at the Bulgarian National Astronomical Observatory (NAO), to observe the co-orbitals at every available opportunity and ascertain their physical properties. This programme continues to benefit from a standing agreement between AOP and NAO that grants Armagh researchers access to the 2m RCC telescope at Rozhen. A recent paper (*Borisov et al., 2023*) reports on observations of four co-orbital targets, monitoring their brightness over time to constrain their shape and spin rate. The largest asteroid in the study was Minor Planet (138175), an object smaller than a kilometre across. Our analysis shows a rotation period of ~14 hours during which the asteroid brightness changes by more than 50%, suggesting an elongated or bi-lobed "dumbbell" shape. Another asteroid, 2017 SL16, is roughly similar in size to the Observatory or Planetarium main buildings. Our observations show an extremely short rotation period of only 19 minutes, suggesting an internally cohesive asteroid like solid rock, as a strengthless agglomerate held together by gravity alone would have readily spun itself apart.

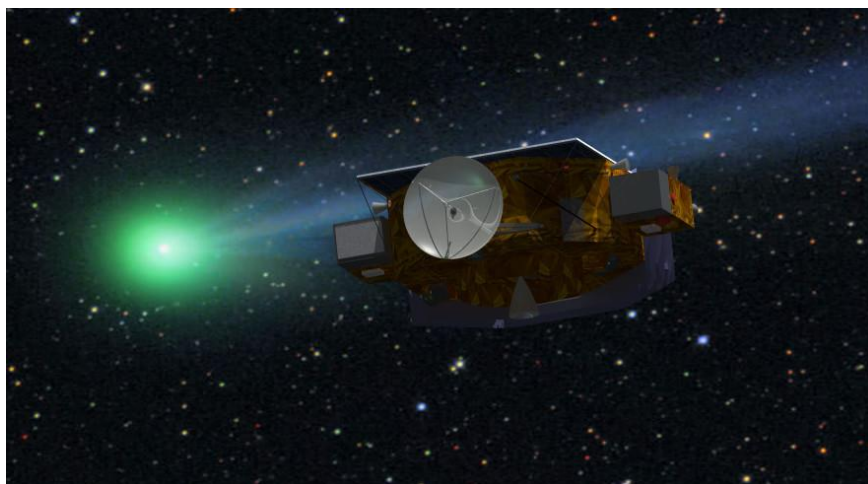
Christou is collaborating with Prof Stanley Dermott (U. Florida at Gainesville, FL, USA) and Dr Dan Li (NSF NOIRLab, Tucson, AZ, USA) to determine the origin of meteorites such as those currently on display in the Planetarium building exhibition area. Scientists examine meteorites in the laboratory to understand how planets like the Earth came together 4 billion years ago. Most meteorites arrive on our planet from a belt of asteroids between Mars and Jupiter. The processes that remove them from the belt and deliver them to Earth are still active today and can be studied through the current distribution of asteroids as a starting point. A recent paper in MNRAS (*Christou et al, 2022*) describes a new numerical method to precisely measure the meteorite removal rate at a given location. Mapping this quantity across the belt in future work will allow us to identify the most likely parent asteroids and source regions of meteorites.

Christou further reports the completion of a term of service within the Vera C. Rubin Early Career Prize selection committee under the Division of Dynamical Astronomy (or DDA) of the American Astronomical Society. Named after one of the most influential figures in 20th century astronomy and a strong advocate for the participation of women in science, this prestigious award recognises work by outstanding and impactful early career international researchers in Dynamical Astronomy or closely related fields. The roster of Rubin prize candidates is considered the "Top Gun" equivalent of Dynamical Astronomy professionals worldwide and, with only one Prize winner to select from a cadre of excellent candidates, the selection committee usually has their work cut out for them. Christou began his three-year term of service in the Spring of 2021 as the world was slowly coming out of lockdown conditions in response to the COVID pandemic. In 2023 Christou assumed the duties of committee Chair, being responsible for co-ordinating the work of committee members in selecting the winning nomination. With the selection process now successfully completed, the 2023 Rubin Prize winner is to be announced during the 54th Annual Meeting of the DDA to be held between 8-12 May at Michigan State University, USA.

Stefano Bagnulo and his PhD student Zuri Gray secured telescope time at the ESO VLT to study the consequences of the impact of Double Asteroid Redirection Test (DART), a planetary defence mission to test a method of deflecting an asteroid on course to hit Earth. DART arrived at near-Earth asteroid Didymos on September 26 2022. The spacecraft crashed into the asteroid's small moon Dimorphos, testing whether the kinetic impactor technique works. Because of the impact, dust clouds were ejected from Dimorphos, which was studied by Bagnulo and Gray from ground-based telescopes using polarimetric techniques (*Bagnulo, Gray & Granvik 2023*). Their work formulated two distinct scenarios for the formation of the dust on the surface of the impacted asteroid and has attracted international interest including through an official ESO press release.

Finally, AOP work on our Solar system links also to extra-solar planetary systems and in particular to the ESA's Plato mission, which is due to be launched towards the end of 2026, has a prime goal of identifying Earth sized planets around Solar type stars in its habitable zone. Gavin Ramsay is one of two ESA Plato Community Scientists and member of the Science Working Team. At the start of the mission, Plato will point at one particular area of the sky covering 2,250 square degrees for at least two years. Identifying the location of this field will be critical to the success of the mission and a final decision will be decided by the Science Working Team in June 2023.

The COMET INTERCEPTOR Space Mission



Artist impression of COMET INTERCEPTOR Space Mission

The European Space Agency (ESA) recently approved a space mission to encounter a comet coming from the edge of our Solar System; the launch is expected in 2028. A novel idea sets this mission apart. So far, spacecraft have approached comets that are already well known and have gone around the Sun already several times. Therefore, it is very likely that the comet material has been “processed” by solar radiation and the space environment, and it is no longer in pristine condition. By contrast, here we are interested in comets on their first trip around the Sun, made of unprocessed material preserved in the cold outer parts of the solar system. To achieve the goal of visiting such a new comet, the spacecraft will be launched before the comet is found and will wait in deep space for instructions. Once a suitable target comet is found, instructions will be sent from the ground to guide the spacecraft to the comet (hence the name **Comet Interceptor**). Studying the material brought for the first time to the heat and light of the Sun will give us the opportunity to look at the solar system as it was when it formed. AOP is contributing to the development of the instrument that will send to Earth comet images (including polarimetric images) obtained with a fish-eye lens. Stefano Bagnulo is an expert in polarimetric observations and is one of the co-Investigators of the project, and his PhD student Zuri Gray is also involved in the mission team. Most recently, Bagnulo has officially become co-I of the EnVisS instrument on-board Comet Interceptor, and member of the Comet Interceptor “Near Environment” working group. He has participated to the second CI Working Group meeting at the European Space Research and Technology Centre in March 2023.

Education and Community Outreach

Planetarium

AOP is a special place that brings together fundamental research and public curiosity about the nature of the cosmos, all within a heritage environment that is rich in scientific history. Four pillars underlie and support the public programme of AOP - education, inspiration, entertainment and outreach. The Planetarium was established in 1968 and is world-renowned as an innovative centre of excellence in promoting the public understanding of science.

At the Planetarium, the primary activity is the education and the dissemination of scientific and astronomical knowledge. The Planetarium also promotes an understanding of astronomy and science to a large audience base of all ages, from nursery to seniors via a school's educational programme and science offering to the wider public through both onsite and outreach means.

This year we achieved record-breaking numbers of 72,000 visitors to AOP. This was largely due to a very successful summer event “Brickosaurs” which consisted of an exhibition of a range of large-scale LEGO brick dinosaur models. The models were housed in an outdoor marquee during June/July 2022 with dinosaur activities and dome shows themed around the event. Credit to the education team who worked tirelessly to ensure that this was a success, each playing their role with Senior Education Officer Ria Mee overseeing the logistics of the event.

This year has seen us experiment with live music in the dome through orchestras which are detailed in the highlights

section below. This is a new use for the dome, and one in which provides a very unique venue and indeed selling point. We also utilised the dome to livestream the Artemis rocket launch. Although the first launch was abandoned, we had a full dome audience ready to witness history in Fulldome format. The second planned launch was set for 5.30am, and thus we ran a staff event where we streamed the live launch. This was a very unique and historic event, and one in which shows the power of Planetarium technology for a full immersion experience.

During 2021-22 we had changed our operational model to reflect the growing need to open at the weekends and our hours of opening changed from Monday-Saturday to Tuesday-Sunday and this has continued into 2022-23. This has also helped our non-school audience grow.

Towards the end of the 2022-23 financial year our school visitors reached the same level as they had been at pre-pandemic which is very encouraging, and our school bookings are very healthy going forward. Careers events continued with a partnership with School Employer Connections with Operations Manager Helen McLoughlin continuing to drive and deliver this element of our outreach.

Half-way through the year we changed our focus on outreach and with a dedicated Tours and Outreach Officer we explored the demand for offsite dome visits. This has proved to be a popular and worthwhile venture with Dr. Rok Nežič leading the delivery of the programme. Included were visits to schools, youth group organisations, Ulster University, Marble Arch Caves event, special schools and council festivals. With a new electric van, Rok has been increasing our outreach visibility which is having a positive impact on our bricks and mortar visitors with customers coming back for a fulldome show visit. We also partnered with the Royal Institution (RI) to conduct outreach on their behalf to secondary schools which has been a popular and worthwhile partnership, opening more opportunities to work with the RI and it has increased our outreach visibility.

Accessibility was a focus in 2022-23 ensuring that we have a place that is a "space for all". We introduced Makaton inclusion this year at the Planetarium as well as having Level 1 British Sign Language (BSL) and Irish Sign Language (ISL) translators. Our popular dome show "CapCom Go" was filmed in both BSL and ISL as well as Irish and Ulster Scots with the help of the DfC translation department. We also provided a BSL and ISL translation of our live Christmas experience "Mission Santa". Monthly relaxed-dome show sessions are now standard in our programme as well as relaxed event sessions for workshops. We have also renewed our JAM (Just A Minute) Card registration with all front-line staff JAM Card trained. This year we also set up a youth forum giving children with autism the opportunity to lead and show us what they need in order to make a successful visit to AOP. They have been driving change and they have been working on developing ideas for items such as sensory bags, sensory maps and increasing awareness of our accessibility through our website. This was made possible through an Association of Science and Discovery Centres (ASDC) Bold Futures fund for which we also set a target to increase our reach of special schools through outreach. We were getting an engagement level of 8% of special schools in previous years. By the end of March 2023, we had already increased that to a 35% engagement level.

During this year we were successful in some education and outreach funding bids as well as advertising bids. To note are the Tourism NI (TNI) marketing bids in which we received funding per season to help promote AOP. This funding has helped us to reach different audiences and grow our annual visitor figures. We also applied and were successful in an Association of Science and Discovery Centre's (ADSC) bid through "Bold Futures" for which the programme is listed above. Through the IAU we got seed funding to pilot an afterschool's programme which Education Officer Nick Parke is taking the lead to organise. Missions and Mindsets was a small funding bid that resulted in AOP joining a fully funded learning programme with the opportunity next year to apply for further programme funding.

Through our marketing activities we have produced a steady stream of good news stories from AOP, including highlighting the research we conduct, job roles throughout the organisation and promoting a visit to AOP.

We also participated in providing work experience for a Stranmillis College student which was a rich and valued learning experience.

Towards the end of the year, we installed two Astropark trails after successfully applying for TNI Experience funding. Following a successful tendering exercise, we developed a new kids Eco trail with a workbook, sculptures, clues and an augmented reality (AR) app around the grounds. There is also an adult app focusing on a tour of the grounds and Observatory. A lot of work across the organisation went into this new experience over the last year and these outdoor trails have already increased dwell time and been popular with visitors and locals. We aim to officially launch these trails in the new financial year.

Highlights from AOP's Programme of Events in 2022-23

In April we had our first official live music event in the new dome when the Southern Regional College music department performed a live musical rendition of the "Our Place in the Cosmos" soundtrack.

In May, Helen McLoughlin and Ria Mee brought the outreach dome to the Slieve Russell Hotel in county Cavan for the Massive Stars IAU conference and held both a schools and public event, our first outreach event since the start of the pandemic. A new climate temporary exhibition was launched this month also in Copernicus Hall.

June 2022 saw the introduction of Brickosaurs, after a two-year wait due to the pandemic. The install took place on week beginning 6 June with a marquee erected to house the dinosaurs. The exhibition opened to the public on June 11.

July was all about Brickosaurs. Over 17,000 people came to see the exhibition in July which surpasses any previous month's visitors on record. Adrian Dunbar came by for a visit to film for his new Channel 5 show as well.

In August we began presentations in our new Digital Visualisation Lab (DVL) which were very well received. Armagh Library held story time at AOP and we went to the library with our experiments from the Big Book of Experiments and Bright Ideas. The big event was the Artemis live streaming event in the dome - a first in terms of a live launch screened in the dome around the world. Although the launch was scrubbed, AOP received positive PR from the event through numerous BBC Newsline pieces and both online and newspaper articles. We also held our first concert in the dome with the Sligo Baroque Orchestra "The Music and Astronomy of William Herschel - Celebrating 200 years". The event was fully booked and we will want to replicate the success again in the future, merging live music with imagery on our dome.

In September, Rushmere Shopping Centre hired our outreach dome to give shoppers a unique experience. We also had stands at four local Southern Regional College campuses for freshers week. Members of the team attended the British Association of Planetaria (BAP) conference in Leicester and ASDC conference in Glasgow. The big event this month was the Observatories Network Conference which was a huge success and showcased the organisation using both the Planetarium and Observatory for conferencing opportunities.

October kicked off with a PhD Saturday where students planned workshops and delivered talks in our hall. For Space Week we delivered afternoon visual reality sessions where visitors got the chance to put on a headset and learn about climate change. An online careers event saw 340 secondary school pupils learn all about astronomy as a career. Interesting events that month also included a Bat Walk, the Partial Solar Eclipse event, the return of Startrackers. We had Tall Tales and Terror in the Observatory, Spooky Space in the Planetarium with some potions and explosions, DVL demos and Infrared talks.

November saw the Armaghi People of the Year Awards launch event. Rok Nežič visited Cavan, Laois and Dublin, and began outreach visits as part of the Royal Institution partnership. We had sold-out tours of the Observatory as part of the Georgian Day events in Armagh. "Our Place in the Cosmos" was featured at the Fulldome Film Festival in Plymouth. For Mission Santa, we held accessible sessions this month in BSL which were well received. Our second orchestra concert in the dome took place "Thus she shall go to the stars" featuring the work of astronomer Agnes Clerke. AOP's Erin Higgins worked with Senior Education Officer Ria Mee to put together some of the event which was screened on the dome.

December continued with sold-out Mission Santa dates and a trial of providing sessions for schools. We included sensory sessions, BSL and ISL interpreted events and engaged with community groups and special units in schools. We were involved with the Royal Institution Christmas Lectures and hope to build upon this for next year.

February half-term was very successful for AOP with sold-out dome shows and events. Events included DVL sessions, careers events and Lego Brick workshops. A GCSE Day was held this month where multiple schools came to enjoy a dome show, workshop and walk to the Observatory. The Armaghi Awards were held in the Copernicus Hall this month with 100 people in attendance.

March brought the launch of the Irish language translated "CapCom Go" with the help of the DfC translation department, Southern Regional College in Armagh, National Space Centre Leicester and Aonach Mhacha. We began our Bold Futures project which has been funded by ASDC. Outreach has been taking place at special schools and our youth forum met at the end of March to give us feedback and ideas on our programming and to create sensory bags and maps for us. Two trails have been installed around the grounds - a kids Eco trail with workbook and AR app and a more adult tour of the Astropark and Observatory.

History and Heritage

History & Heritage Policy

AOP boasts a collection of over thirty-one thousand historic documents, rare and antiquarian books, scientific instruments and photographs. This collection is unique on the Island of Ireland and one of the best-preserved observatory collections in the United Kingdom. The heritage policies that have been implemented ensure that the collection is cared for in accordance with best practice and has allowed ongoing historical research.

During 2022-23 the Observatory has continued to be open to the public for the 'Legendary Telescope Tour' package, which has been well received. The eMuseum has 485 objects available for public viewing on the Armagh.space website, with a goal of making 7,000 objects available by summer 2024. Since 2021-22, four new temporary exhibition cases have been filled in the Planetarium, with rotating displays. In addition, two new cases have been filled in the Planetarium Board Room.

In accordance with AOP's policy of making our collection available for the public and researchers to use we have continued to facilitate public information requests. The 2022-23 financial year brought 21 requests which were facilitated by the Museum Collections Officer. This is an increase of 7 requests over the 2021-22 year. In addition, AOP was host to the Observatory Networks Workshop Four, which was held in September 2022. This workshop saw the premier academics in the field of astronomical history gather in Armagh, and included sessions delivered by staff and students of AOP.

2022-23 introduced the second successful project supported by the National Lottery Heritage Fund. This project, 'Wisdom Begins With Wonder' is funded to run from May 2022 to June 2024 and has seen the successful implementation of a volunteer program. Since launching, the volunteer program has facilitated over one hundred hours of voluntary work in AOP, with more volunteers awaiting projects. The project has also funded the position of Museum Collections Officer from June 2022-May 2024, on a part time basis. This position is responsible for ongoing volunteer coordination, museum policy development, cataloguing and the facilitation of research requests.

In 2022-23 AOP was awarded Museum Accreditation by the Northern Ireland Museum Council and the Arts Council. This has been an objective of the Living Space Committee since 2019 and was successful thanks to the buy-in from across the organisation and the assistance of our Museum Mentor, Sean Barden, from the Armagh County Museum. The accreditation lasts for five years, at which point it will be reassessed. AOP has also been consulting with the Northern Ireland Museum Council on a wide range of ongoing challenges to the sector, and staff have attended four consultations and two training sessions. Since achieving Museum Accreditation, AOP has hosted visits from the Director of the Northern Ireland Museum Council twice.

AOP has also continued to publish historical research, and staff have been involved in a project to publish a book in conjunction with the International Planetarium Society. The team have also continued to provide access to the operated collection of historic scientific instruments. Over the winter observation period, four successful observation sessions were held with the Grubb 10-Inch telescope, and five staff and students were trained in its use. The Grubb 10-Inch and Calver telescopes have also undergone successful preventative conservation including the rebalancing of the Calver telescope and the removal and reattachment of the finder scopes.

Library & Archives

AOP's suite of technical equipment is complemented by a Library and Archives which, together, represent one of the premier specialist collections of their kind in the world. The Library, Archives and Historic Scientific Instruments collection contains a unique variety of historic books and manuscripts, images, photographic plates, scientific instruments, clocks and other artefacts concerning the development of modern astronomy from the Age of Enlightenment up to the present day with specific reference to the important discoveries and scientific contributions made by the international research community here at Armagh. The library also provides an essential reference resource for AOP research, and especially for its student and young researcher cohort. It contains approximately 3,400 textbooks, monographs, special reports, and conference proceedings covering nearly all disciplines in astronomy. Some 17,000 volumes from nearly 200 scientific journal titles include nearly complete runs of all the major astronomy journals, as well as journals of significant historical interest.

During 2022-23 the collection has been supplemented by approximately 20 new books on topics relevant to AOP research. Work continues on binding the backlog of unbound journals. Attention has been given to some of the more historical items, including the volumes of Nature from the 1890's and Popular Astronomy from the 1930's. A scoping audit of the remaining backlog has been carried out to inform future funding requirements.

Whilst still under enormous pressure for space, the AOP library is now an attractive space and a more effective research tool, with potential for further development and revenue generation, and increasingly demonstrating its potential for historical discovery as well as astronomical research.

Meteorological Record

As part of AOP's primary research role, staff and students take daily readings of a wide range of meteorological parameters at Armagh and maintain the Observatory's unique 228-year long meteorological record and databank. This is believed to be the longest daily climate series in the UK and Ireland from a single site (though the log book for the period June 1825 to December 1832 appears to have been lost), as well as being one of the longest in the world. The climate station has been continuously maintained since July 1795 with readings currently taken

every day at 09:00 (GMT). The World Meteorological Organisation (WMO) has recognised Armagh with Centennial Station status for its longevity and importance in contributing to the climate record.

Calibration of these data has enabled researchers and government agencies to use the Armagh series for reports and research into global warming. The data contributes to the UK Meteorological Office's main climate database and are released to the general public on a monthly basis through press releases and on our climate website (<http://www.climate.armagh.ac.uk/archives.html>) whilst also contributing to the UK Meteorological Office's main climate database.

Climate change is a subject of strategic importance for Northern Ireland as we move into an era of rapid climate variability, and the Armagh's unique climate record provides an exceptionally long historical baseline, enabling better informed judgements to be made as to how Northern Ireland's climate has responded and is responding to climate change world-wide. In order to inform the public about the impacts of climate change, AOP has introduced a movable exhibition on the subject into the Planetarium exhibition area in the Copernicus Hall. This is centred around an interactive Puffersphere presentation on climate change, together with supporting exhibits around the room which expand on local impacts. The exhibition has been designed to be readily mounted / demounted so that it can be moved and reassembled quickly when the Copernicus Hall is being used for other activities and events.

An automated weather station (AWS) was installed by the Met Office in 2019, sampling the weather every minute. This now provides the primary source of weather data in the Met Office records (e.g., temperature, pressure, rain fall, windspeed) since it is automatically uploaded to the Met Office. However, manual collection still continues, and provides the only source for some of the data collected (e.g. sunshine, grass temperature) at Armagh. We have now placed the measuring instruments inside a second Stevenson Screen within an expanded meteorological enclosure. This is to ensure that the AWS enclosure is identical to those used by the Met Office in their UK-wide network. In doing this we also changed the fencing around the weather station to make it less visually intrusive.

We developed a series of python scripts to store, analyse and provide access to the weather data base via the weather webpages. This includes both the manual data as well as the (recent) automated weather station data. Research Assistant Tom Watts wrote the necessary code. This takes the monthly observers log, provides a means of entering the information via an online log, and in addition automatically downloads the data received from the automated station, to ingest these data sets into a new database. Analysis scripts then allow this database to be interrogated, e.g. to find climate extrema over any date range of interest. This can then be examined from the website: <https://weather.armagh.space>. This includes enquiring about weather on any single day (as might be used in a visitor display in the Planetarium), as well as examining the data set over any period of interest and searching for climate records (extrema) over a period of interest. The automated weather station data is now also available to inspect online, in addition to the manual data. Plotting tools allow the user to see the weather over any time period, as well as to find when extrema in the various measured parameters occurred.

The Met Office changed their method of provision of data from the automated station to us in April. It is no longer sent it via a daily email digest. We have developed code to access this data direct from the Met Office repository. This has had the added benefit of AOP now being able to provide real time weather data (including conditions for the past 24 hours) for Armagh via our web pages (see <https://weather.armagh.space/aws-live.php>), including for visitors to the Planetarium.

The three new PhD students were trained in weather observations (Andrew Marshall-Lee, Asish Monai, Saskia Schlagenhauf), and then accredited as Level 1 Met Observers by the Director. This forms part of their PhD training in the techniques of scientific data measurement and analysis.

Information about the weather record in Armagh has now been transferred from the previous climate website (climate.armagh.ac.uk), updated, and had extensive new material added; see armagh.space/weather. This includes information about the history of the weather record, on the instruments used, the log book, and on publications. Rok Nežič has primarily compiled the material for these web pages.

On 18 July 2022 our manual station recorded a maximum temperature of at 31.2°C, the second hottest ever measured in Armagh (only exceeded by the 31.3°C on 22 July of the previous year). Record temperatures were measured across the UK during this period, notably exceeding 40°C in some locations in England on 19 July. The average temperature on 18 July in Armagh (the average of max and min values) was the highest ever recorded here, i.e. since 1844 when we starting recording min/max temperatures. Overall, 2022 was the warmest year ever recorded, with a mean daily temperature of 10.8°C (average of all max & min values across the year). The next two most-warmest years are 2007 (10.6°C) and 2021 (10.5°C).

In March 2023 our Met Station measured 140.5mm of precipitation, the highest March figure ever recorded since rainfall records began in 1838. November 2022 was also the sunniest November in Armagh for 98 years with 89.8 hours of sunshine, 50% higher than the long-term average.

Support

AOP is committed to ensuring fit for purpose governance and support services to support the delivery of organisational objectives.

Information and Communications Technology (ICT)

The comprehensive research computer facilities are used primarily for numerical analysis, computer modelling and data reduction. The computers and peripherals are largely funded by DfC, but occasionally by external research grants. Staff require access to high-end Apple Mac and Linux workstations. In addition to this, Corporate and Education is serviced within a Windows and Office 365 environment.

An ICT Strategy was approved in October 2022 and progress against the Action Plan's ongoing support commitments, continuous focus and short, medium and long-term activities are considered by the Audit and Risk Assurance Committee (ARAC) each quarter.

AOP continues to modernise and improved its centralised ICT hub. In 2022-23 all primary MacBook laptops and six compute servers were replaced.

AOP is continually implementing measures to improve its resilience against cyber security measures without disproportionately inhibiting the ICT requirements of researchers. An ICT Risk Assessment is reviewed quarterly and considered at ARAC. ARAC also receives received quarterly updates on implementation of patching and software updates.

Finance

AOP has a well-established finance function. Financial policies and procedures are continually being enhanced to ensure that the organisation meets the governance standards required. This includes the application of public sector procurement controls, meeting prompt payment targets and providing regular and ad hoc financial information within the organisation and to the Department.

AOP continues to experience significant cost pressures within a core budget that has remained static for 6 years. In 2022-23 it was able to mitigate this through an additional resource allocation and exceptional income from admissions and trading sales which greatly exceeded expectations.

Human Resources

A Human Resources Action Plan 2022-23 has been implemented to include:

- Maintaining a Fit for Purpose Organisation Structure – recruitment of 4 new staff; maintaining a pool of casual employees; preparation of new skills-gap paper; inclusion of succession planning questions in appraisal cycle; preparation of organisational planning report for 2023-24 Business Plan and budgeting process; identification of short term opportunities to plug skills gaps with short term projects or engagements and recruitment activity as required in-year;
- Continual review of Operating Models – implementation of formal hybrid working arrangements; monitoring and reporting on new arrangements; supporting Education Team Officers with employee working arrangements; review of staffing needs in context of budgets and affordability;
- Employing and Investing in Motivated and Engaged Staff – agree and implement actions arising from Staff Survey and engagement event; consideration of Concordat to support the career development of Researchers; supporting annual appraisal process; completing/revising a rolling training plan; review implementation of training plans in the context of available budget; prepare business case for special bonus scheme; conduct annual staff engagement survey; development of internal engagement plan; preparation for two significant engagement events; supporting the Health and Wellbeing of PhD students;
- Fair and Equitable Employment Policies and Procedures – completion of annual Fair Employment return; achievement of Bronze Diversity Mark Award; preparation of Project Juno Champion application; review of policies and induction and refresher training in policies.

A Human Resources Strategy 2022-26 has been developed and approved along with the Q1 Action Plan for 2023-24.

Diversity and Inclusion

AOP has an obligation under Section 75 of the Northern Ireland Act to ensure that equality of opportunity and good relations are central to policy making, policy implementation and review as well as service delivery. AOP monitor the composition of their workforce in terms of community background and sex and use an equal opportunities monitoring form questionnaire. AOP complete an annual Fair Employment Monitoring return to the Equality Commission detailing staff composition and that of job applicants to AOP posts.

In the AOP Strategic Plan 2021-26 we state that having Fair and Equitable Employment Policies and Procedures is one of our key elements in delivering high standards. AOP have a number of policies in place including an Equal Opportunities Policy.

AOP signed up for Diversity Mark Accreditation in December 2021, formally applied for the Bronze Award in July 2022 and was awarded the Bronze Award in November 2022. Three Equality, Diversity and Inclusion targets have been set as follows:

- To develop an Equality, Diversity and Inclusion Strategy;
- To increase the number of female research staff at AOP from 2 to 4; and
- To increase female representation on the AOP Management Committee from 3 to 5.

AOP achieved Juno Practitioner status in June 2019. This is an award scheme that recognises and rewards university physics departments, schools of physics, and related institutes and organisations that can demonstrate they have taken action to address gender equality at all levels and to foster a more inclusive working environment. We applied for Juno Champion status in April 2023. This application will involve satisfying the following 6 Juno Principles:

- Principle (1) Robust organisational framework - A robust organisational framework to deliver equality of opportunity and reward;
- Principle (2) Appointment and Selection - Appointment and selection processes and procedures that encourage men and women to apply for academic posts at all levels;
- Principle (3) Career Progression and Promotion - Departmental structures and systems that support and encourage the career progression and promotion of all staff and enable everyone to progress and continue in their careers;
- Principle (4) Open and Inclusive Culture - Departmental organisation, structure, management arrangements and culture that are open, inclusive and transparent, and encourage the participation of all staff;
- Principle (5) Flexible Working - Flexible approaches and provisions that enable individuals, at all career and life stages, to optimise their contribution to their department, their institution and to science, engineering and technology; and
- Principle (6) Professional Conduct - An environment where professional conduct is embedded into departmental culture and behaviour.

Governance

Governance and accountability continue to be strengthened and improved and risks reduced as demonstrated by external and internal audit reviews. Actions arising from effectiveness reviews undertaken by both ARAC and the Management Committee have also resulted in enhanced arrangements.

One outstanding Internal Audit recommendation, relating to Record Management, is currently being addressed. A retention and disposal schedule is awaiting consideration by the Public Record Office of Northern Ireland (PRONI). The organisation has moved towards paperless record management systems which will be easier to manage and control in accordance with the approved Retention and Disposal policy.

Estates Management

AOP manages an extensive estate which includes 9 separate buildings, including the Grade A listed Observatory and a circa 20-acre historic estate. There are also several leases associated with land and property.

During the year AOP has prepared an Outline Business Case (OBC) for redevelopment. AOP views this project as imperative to future proof its role into the next generation. The case for change is predicated by an estate that is outdated and misaligned to expectations of modern-day visitors and future opportunities. The OBC was approved by the Board of Governors in May 2023, and submitted to the Department for consideration.

NetZero

AOP's international research standing, and unique record of uninterrupted meteorological observations has allowed AOP to effectively communicate on the issue of climate change (CC) to the general public, in particular since the design and installation of a temporary exhibition in the Planetarium and through AOP's participation in 2021 at the COP26 conference in Glasgow. This has also prompted AOP to lead by example in the CC arena, in particular by joining the UK Government SME Climate Hub by committing to reduce by 50% its CO2 emission 2030.

As an initial step in this direction, DfC funding was granted to facilitate a carbon baselining exercise to capture both the present carbon footprint of AOP and to indicate a set of emission reduction measures (ERMs) that could

eventually half such a carbon footprint. This study indicated that the Planetarium building and its operation are the main source of both direct (e.g. through heating oil consumption) and indirect (e.g. by consuming electricity generated elsewhere) CO2 emission. Trying to reduce or optimise emission in the Planetarium should therefore be a priority, although in the long term a new and energy efficient building would be desirable. Meanwhile, it is the AOP grounds that offer the wider scope for reducing AOP's footprint either through green energy generation or the carbon offsetting through the planting of trees.

Moving in this direction, in the last financial year Department for the Economy (DfE) capital funding was obtained to change the internal lighting of the Bell building and the Planetarium based on more efficient LED technology and to install two green energy power generation stations based on wind and solar power on AOP grounds. While the latter will certainly not generate sufficient power to cover the need of the Planetarium, they will serve to illustrate the role that new technologies will play in harnessing even more efficiently the energy from winds and our Sun, thus adding to AOP's education offering. Finally, a NetZero committee with representative from all of AOP's main team, including also students, has been meeting regularly to discuss and implement additional ERMs and more generally good practice in terms of ecological sustainability.

Achievements and Performance

The targets set for AOP in the 2022-23 Business Plan are shown in the following table. Actual performance achieved is shown along with the corresponding achievement in the previous financial year, where applicable.

Targets were achieved or exceeded in many areas; however, there were 6 targets not met. Failure to meet a number of the missed targets is beyond AOP's control in that they are reliant upon external factors. In particular, capital funding is required to achieve Urban Night Sky Place accreditation; the joint development Masterplan project was dissolved in-year and it was anticipated that a major funding stream would be live to make application in pursuance of AOP's future development. Targets relating to school visitors and cosmic classroom events were not achieved due to a combination of the level of schools returning post-Covid and an increase in dome outreach. The objective of submitting an OBC for AOP's future development within one year was ambitious. Significant progress has been made, however, there has been slight slippage in the timeline.

KPI	Description	Target	As at 31 March 2023	As at 31 March 2022 (where applicable)	Comments
1	Attract 55,000 visitors (to include 43,000 public visitors and 12,000 school visitors)	55,000	Public 62,793	37,345	Bookings overall exceeding pre-pandemic levels. 2021-22 target affected by Covid-19.
			School 9,381	n/a	Total 72,174 visitors - School visitor target unachievable due to the level of schools returning.
2	Achieve £486,000 income from admissions and sales	£486,000	£570,851	£364,553	2021-22 target affected by Covid-19.
3	Achieve an 80% satisfaction rating of 4 or above out of 5	80%+ evaluation ratings ≥ 4	88.67%	93%	
4	Achieve 75 number bed nights from a collaboration with local accommodation providers	75	182	New KPI	
5	Deliver 2 new school programmes (ecology and GCSE)	2	2	New KPI	
6	Deliver 4 events focused on the work of astronomers and PhD students	4	7	New KPI	
7	Deliver 20 cosmic classroom events (10 paid and 10 free for schools with low educational achievement in STEM)	20	Paid 2	Paid 20	Paid - unachievable due to level of schools visiting and increase in dome outreach
			Free 11	Free 7	

KPI	Description	Target	As at 31 March 2023	As at 31 March 2022 (where applicable)	Comments
8	Press coverage: 15 positive press releases for print media 3 broadcast TV coverage	15 3	68 6	New KPI	
9	Deliver one pilot event to raise awareness of the Armagh-Birr-Dunsink partnership	1	1	New KPI	
10	Achieve recognition as an Urban Dark Sky Place			Unachievable	Capital funding required to deliver
11	Publish 50 articles in referenced scientific journals	50	85	67	
12	Scientific Outreach: 12 scientific talks at international conferences 12 public talks by scientists	12 12	39 43	New KPI	
13	Admit 3 new PhD students in October 2022	3	3	2	
14	Attract 8 number of external bookings for events or seminars	8	14	New KPI	
15	Facilitate 6 onsite scientific visits	6	26	New KPI	
16	Develop one non-astronomy partnership in the use of DVL facilities	1	1	New KPI	
17	Create 1 externally funded non-astronomy PhD	1	1	New KPI	
18	Create 2 new Puffersphere applications in house	2	2	New KPI	
19	Develop one new educational workshop using VR	1	1	New KPI	
20	Submit an OBC for AOP future development			New KPI	Slight slippage in the timeline. Submitted May 2023.
21	Secure outline planning approval for a joint development Masterplan in partnership with ABC Council			New KPI	KPI obsolete as joint development Masterplan project dissolved
22	Submit one major funding application in pursuance of AOP future development	1		12	It had been anticipated that PEACE PLUS would be live. An expression of interest was submitted.
23	Deliver 1 community/schools climate change event	1	3	9	
24	Achieve £320,000 funding from scientific sources to support AOP research	£320,815	£359,339	£420,000	Reduction in Covid-19 supplementary funding

Progress Key: **Complete**, **Not Achieved**

Financial Review

Operating Results

In the financial year to 31 March 2023, the value of charity funds increased by £2,111m, summarised below.

		2023	2022
		£	£
Total incoming resources		3,730,874	4,041,109
Total outgoing resources		(4,285,869)	(4,034,081)
Net income / (expenditure)		(554,995)	7,028
Gains on the revaluation of fixed assets		255,242	422,885
Actuarial gains on defined benefit pension scheme		2,411,000	1,534,000
Net movement in funds for the year		2,111,247	1,963,913
Movement in Unusable Funds			
Capital financing			
Capital grants received		549,000	1,254,000
Government grant fund		(858,746)	(828,152)
Revaluation reserve		1,904	185,428
Pension reserve		2,035,000	1,098,000
Movement in Usable Funds			
Restricted		(26,080)	(14,346)
Unrestricted		410,169	268,983
		2,111,247	1,963,913

The total income for the year was £3.731m, a decrease of £0.310m from 2021-22, mainly due to a decrease in DfC capital grant income of £0.705m, offset by increases in DfC Recurrent grant-in-aid of £0.160m, operating income of £0.163m and trading income of £0.065m.

Expenditure was £4.286m, an increase of £0.252m from the previous year. Staff costs continue to be the largest component of operational expenditure, comprising 62% of all direct costs.

Unrestricted operating costs are funded primarily by DfC grant-in-aid. The balance of such unrestricted operating costs is funded by contributions from external grants, operating income, trading activities and miscellaneous income. We continue to seek other funding streams to maintain this important source of funds. In 2022-23 the Department provided 71% of the total income through recurrent and capital grant allocations (2021-22: 79%).

Net Assets

Net assets at 31 March 2023 were £12.720m (31 March 2022: £10.609m).

Reserves

The AOP reserves policy is included in note 1 of the accounts. Total accumulated funds are as follows:

Funds at 31st March	2023	2022
	£	£
Restricted funds	148,028	174,108
Unrestricted funds	5,010,569	4,910,146
Revaluation Reserve	7,403,874	7,401,970
Pension Reserve	158,000	(1,877,000)
Total Charity Funds	12,720,471	10,609,224

Going Concern

The Trustees are satisfied that the organisation is a going concern on the basis that it has a reasonable expectation that it will continue in operation for the foreseeable future. The financial statements are therefore prepared on a going concern basis.

Pension Reserve

AOP is a member of Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) which manages Local Government Pension Scheme (LGPS) Northern Ireland, which in turn provides a defined benefits pension to employees. The scheme moved into surplus during the year and at 31 March 2023 the surplus was calculated by independent actuaries at £158,000 (2022: deficit £1,877,000). The assets, defined benefit obligation and current service cost shown in note 19 to the accounts have been calculated based on the data and results of the 2022 triennial actuarial valuation. AOP is able to recognise the surplus in full at this accounting date because we can gain an economic benefit from payment of reduced contributions below the cost of the expected FRS102 service costs in the future.

Key Risks and Uncertainties

At year end, the key risks were identified as:

- Reputation – loss of confidence in AOP's ability to deliver acceptable level of research of international value;
- Engagement:
 - Visitors – failure to provide experiences that attract new and returning visitors and/or failure to engage local pride in AOP as a cherished asset;
 - Partners and collaborators – failure to attract support and commitment from key stakeholders to be able to deliver future vision;
- Resources:
 - Staff - failure to maintain an appropriately skilled, highly motivated and engaged workforce of sufficient capacity to satisfactorily deliver AOP objectives;
 - Budget – insufficient or poor management of budget could result in objectives not being met and/or value for money not being achieved;
- Asset Management:
 - Buildings and Heritage – failure to plan for the long term development needs of the estate and assets resulting in increasing reliance on remedial intervention and failure to protect heritage assets from irreparable decline;
 - Other physical assets including ICT – failure to plan for the upkeep and renewal of plant and equipment resulting in reduced service delivery; and
- Governance and Planning:
 - Failure to embed best practice approaches to corporate governance and risk management resulting in loss of confidence and reputational damage and/or legal challenge;
 - Inadequate information/data security measures resulting in information breaches and/or cyber security breaches.

As part of the Risk Management Strategy, management regularly review the inherent level of risk for each of the above and how the risk is currently managed. An Action Plan is documented to reduce the level of risk, mindful of the risk appetite of the organisation. This Risk Register is reviewed on a quarterly basis by the Audit and Risk Assurance Committee and approved by the Management Committee. Many of the above risks derive from the uncertainty around funding. Until AOP has both a budget appropriate to its needs and long-term security of funding, this situation is likely to continue. In managing these funding risks, the organisation has developed and maintained close communication links with the Department and submitted in-year monitoring bids for additional funding while carefully monitoring spend and budgets. For many of the above risks all reasonable steps within AOP's control are being taken to manage the risk.

The above risks also take account of recommendations from internal and external audit investigations and reports. Significant progress has been made in addressing the weaknesses identified in previous years and considerable effort has been put into the management of these risks going forward.

Plans for Future Periods

In October 2021, AOP published a new Strategy for 2021-26 with four key themes of Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

Leading on from this AOP has prepared a Business Plan for 2023-24 for consideration by the Department. The business plan has been developed in the context of an unclear and uncertain, political and financial environment, however AOP remains focused and optimistic towards continued achievements within its key priority areas.

AOP, in conjunction with Dublin Institute of Advanced Studies, Dunsink Observatory, and Birr Science and Heritage Foundation, have embarked since September 2022 on a formal strategic process to develop an inter-institutional partnership for mutual benefit. This takes place in acknowledgement of the potential for strengthening the partner institutions' collaborative working capacity and for wider impact on a transboundary basis. This also includes taking into account a context of emerging opportunities for strengthening the long-standing north-south connections between Armagh, Dunsink and Birr in a way which maintains the integrity of each partner's core mission, and promotes the intrinsic value of scientific knowledge and heritage represented by the body of work carried out over the three sites since their establishment and ongoing. This will continue to be a key area of work in 2023-24 and will include submission of an application for consideration to be included in the Republic of Ireland Tentative List for UNESCO World Heritage Status as a transnational bid.

Following on from completion of a draft Outline Business Case for future development AOP will continue to work with partners and stakeholders to identify funding opportunities and other resources to move the project forward to the next phase of planning.

Structure, Governance and Management

Armagh Observatory and Planetarium is a single statutory corporation and arms-length body (ALB). ‘The Governors of The Armagh Observatory and Planetarium’ are as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*.

This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled ‘*An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever*’, and an Amendment of 1938 (‘The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938’).

AOP is a registered charity under the title “The Armagh Observatory And Planetarium”.

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one Department nominee;
- one Queen’s University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

The Armagh Observatory and Planetarium (Northern Ireland) Order 1995 (the Order) places a statutory duty on “the Governors of Armagh Observatory and Planetarium” to maintain and manage AOP with the purpose of “developing and improving the knowledge, appreciation and practice of astronomy and related sciences.”

The Board of Governors (the Board) has retained a role to ensure that the culture and character, history and patrimony embodied in AOP are protected and preserved and that the institution is managed in line with the statutory purpose outlined in the Order. This role will normally be fulfilled through an Annual Review meeting (visitation) where the Board will receive assurance as to the management and performance of AOP from the Management Committee.

Management Committee of Armagh Observatory and Planetarium

The Board has delegated primary responsibility for the governance and management of AOP to a Management Committee. The Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department and approved by the Minister and for promoting the efficient, economic and effective use of resources. The Management Committee provides leadership, challenge, oversight, support and encouragement to the Director and staff.

The Management Committee comprises:

- three nominees from the Board of Governors;
- six nominees from the Department appointed through open competition;
- one nominee of Queen’s University, Belfast;
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS);
- a Chair appointed through open competition; and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

The following committees are established as sub-committees of the Management Committee.

Audit and Risk Assurance Committee (ARAC)

The ARAC is a sub-committee of the Management Committee established in accordance with DAO (DFP) 06/13 - Corporate governance in central government departments: Code of Good Practice NI 2013, and in line with the HM Treasury Audit and Risk Assurance Committee Handbook (DoF 03/18) to advise the Board of Governors, the Management Committee and the Director of AOP as Accounting Officer and to support them in their responsibilities for issues of organisational risks, internal control, governance and their associated assurances and in reviewing the reliability and integrity of these assurances.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is a sub-committee of the Management Committee and provides advice and recommendations to the Management Committee on employment issues.

Research and Education Advisory Committee

The Research and Education Advisory Committee is a sub-committee of the Management Committee and advises it on research and education issues.

Redevelopment Committee

The Redevelopment Committee is a sub-committee of the Management Committee and was established to develop an Outline Business Case for redevelopment proposals.

Further details on the membership of these Committees are set out in the Governance Statement on pages 30 to 39.

Reference and Administrative Details

Name of the Charity

The charity is registered and operates under the title of The Armagh Observatory And Planetarium.

Charity number

Registered with the Charity Commission for Northern Ireland 103948.

Principal Office

College Hill, Armagh, BT61 9DG

Trustees (and Board of Governors)

Archbishop J McDowell, (Chair)
The Very Revd Dean S Forster
The Venerable Archdeacon T Scott (to 30 January 2023)
The Venerable Archdeacon E Cairns
The Venerable Archdeacon Dr P Thompson
Revd Canon W M Adair
Revd Canon W J A Dawson
Revd Canon M Hagan* (from 23 April 2023)
Revd Canon D Hilliard
Revd Canon J Moore (to 22 February 2023)
Revd Canon B Paine
Revd Canon R J N Porteus
Mr G Cox
Professor A Fitzsimmons
Mr R Wilson
Archbishop E Martin
Ms S Leslie*

**Pending the outcome of ongoing discussions with CCNI, Ms Leslie and Revd Canon Hagan have not been registered as a Charity Trustees.*

Director and Accounting Officer

Professor Michael Burton

Auditors

Northern Ireland Audit Office, 106 University Street, BELFAST, BT7 1EU

Internal Auditors

Cavanagh Kelly, 36-38 Northland Row, Dungannon, BT71 6AP

Bankers

Danske Bank, Donegal Square West, Belfast, BT1 6JS

Register of Interests

A Register of Interests is maintained for Board and Committee Members and the Executive Team and is available for inspection at the Principal Address. Declared Interests by Board and Committee Members and the Director are available on the AOP website – www.armagh.space.

Related party transactions are shown in note 23 of the accounts.

Gifts

AOP adheres to the limits and rules laid out in its Management Statement approved by the Department and the guidance in Managing Public Money Northern Ireland (MPMNI). There were no gifts made or accepted during the 2022-23 financial year that exceeded these limits.

Personal data related incidents

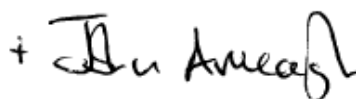
AOP has considered the requirement to report personal data related incidents. It is content that there were no such incidents in the year ended 31 March 2023.

Disclosure of Audit Information

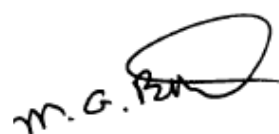
So far as the Accounting Officer is aware, there is no relevant audit information of which AOP's auditors are unaware. The Accounting Officer has taken all necessary steps to make himself aware of any relevant audit information and to establish that AOP's auditors are aware of that information.

Events after the end of the reporting period

There have been no events since the end of the financial year requiring disclosure.



Archbishop John McDowell
Chair of the Board of Trustees
Date: 2 October 2023



Professor Michael Burton
Director
Date: 2 October 2023

Remuneration and Staff Report

The remuneration and staff report sets out AOP's remuneration policy for Board members and senior managers, reports on how that policy has been implemented and sets out the amounts awarded to the Director. In addition, the report provides details on remuneration and staff that users see as key to accountability.

Remuneration Policy

The pay remit for the Northern Ireland (NI) public sector, including senior civil servants (SCS) in the NICS, is normally approved by the Minister of Finance. In the absence of a functioning Executive, the 2022-23 NI public sector pay award was announced by the Permanent Secretary, Department of Finance in April 2023.

Annual AOP pay awards are made in the context of the wider Northern Ireland public sector pay policy. The pay awards for 2022-23 were paid in May 2023. The pay of staff (other than post-doctoral research assistants who are paid in accordance with academic scales in use by Queens University, Belfast) is based on a system of pay scales for each grade, including SCS, containing a number of pay points from minimum to maximum, allowing progression towards the maximum based on performance.

Board Members

Board members do not receive any remuneration. They receive travel and subsistence allowances at rates and on conditions determined by AOP, subject to Departmental approval. No Board member receives pension benefits or makes pension contributions in their capacity as a Board member.

Service Contracts

The Director of AOP, Professor Michael G. Burton, is the person in a senior position having authority and responsibility for directing and controlling the activities of the organisation. The service contract of the Director commenced on 1 August 2016.

Current terms and conditions for staff are those set out in various policies and individual employment contracts. Senior staff are permanent employees of AOP. The notice period for senior staff is three months. Termination payments are in accordance with contractual terms and those of the principal Civil Service Pension Scheme (NI).

Director's Remuneration (including Salary and Pension Entitlements) (Audited Information)

The following tables provide details of the remuneration and pension entitlements of the Director of the organisation.

Single Total Figure of Remuneration of Director							
	Salary (£'000)		Pension Benefits* (£'000)		Total (£'000)		Percentage Change
Official	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	
M.G. Burton	80-85	85-90	14	23	95-100	105-110	(9.7%)

**The value of pension benefits accrued during the year is calculated as (the real increase in pension multiplied by 20) plus (the real increase in any lump sum) less (the contributions made by the individual). The real increases exclude increases due to inflation and any increase or decrease due to a transfer of pension rights.*

'Salary' includes gross salary to the extent that it is subject to UK taxation. There was no overtime, benefit-in-kind, bonus or other allowances. The salary of the Director shown above is based on the Northern Ireland Senior Civil Service Grade 5 pay scale.

Compensation on early retirement or for loss of office

No payment for compensation on early retirement or for loss of office has been made (2021-22: £nil).

AOP Fair Pay Disclosures

AOP is required to disclose the relationship between the remuneration of the Director and the lower quartile, median and upper quartile remuneration of the organisation's workforce. The banded remuneration of the Director in the financial year 2022-23 was £80,000 - £85,000 (2021-22: £85,000 - £90,000). The relationship between the mid-point of this band and the remuneration of AOP's workforce is disclosed below.

2022-23	25th percentile	Median	75th percentile
Total remuneration	£18,783	£29,731	£37,373
Pay ratio	4.4:1	2.8:1	2.2:1

2021-22	25th percentile	Median	75th percentile
Total remuneration	£18,783	£29,307	£39,324
Pay ratio	4.7:1	3.0:1	2.2:1

Total remuneration includes salary, overtime and performance related bonuses. It does not include severance payments, employer pension contributions and the cash equivalent transfer value of pensions. Remuneration ranged from £18,783 to £82,500.

The percentage changes in respect of AOP are shown in the following table. It should be noted that the calculation for the Director is based on the mid-point of the band within which their remuneration fell in each year.

Percentage change for:	2022-23 v 2021-22	2021-22 v 2020-21
Average employee salary and allowances	2.4%	-2.9%
Director's salary and allowances	-5.7%	6.1%
Average employee performance pay and bonuses	14.9%	-24.0%

No performance pay or bonus was payable to the Director in these years.

Pension Entitlements (Audited Information)

Official	Accrued pension at pension age as at 31/03/23	Real increase in pension at pension age	Accrued Lump Sum at 31/03/23	Real Increase in Lump Sum	CETV at 31/03/23	CETV at 31/03/22	Real Increase in CETV
	£'000	£'000	£'000	£'000	£'000	£'000	£'000
M.G. Burton	12	1	-	-	179	144	13

The CETVs above have been calculated in accordance with guidance from the Department of Finance in Employer Pension Notice EPN 12-2022. When calculating the real increase in CETV and the pension benefits accrued during the year 2022-23 for the single total figure of remuneration, NILGOSC takes account of inflation. The CPI increase for September 2022 was 10.1%. The in-service revaluation rate for the Career Average Revalued Earnings Scheme was also 10.1%.

Pension Scheme

Pension benefits are provided through the Northern Ireland Local Government Officers' Superannuation Committee Pension Scheme (NILGOSC). Retirement pension will be based on 1/49th of salary paid in year and pension is based on career average earnings. Details can be obtained at <http://www.nilgosc.org.uk>.

Active members of the pension scheme will receive an Annual Benefit Statement. The accrued pension quoted is the pension the member is entitled to receive when they reach their scheme pension age, or immediately on ceasing to be an active member of the scheme if they are at or over pension age.

Employee contribution rates for all members for the period covering 1 April 2022 to 31 March 2023 are as follows:

Pensionable Pay	Contribution Rate
£0 to £15,400	5.5%
£15,401 to £23,700	5.8%
£23,701 to £39,500	6.5%
£39,501 to £48,000	6.8%
£48,001 to £95,100	8.5%
More than £95,100	10.5%

Employer contribution rates are determined by the Scheme's actuary every three years. Following the results of the 2022 actuarial valuation, the Committee agreed with its actuary the employer contributions and deficit recovery contributions for the following three years, effective from 1 April 2023. The next valuation is due as at 31 March 2025.

Cash Equivalent Transfer Values

A Cash Equivalent Transfer Value (CETV) is the actuarially assessed capitalised value of the pension scheme benefits accrued by a member at a particular point in time. The benefits valued are the member's accrued benefits and any contingent spouse's pension payable from the scheme. A CETV is a payment made by a pension scheme or arrangement to secure pension benefits in another pension scheme or arrangement when the member leaves a scheme and chooses to transfer the benefits accrued in their former scheme. The pension figures shown relate to the benefits that the individual has accrued as a consequence of their total membership of the pension scheme, not just their service in a senior capacity to which disclosure applies. The CETV figures include the value of any pension benefit in another scheme or arrangement which the individual has transferred to the NICS pension arrangements. They also include any additional pension benefit accrued to the member as a result of their purchasing additional years of pension service in the scheme at their own cost. CETVs are calculated in accordance with The Occupational Pension Schemes (Transfer Values) (Amendment) Regulations 2015 and do not take account of any actual or potential benefits resulting from Lifetime Allowance Tax which may be due when pension benefits are taken.

Real increase in CETV

This reflects the increase in CETV effectively funded by the employer. It does not include the increase in accrued pension due to inflation, contributions paid by the employee (including the value of any benefits transferred from another pension scheme or arrangement) and uses common market valuation factors for the start and end of the period. However, the real increase calculation uses common actuarial factors at the start and end of the period so that it disregards the effect of any changes in factors and focuses only on the increase that is funded by the employer.

Total Permanently Employed Staff Costs (Audited Information)

	Permanent staff £	Others ¹ £	2022-23 £	2021-22 £
Wages and salaries	1,172,056	169,562	1,341,618	1,298,400
Social security costs	125,302	16,806	142,108	132,074
Employer's pension contributions	218,849	31,956	250,805	238,763
Defined benefit pension additional service cost	327,000	-	327,000	376,000
	1,843,207	218,324	2,061,531	2,045,237

¹ "Others" includes £13,501 for agency staff

Average staff numbers (Audited Information)

	Permanent staff	Others ²	2022-23 Total Number	2021-22 Total Number
Average staff numbers	27.4	7.9	35.3	34.9

² "Others" includes 5.4 fixed term, 2.2 casuals and 0.3 agency staff

Staff Composition – permanent employees (full time equivalent)

	Male	Female
Directors/senior managers	2.6	2.0
Other employees	8.9	13.9

Staff Turnover

	2022-23	2021-22
Leavers as a percentage of average staff in post	3.1%	8.9%

Sickness Absence (Audited Information)

Staff sickness for the period 1 April 2021 to 31 March 2023 totalled 126 days (2022: 101 days) which equates to an average per FTE of 1.66% (2022: 1.37%).

Expenditure on External Consultancy (Audited Information)

Expenditure on external consultancy during the year was £nil (2021-22: £nil).

Off-payroll Engagements (Audited Information)

There were no “off-payroll” engagements in place as at 31 March 2023, nor were any arrangements entered into between 1 April 2022 and 31 March 2023.

Exit Packages (Audited Information)

Exit package cost band	No of compulsory redundancies	No of other departures agreed	Total no. of exit packages by cost band	Total no. of exit packages by cost band
	2022-23	2022-23	2022-23	2021-22
Total no. of exit packages	-	-	-	-
Total resource cost	Nil	Nil	Nil	Nil

Statement of the Responsibilities of the Governors and Accounting Officer

Under the Audit and Accountability (Northern Ireland) Order 2003, the Governors are responsible for preparing for each financial year and for preparing a statement of accounts in the form and on the basis set out as the Department for Communities, with the approval of the Department of Finance, shall direct. The accounts are prepared on an accruals basis and must give a true and fair view of the state of affairs of AOP and of its income and expenditure, Statement of Financial Activities and cash flows for the financial year.

In preparing the accounts, the Accounting Officer is required to comply with the requirements of the Government Financial Reporting Manual and in particular to:

- observe the accounts direction issued by the Department of Finance, including the relevant accounting and disclosure requirements, and apply suitable accounting policies on a consistent basis;
- make judgements and estimates on a reasonable basis;
- state whether applicable accounting standards as set out in the Government Financial Reporting Manual have been followed, and disclose and explain any material departures in the accounts;
- prepare the accounts on a going concern basis; and
- confirm that the Annual Report and Accounts as a whole is fair, balanced and understandable and take personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

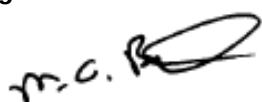
The Department for Communities has appointed Professor M.G. Burton as Accounting Officer of AOP. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding AOP's assets, are set out in Managing Public Money Northern Ireland.

Statement of Disclosure of Information to the Auditors

So far as the Accounting Officer of Armagh Observatory and Planetarium, in office at the date of the approval of these financial statements, is aware:

- there is no relevant audit information relating to these respective charitable organisations of which the auditors are unaware;
- he has taken all the steps that he ought to have taken as Accounting Officer in order to make himself aware of any relevant audit information relating to these charitable organisations and to establish that the auditors are aware of that information;
- he confirms that the Annual Report and Accounts as a whole is fair, balanced and understandable; and
- he confirms that he takes personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

Signed:



Professor Michael Burton
Accounting Officer for Armagh Observatory and Planetarium

Date: 2 October 2023

Governance Statement

AOP is a Non-Departmental Public Body established under The Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

1. Compliance with Corporate Governance Code

In 2013 the Department of Finance and Personnel published Corporate Governance in Central Government Departments: Code of Good Practice NI. The Code draws on best practice in the public, private and charity sectors by: reinforcing the importance of corporate governance as a pre-requisite to achieving good financial management; reflecting changes in governance best practice, including increased emphasis on good leadership; and promoting better governance arrangements within departmental families.

The Code is written for departments, concentrating throughout on key principles which will have wider application for other parts of the public sector. Such bodies (including arms-length bodies (ALBs)) are encouraged to consider and adopt the practices set out in the Code wherever it is relevant and practical and suits their business needs.

AOP in so far as they are relevant for an arms-length body, complies with the principles of good practice in the Corporate Governance Code.

2. Governance Framework

Accounting Officer

Name	Accounting Officer
Professor Michael Burton – Director and Chief Executive	From 1 September 2016 onwards

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one DfC nominee;
- one Queen's University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

During 2022-23 two Members of the Chapter of the Church of Ireland Cathedral of Armagh retired. Revd Canon M Hagan was appointed in 2023-24 to one of these positions and the second currently remains vacant.

BOARD OF GOVERNORS			
GOVERNOR	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 1)
Archbishop J McDowell (Chair)	28 April 2020	None	1
The Dean Very Revd S Forster	14 February 2021	None	1
The Venerable Archdeacon T Scott	9 November 2006	30 January 2023 (Retired)	1
The Venerable Archdeacon E Cairns	13 December 2020	None	0
The Venerable Archdeacon Dr P Thompson	13 January 2019	None	0
Revd Canon W M Adair	10 September 2008	None	0
Revd Canon W J A Dawson	1998	None	0
Revd Canon M Hagan	From 23 April 2023	None	0
Revd Canon D Hilliard	13 March 2016	None	1
Revd Canon J Moore	13 March 2016	22 February 2023 (Retired)	1
Revd Canon W B Paine	7 May 2017	None	0
Revd Canon R J N Porteus	1998	None	0
Professor A Fitzsimmons	18 April 2019	1 May 2024	0
Mr R Wilson	1 December 2019	30 November 2024	1
Archbishop E Martin	1 January 2021	31 December 2025	1
Ms S Leslie	From 1 June 2021	31 May 2026	1
Mr G Cox	1 March 2021	28 February 2026	1

At the annual meeting on 26 April 2022, the Board of Governors endorsed the continuing membership of Revd Canon Adair, Mr Cox and Mr Wilson as its nominees on the Management Committee and agreed to extend the Chair of the Management Committee's appointment for a further 5 year term.

The Board received an update on a confidential land matter; the appointment of a Management Committee Sub-Group relating to the matter and established the parameters for convening a Special Meeting.

The Board formally resolved to change the registered charity name and to delegate the role of Trustee to the members of the Management Committee, once the process of name change had been concluded.

The Board approved the draft Partnership Agreement with DfC and delegated authority to the Chair to sign it and to the Management Committee to approve the necessary changes required as a result of its implementation. It also granted the Management Committee authority to delegate some of its activities to its Sub-Committees and to approve the necessary changes required to Terms of Reference as a result.

The Board reviewed a written report from the Chair of the Management Committee and the minutes from the Management Committee and the Audit and Risk Assurance Committee meetings between June 2022 and March 2023 (draft).

The Board formally retrospectively approved the Annual Report and Accounts 2020-21 and approved the 2021-22 draft Annual Report and Accounts, subject to minor amendments and delegated authority to the Management Committee to approve the accounts and to the Archbishop to sign them off on its behalf when completed. The Board noted the Management Report for 2021-22 which included the Director's Report, Corporate Plan Objectives, Key Performance Indicators and the Risk Register as at April 2022.

The Board approved the draft 2022-23 Business Plan.

The Board is satisfied that comprehensive arrangements are in place to ensure that high-quality information is received to enable it to make informed decisions. Internal controls are in place to validate the accuracy and completeness of information presented to the Board.

Management Committee of Armagh Observatory and Planetarium

There were no changes to the Management Committee membership during 2022-23. The term of appointment for the Chair of the Management Committee was extended for a further 5 years and the term of appointment for both Professor Harra and Mr Brown extended by one year, from 30 April 2023 to 30 April 2024. Mr McGurgan's term of appointment ended on 30 April 2023, leaving one public appointment vacancy which will not be filled until March 2024.

MANAGEMENT COMMITTEE			
MEMBER	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 4)
Mr J Briggs (Chair)	1 January 2018	31 December 2027	4
Professor L Harra	1 November 2014	30 April 2024	3
Mr S Brown	1 November 2014	30 April 2024	3
Mr P McGurgan (to 30 April 2023)	1 November 2014	To 30 April 2023	1
Professor M Mathioudakis	11 November 2016	10 November 2026	3
Mr R Wilson	1 December 2019	30 November 2024	2
Dr C Jackman	1 January 2021	31 December 2025	2
Dr M Darnley	1 January 2021	31 December 2025	2
Mr P Kennedy	1 March 2021	28 February 2026	3
Dr K Lemon	1 March 2021	28 February 2026	4
Mr E Rooney	1 March 2021	28 February 2026	4
Mr G Cox	19 May 2021	18 May 2026	3
Rev Canon W M Adair	15 September 2021	14 September 2026	0
VACANT (from 1 May 2023)			

During 2022-23 the Management Committee considered a wide range of business. The Management Committee held their first full in-person meeting in June 2022, which was the first such meeting for over two years.

In June 2022 the Management Committee reviewed AOP's draft Operating Framework, an operational document developed as part of the Partnership Agreement. Coinciding with the June meeting, a number of engagement activities were held over a two-day period.

At its October 2022 meeting the Management Committee noted that the 2022-23 Business Plan had been approved by Minister Deirdre Hargey MLA on 23 September 2022.

A 'task and finish' working group to consider issues arising from the Management Committee Effectiveness review was established in June 2022. It met in August and November 2022 and in December 2022 the Management Committee approved its recommendations to approve a Policy Approval Process Paper, and implementation of its recommendations, and to establish a principle for meeting dates for 2024 and beyond.

In December 2022 the Committee agreed to further engagement with the Charity Commission in relation to a proposed name change to the Registered Charity.

A Special Meeting of the Management Committee took place in March 2023 to consider a draft Outline Business Case for AOP's redevelopment project, prior to consideration by the Board of Governors.

At each of its meetings throughout the year the Committee received a report from the Director, updates from its sub-committees and approved relevant reports. Regular governance reports such as the Bi-Annual Assurance Statement, the Risk Register, Key Performance Indicators and Finance monitoring reports were reviewed and approved. The Committee considered and noted amendments to policies that had been reviewed in line with the policy review process and approved new policies as appropriate.

During the year the Armagh Leisure Village Development Proposal was withdrawn and the Management Committee's attention was re-focused on AOP's Vision and redevelopment. The Committee received regular updates on progress from its Redevelopment Sub-Committee.

Internal controls are in place to validate the accuracy and completeness of information presented to the Management Committee.

Audit and Risk Assurance Committee

The Audit and Risk Assurance Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

AUDIT AND RISK ASSURANCE COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 3)
Mr S Brown Chair (from June 2021)	2
Professor L Harra	3
Mr P Kennedy	2
Dr K Lemon (from 4 May 2023)	0
Mr P McGurgan (to 30 April 2023)	1
Mr E Rooney	3

During 2022-23 the Audit and Risk Assurance Committee considered reports from Internal Audit on progress against the audit plan and progress on outstanding recommendations; reports from external audits on the 2021-22 Annual Report and Accounts; the 2022-23 external audit strategy; review of the Accounting Officer's Assurance Statement and review of the Risk Register. Throughout the year particular attention was given to ICT related risks, including data and cyber security.

The Committee is satisfied that the integrated approach, the frequency of meetings, the breadth of the business undertaken, the skills of Members and the range of attendees at meetings of the Committee has allowed the Committee to meet the governance requirements of the organisation and assisted the Management Committee to demonstrate its stewardship of the public resources with which it is charged.

The Committee is satisfied that the organisation has robust risk management arrangements in place which are in line with the good practice in the HM Treasury 'Orange Book' and are reviewed regularly by the Management Committee.

There were 6 Internal Audit recommendations from prior years outstanding, 5 of which have been completed. The Committee is satisfied that the remaining outstanding recommendation has been implemented by AOP as far as possible, but that its completion is beyond AOP's control. There were 11 new internal audit recommendations in 2022-23, of which 3 remain outstanding, having not reached the date of implementation during the financial year.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee's membership is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

STAFFING POLICY AND REMUNERATION COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 4)
Mr E Rooney (Chair)	4
Mr S Brown	3
Mr J Briggs	4
Dr K Lemon	4
M P Kennedy	3

In 2022-23, amongst other matters, the Committee considered:

- staffing and recruitment, including Skills Gaps Analysis and Strategic Workforce Planning;
- staff related policies, including new Hybrid Working and Volunteer Policies;
- staff survey and engagement; and
- updates on a range of Human Resources issues including progress against the Human Resources Strategy and Action Plan.

AOP's application for the Diversity Mark (Bronze Award) was successful.

Research and Education Advisory Committee

The Research and Education Advisory Committee's membership is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

RESEARCH AND EDUCATION ADVISORY COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 3)
Prof L Harra (Chair)	3
Prof M Darnley	3
Dr K Lemon	3
Prof M Mathioudakis	2

In 2022-23, amongst other matters, the Committee considered:

- education and outreach;
- concordat to support the career development of researchers;
- Research Excellence Framework (REF);
- funding opportunities; and
- new STFC Consolidated Grants.

Redevelopment Sub-Committee

The Redevelopment Sub-Committee's membership is drawn from the Management Committee and comprises of six members.

REDEVELOPMENT SUB-COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 11)
Mr S Brown (Chair)	11
Mr J Briggs	5
Mr G Cox	4
Mr P Kennedy	9
Dr K Lemon	4
Mr E Rooney	10

The primary purpose of the Sub-Committee was to drive the 'Development of AOP Science and Education Park' Project forward, and oversee the delivery of the outcomes and benefits, most notably initially an Outline Business Case (OBC) by March 2023. In doing so, its primary functions included:

- Providing leadership and direction - championing the project as appropriate within AOP and with stakeholders, and supporting the SRO.
- Taking decisions – members must have the authority to take / recommend decisions to the SRO
- Challenging and scrutiny - all aspects of Project and project delivery.

It was a very ambitious and challenging timetable and there was a little slippage in the completion of the OBC.

This is a 'task and finish' sub-committee which will continue until the OBC is approved, following which appropriate governance for the next stage of the project will be considered.

Conflicts of Interest

The organisation maintains a register of interests to ensure that potential conflicts of interest can be identified and addressed in advance of Board, Management Committee and other Committee discussions. The register is formally revisited on an annual basis. Where conflicts exist, they are recorded in the Committee minutes and the Chair of the meeting decides the most appropriate way of managing the conflict. This may include that member not taking part in discussions or making decisions on certain matters or being excluded for part or all of that meeting.

The Register of Interests for Board of Governors, Management Committee and senior staff is published on the AOP website in accordance with central government guidance.

Directors and Secretary

Professor Michael Burton, Director and Accounting Officer.

The Corporate Manager provides a range of secretarial support services to the Board of Governors, Management Committee and Audit and Risk Assurance Committee, the HR and Policy Officer provides secretarial support to the Staffing Policy and Remuneration Committee and the Executive Officer to the Research and Education Advisory Committee.

3. Business Planning and Risk Management

Business Planning

'Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.'

'Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.'

The pillars that support us are – Knowledge, Legacy, People and Engagement.

The five year strategy is built around four strategic themes - Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

The Strategic Plan aligns closely with the aims and objectives of AOP's sponsor branch, the Department for Communities, and with the broader aims and objectives of the Northern Ireland Executive's Programme for Government. The organisation's Strategic Plan 2021-26 received Departmental approval on 17 August 2021.

The work of the Observatory encompasses both internationally acclaimed research and a unique cultural heritage - scientific, historical, architectural - as well as maintaining the unique daily climate series (the longest daily series from a single site in the UK and Ireland) and undertaking a world-class programme of science in the community, which complements the Planetarium's main business of education.

The Planetarium's main business is education, and all age and social groups are welcome to visit. The educational programmes and demonstrations are designed to include participation by children of pre-nursery age up to senior citizens and all age groups in between. The primary educational aim of the Planetarium is to endorse and promote the Science, Technology, Engineering, Arts and Mathematics (STEAM) agenda which promotes scientific careers to young people. All of the ancillary activities support the primary aim, with the additional target of offering excellent value for money, both to the visitors taking part and to the public purse. The Planetarium maintains a focus on being inclusive so that all children can enjoy the Planetarium experience.

Full details of all AOP's activities are provided in comprehensive Annual Reports which are available online at: www.armagh.space

No Ministerial Directions have been issued regarding the work of AOP.

Risk Management

Risk Management is an essential element of AOP's corporate governance framework and is closely linked to the system of internal control and business planning process. A robust risk management process assists AOP in identifying and managing issues which may hinder the achievement of objectives. The arrangements are regularly reviewed.

As well as ensuring that there is an effective system in place to deal with threats to AOP's aims and objectives, the organisation encourages a proactive approach to innovation and well-managed risk taking where there is potential to realise sustainable improvements in the organisation's research and educational services. For this reason, the organisation's Risk Appetite is 'Open'.

The Management Committee sets the risk appetite for AOP. The Accounting Officer, Senior Management Team and other staff are responsible for ensuring that residual risks are reduced to a level as low as reasonably practicable and wherever possible consistent with the level of risk appetite established by the Management Committee.

Updates are provided to the Audit and Risk Assurance Committee on the development and implementation of the risk management process across AOP. The Audit and Risk Assurance Committee provides the Accounting Officer with objective advice on issues concerning the risk, control and governance of the organisation and the associated assurances. An update on the main points considered by the Audit and Risk Assurance Committee is provided to the Management Committee following each meeting and the Management Committee has access to all papers for the Audit and Risk Assurance Committee.

4. Fraud and Information Risk

The Accounting Officer has overall responsibility for managing the risk of fraud including:

- developing a fraud risk profile and undertaking a regular review of the fraud risks associated with each of the key organisational objectives in order to keep the profile current;
- establishing an effective fraud prevention policy and fraud response plan, commensurate with the level of fraud risk identified in the fraud risk profile;
- designing an effective control environment to prevent fraud commensurate with the fraud risk profile;
- operating appropriate pre-employment screening measures;
- establishing appropriate mechanisms for reporting fraud risk issues, reporting significant incidents of fraud, and coordinating assurances about the effectiveness of fraud prevention policies to support the Governance Statement;
- liaising with the Audit and Risk Assurance Committee;
- ensuring that all staff are aware of the organisation's fraud prevention policy and know what their responsibilities are in relation to combating fraud;
- ensuring fraud awareness training is provided as appropriate and, if necessary, more specific fraud prevention training and development is provided to relevant staff;
- ensuring that vigorous and prompt investigations are carried out if fraud occurs, is attempted or is suspected by the establishment of a Fraud Investigation Oversight Group;
- ensuring, where appropriate, legal and/or disciplinary action against perpetrators of fraud;
- ensuring, where appropriate, disciplinary action against supervisors where supervisory failures have contributed to the commission of fraud;
- ensuring, where appropriate, disciplinary action against staff who fail to report fraud;
- taking appropriate action to recover assets and losses;
- ensuring that appropriate action is taken to minimise the risk of similar frauds occurring in future; and
- ensuring that an anti-fraud culture is promoted throughout the organisation in line with the seven Nolan Principles of Public Life.

Risks to data and information held by the organisation are owned and managed by individuals designated as information asset owners. The Executive Officer responds to requests for information under the Data Protection and Freedom of Information Acts following consultation with the Accounting Officer and the organisation's governing committees, as appropriate.

AOP operates a Raising a Concern (Whistleblowing) Policy which informs all members of the organisation of the standards of behaviour expected of them in carrying out their duties, and to provide information on the procedures to follow if a situation arises in which they are required to act in a way which is believed by them to be illegal, improper, or in breach of the Nolan Principles.

5. Governance and Accountability

AOP seeks to achieve excellence in good governance, in particular the precepts: (1) leadership; (2) effectiveness; (3) accountability and (4) sustainability.

The Chair of the Board of Governors has a particular leadership responsibility for securing the sustainability and vitality of the organisation in the long term; giving advice and direction in formulating AOP's forward look and overall strategy; ensuring that account is taken of guidance provided by the Minister or the Department; promoting the efficient and effective use of staff and other resources; encouraging high standards of probity amongst staff and Board and committee members alike; and ensuring that the Board and its committees meet at regular intervals throughout the year and that the Minutes of meetings accurately record the decisions taken and, where appropriate, the views of individual Board members.

Within AOP, leadership is exercised by the Director and his Senior Management Team who are responsible for the management and effective operation of their organisation. Their operational responsibilities include:

- developing, implementing and monitoring the strategic and operational plans;
- undertaking financial management and Accounting Officer responsibilities;
- managing and developing a team of highly qualified professional and administrative staff;
- identifying and attracting sources of external income;
- promoting their respective organisations in relevant local, national and international arenas; and
- promoting Public Understanding of Science with the objective of improving the level of scientific literacy in the community and to ensure a strong link with government policy and the STEM agenda.

Members of the Board of Governors and of the Management Committee and their various sub-committees exercise an effective challenge function on the leadership team in accord with their respective roles in the organisation. They also provide guidance and advice on strategic and operational matters such as Human Resource issues, accountability and relationships with stakeholders.

The members of these committees are drawn from a wide community background within, and beyond, Northern Ireland, and provide the organisation with a correspondingly wide range of expert knowledge and advice. All the committees of AOP operate with full transparency and accountability, and over the last year have proved effective in the discharge of their duties and responsibilities.

It was agreed by the Board of Governors and the Management Committee that the governance arrangements in place, in line with guidance, removed the need for the current Board of Governors to complete an internal self-assessment of its effectiveness.

The Board of Governors and supporting Committees receive assurances from the Director and his Senior Management Team and Internal Audit that the governance and accountability processes are being managed effectively.

6. Sources of Independent Assurance

Internal Audit

CavanaghKelly was appointed as Internal Auditors for the 3 years 2020-21 to 2022-23. Their work was carried out in accordance with the Public Sector Internal Audit Standards.

During the year, the Audit and Risk Assurance Committee considered reports on the following areas:

Audit Assignment	Assurance Rating
Education and Community Outreach	Satisfactory
HR, including performance management	Satisfactory
Purchasing and Procurement	Satisfactory
Internal Audit Follow Up 2022-23	N/A

An overall 'satisfactory' internal audit assurance opinion has been provided.

Of the new issues identified by internal audit during 2022-23 there were no priority one issues.

The Internal Audit Charter; Internal Audit Strategy 2023-2026 and Annual Internal Audit Plan 2023-24 will be considered at a future meeting when the new internal audit contract has been awarded.

External Audit

The Comptroller and Auditor General (C&AG) is required to audit the financial statements under *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. The C&AG is responsible for reporting whether in their opinion the financial statements give a true and fair view of the state of the Armagh Observatory and Planetarium's affairs and of its income and expenditure, and whether they and the part of the Remuneration Report to be audited have been properly prepared in accordance with *The Armagh Observatory and Planetarium (Northern Ireland) Order*

1995 and DfC directions made thereunder. The C&AG is required to report whether, in her opinion, in light of the knowledge and understanding of AOP and its environment obtained in the course of the audit, she has identified any material misstatements in the Trustees' Annual Report and whether the information which comprises the Statement of the Responsibilities of the Governors and Accounting Officers and Governance Statement, as included within the Annual Report, is consistent with the financial statements. She also reports on whether, in her opinion, in all material respects, the expenditure and income presented in the financial statements have been applied to the purposes intended by the Assembly and whether the financial transactions conform to the authorities which govern them.

A representative from the Northern Ireland Audit Office is invited to all Audit and Risk Assurance Committee meetings.

7. Review of the Effectiveness of the System of Internal Governance

The system of internal governance is designed to manage risk to a reasonable level, rather than to eliminate all risk of failure to achieve certain policies, aims and objectives; it can therefore only provide reasonable and not absolute assurance of effectiveness. The system of internal governance is based on an ongoing process designed to identify and prioritise risks to the achievement of the AOP policies, aims and objectives; to assess the likelihood of the events occurring and the impact should they be realised; and to manage the risks effectively, efficiently and economically. The system of internal governance has been in place in AOP for the year ended 31 March 2023 and up to the date of approval of the annual accounts, and accords with Department of Finance guidance.

As previously detailed in Section 2, the responsibilities of the Accounting Officer include the need to maintain a sound system of internal control which supports the achievement of the organisation's policies, aims and objectives. The review of the effectiveness of the system of internal governance has been informed by the assurances provided by relevant parties such as: Internal Audit and the Senior Management Team. Where weaknesses have been identified these have been promptly drawn, through normal reporting mechanisms, to the attention of the Audit and Risk Assurance Committee, Management Committee and/or Board of Governors, as appropriate.

The main procedures in place to monitor the effectiveness of the system of internal governance are as follows:

- ongoing independent assessment of the Observatory's research outputs;
- regular reports by financial staff on progress against principal financial targets and the projected financial outcome for the year and progress reports by staff responsible for major projects;
- detailed progress reports to the Management Committee and Board of Governors at their regular meetings and inclusion of performance measures and results against targets in the annual operating plan;
- annual reports on the system of internal control from internal auditors to the Audit and Risk Assurance Committee;
- regular Accountability meetings with officials from the Sponsor Department to consider operational and strategic issues and matters relating to the system of internal control;
- Bi-Annual Assurance Statements submitted to the Sponsor Department;
- periodic review of the AOP Risk Register by the Audit and Risk Assurance Committee, the Management Committee, the Accounting Officer and Senior Management Team and the Sponsor Department;
- continuous assessment of the quality of research through peer review of grant applications, applications for telescope time, and the submission of scientific papers to academic journals of international standing by Armagh Observatory staff;
- peer review of the research quality, capability and output of the Observatory, and through participation in an objective external Assurance Committee, which provide an opinion on the adequacy and effectiveness of the system and contain recommendations for improvement; and
- annual reports from Northern Ireland Audit Office to the Audit and Risk Assurance Committee, the Management Committee and the Board of Governors on the annual accounts, providing an opinion on the state of affairs of the organisation and its total incoming resources and expenditure of resources.

All reports based on the internal and external audits include opinions on the adequacy and effectiveness of risk management and the control framework in place. These matters are considered by the Audit and Risk Assurance Committee and are reported by the Audit and Risk Assurance Committee Chair to the Management Committee and the Board of Governors.

Weaknesses identified in AOP's control systems and internal governances are set out within the next section. Upon identification, plans were immediately put into place to address these issues.

8. Internal Governance Divergences

There is currently one outstanding internal audit recommendation from prior years, which has been partially implemented:

Recommendation	Priority	Status
GDPR – the draft Records Management Policy and Retention and Disposal Schedules should be finalised as soon as possible.	Medium	Draft policy and schedules with PRONI for consideration. Completion pending confirmation by PRONI.

During its audit for 2022-23, NIAO identified three priority 1 issues to be addressed by management in their areas of responsibility, with recommendations as follows:

- (i) Recommended that AOP seek to put in place an appropriate contract arrangement to cover the cloud services being provided by Microsoft Azure beyond the 2023-24 year close.

Management Response:

AOP are named on the NICS collaborative agreement ID 3095831 Collaborative Call Off Contract for Microsoft Licensing Solutions Partner (LSP). With the assistance of the contractor, AOP is actively progressing the transfer of Microsoft Azure services to the Collaborative Contract, with an expected completion no later than 31 October 2023. No material cost savings are anticipated through use of the Collaborative Contract.

- (ii) Recommended AOP seek to put measures in place to ensure that appropriate checks on expenditure and purchase orders are carried out to ascertain whether or not a contract is in place for the services required, so that appropriate approval can be sought either through the normal procurement process or a Direct Award Contract (if required) before any expenditure is incurred.

Management Response:

With immediate effect, AOP will intensify its financial procedures relating to procurement of goods and services valued in the range of £5,000-£30,000 to ensure that Financial Policies are complied with. Additional training will be provided for staff.

- (iii) Recommended that AOP only drawdown funds as they are needed and seek departmental approval if this is not going to be the case.

Management Response:

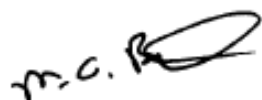
When dome shows are purchased at year end, it is inevitable that they will not be used until the new financial year. In this instance, an opportunity was taken to delay the first showing in order to extend the end date of the license. AOP will ensure such extension does not occur in future if it will breach drawdown rules.

9. Conclusion

Armagh Observatory and Planetarium has an effective governance structure and is operating to a high standard of integrity and probity.

In signing this report, I have taken assurances, where available, from the Audit and Risk Assurance Committee and I will continue to monitor the Internal Audit and Northern Ireland Audit Office recommendations to ensure that all issues are appropriately addressed.

To the best of my knowledge this report provides a fair and accurate reflection of the business of AOP and of the status of the controls and checks that have been put in place to regulate and inform the organisation's committees.



Signed:

Date: 2 October 2023

Professor Michael Burton
Accounting Officer
Armagh Observatory and Planetarium

Refereed Journal Publications: April 2022– March 2023

Aharonian F., et al., inc. **Burton M. G., Çubuk K.**, 2022, A deep spectromorphological study of the γ -ray emission surrounding the young massive stellar cluster Westerlund 1, *Astronomy & Astrophysics*, 666, A124, doi:10.1051/0004-6361/202244323, <https://ui.adsabs.harvard.edu/abs/2022AA...666A.124A>

Aschwanden M. J., **Vilangot Nhalil N.**, 2022, Interface Region Imaging Spectrograph (IRIS) Observations of the Fractal Dimension in the Solar Atmosphere, *Frontiers in Astronomy and Space Sciences*, 9, 999319, doi:10.3389/fspas.2022.999319, <https://ui.adsabs.harvard.edu/abs/2022FrASS...999319A>

Aschwanden M. J., **Vilangot Nhalil N.**, 2023, The universality of power law slopes in the solar photosphere and transition region observed with HMI and IRIS, *Frontiers in Astronomy and Space Sciences*, 10, 1099346, doi:10.3389/fspas.2023.1099346, <https://ui.adsabs.harvard.edu/abs/2023FrASS..1099346A>

Bagnulo S., Landstreet J. D., 2022, Multiple Channels for the Onset of Magnetism in Isolated White Dwarfs, *Astrophysical Journal*, 935, L12, doi:10.3847/2041-8213/ac84d3, <https://ui.adsabs.harvard.edu/abs/2022ApJ...935L..12B>

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Zenocratti L. J., De Rossi M. E., Theuns T., **Lara-López M. A.**, 2022, The origin of correlations between mass, metallicity, and morphology in galaxies from the EAGLE simulation, Monthly Notices Royal Astronomical Society, 512, 6164, doi:10.1093/mnras/stac906, <https://ui.adsabs.harvard.edu/abs/2022MNRAS.512.6164Z>

Zhu L., et al., inc. **Sarzi M.**, 2022, The Fornax3D project: Discovery of ancient massive merger events in the Fornax cluster galaxies NGC 1380 and NGC 1427, Astronomy & Astrophysics, 664, A115, doi:10.1051/0004-6361/202243109, <https://ui.adsabs.harvard.edu/abs/2022AA...664A.115Z>

ud-Doula A., et al., inc. **Vink J. S.**, 2022, Ultraviolet spectropolarimetric diagnostics of hot star magnetospheres, Astrophysics & Space Science, 367, 117, doi:10.1007/s10509-022-04097-8,
<https://ui.adsabs.harvard.edu/abs/2022ApSS.367..117U>

Non-Refereed Journal Publications: April 2022 – March 2023

Bagnulo S., et al., inc. **Borisov G., Christou A.**, 2022, in European Planetary Science Congress. Unusual polarimetric properties for interstellar comet 2I/Borisov. pp EPSC2022–1111, doi:10.5194/epsc2022-1111

Burton M., 2023, Where past meets future, *Astronomy and Geophysics*, 64, 1.25, doi:10.1093/astrogeo/atac094, <https://ui.adsabs.harvard.edu/abs/2023AG....64.1.25B>

Burton, M., 2023, Colour in Astronomy and the Infrared Revolution, *Planetarian*, 52, p18

Christou A., Georgakarakos N., 2022, in European Planetary Science Congress. High-inclination NEAs as meteor stream parent bodies. pp EPSC2022–708, doi:10.5194/epsc2022-708

Dermott S., Li D., **Christou A.**, 2022, in AAS/Division of Dynamical Astronomy Meeting. A new method of searching for ghost families in the asteroid belt. p. 401.01

Dorsch M., Heber U., **Jeffery C. S., Scott L.**, 2022, From atomic physics to stellar evolution: decoding the heavy-metal subdwarfs with HST, HST Proposal. Cycle 30, ID. #17072

Dyer M. J., et al., inc. **Ramsay G.**, 2022, in Marshall H. K., Spyromilio J., Usuda T., eds, *Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series Vol. 12182, Ground-based and Airborne Telescopes IX. The Gravitational-wave Optical Transient Observer (GOTO)*. p. 121821Y (arXiv:2208.14901), doi:10.1117/12.2629369

Geballe T., **Burton M.**, Roueff E., Abgrall H., 2023, in American Astronomical Society Meeting Abstracts. Infrared Line Emission in the Herbig-Haro 7 Bowshock from 5,000 K Molecular Hydrogen in Quasi-bound States. p. 213.01

Gomez Martin J. C., Martikainen J., **Gray Z.**, Peiteado M., Jardiel T., Muñoz O., 2022, in European Planetary Science Congress. Experimental scattering matrices of Martian dust analogues for radiative modelling and remote sensing applications.. pp EPSC2022–66, doi:10.5194/epsc2022-66

Gray Z., et al., 2022, in European Planetary Science Congress. The Return of Rosetta's Comet: Photometric and Polarimetric Observations of Comet 67P/Churyumov-Gerasimenko in its 2021-22 Apparition.. pp EPSC2022–1094, doi:10.5194/epsc2022-1094

Heras A. M., et al., inc. **Ramsay G.**, 2022, in *Bulletin of the American Astronomical Society*. ESA's PLATO mission: Development status and upcoming milestones. p. 504.01

Lu A., et al., inc. **Sarzi M.**, 2022, in American Astronomical Society Meeting #240. Star Formation Efficiency in the Bulge of the AGN-host Galaxy NGC 3169 with SHELLE and ALMA. p. 228.03

McMahon M., 2023, in *The Journal of the Herschel Society Vol 22, No. 1*, 'Herschel Family Papers held at Armagh Observatory and Planetarium'

Rauer H., et al., inc. **Ramsay G.**, 2022, in European Planetary Science Congress. The PLATO Mission. pp EPSC2022–453, doi:10.5194/epsc2022-453

Rebolledo D., Green A. J., **Burton M.**, Garay G., 2023, in *Physics and Chemistry of Star Formation: The Dynamical ISM Across Time and Spatial Scales. Proceedings of the 7th Chile-Cologne-Bonn Symposium. Multi-phase view of the ISM in the Carina Nebula*. p. 66

Sarzi M., Iodice E., Fornax3D Collaboration 2022, The Fornax3D Survey — A Magnitude-Limited Study of Galaxies in the Fornax Cluster with MUSE, *The Messenger*, 189, 9, doi:10.18727/0722-6691/5284, <https://ui.adsabs.harvard.edu/abs/2022Msngr.189....9S>

Singer N., Reed M., **Jeffery S.**, 2023, in American Astronomical Society Meeting Abstracts. Masses and Radii of Subdwarf B Stars from Gaia Parallaxes and Spectral Energy Distribution Fitting. p. 401.09

Books and Other Publications Not Listed Above: April 2022 – March 2023

Produced by AOP, 2022, Armagh Observatory and Planetarium Souvenir Guidebook, p. 1–29

Presentations: April 2022 – March 2023

Date	AOP Speaker	Title	Location/Mode	Category
05 Apr 2022	S. Bagnulo	Introduction to Polarimetry	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
06 Apr 2022	D. Eden	What Causes Stars to Form?	Seminar, Astrophysics Research Institute, Liverpool John Moores University, Liverpool	Research
07 Apr 2022	M. Sarzi	How to Get Observing Time on the Largest Ground and Space Telescopes in the World	Astrobytes, AOP	Internal Outreach
12 Apr 2022	G. Ramsay	Super-flares on the Sun and Solar Type Stars	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
24 Apr 2022	J. Rigney	Low Mass Stars at Radio Wavelengths	Dunsink Observatory, Dublin Institute for Advanced Studies, Dublin	Outreach
22 Apr 2022	A. Christou	The Three Body Problem in Action: A Guided Tour of the Coorbital Zoo	Seminar, Grupo de Dynamical Orbital e Planetologia (GDOP) - Faculdade de Engenharia de Guaratinguetá, UNESP, Sao Paolo, Brazil (online)	Research
25 Apr 2022	E. Higgins	Constraining Physical Processes in Pre-Supernova Massive Star Evolution	Lorentz Workshop: 'Bridging Stellar Evolution and Feedback Together', Lorentz Center, Leiden, The Netherlands	Research
27 Apr 2022	D. Eden	SKA: Current Status and Pathfinder Science	Astrobytes, AOP	Internal Outreach
28 Apr 2022	H. Dalglish	The Nature of the Night	The Nature of the Night Event, AOP	Outreach
28 Apr 2022	C.S. Jeffery	Guts, Bangs, Branes, Strings and Multiverse	Astrobytes, AOP	Internal Outreach
28 Apr 2022	A. Sander	The Dependencies of Wolf-Rayet-Type Mass-Loss and the Consequences for their Ionizing Feedback	Workshop, Bringing Stellar Evolution and Feedback Together, Lorentz Center, Leiden, The Netherlands	Research
05 May 2022	M. Burton	Our Place in the Cosmos 2/27	Astrobytes, AOP	Internal Outreach
10 May 2022	G. Sabhahit	The Metallicity (in) Dependence of the Humphreys-Davidson Limit	International Astronomical Union Symposium 361, Ballyconnell, Co Cavan, Ireland	Research
11 May 2022	G. Ramsay	What Does An Astronomer Do	Astrobytes, AOP	Internal Outreach
11 May 2022	M. McMahon	The Grounds of Armagh Observatory	Armagh and District History Group Meeting, AOP	Outreach
16 May 2022	C. Duffy	CV in ZTF and Other All Sky Surveys	ZTF Consortium Meeting, University of Warwick, England	Research
17 May 2022	H. Dalglish	Globular Clusters Young and Old	IOP Three Minute Wonder Competition, Royal Institution, London	Outreach
17 May 2022	C.S. Jeffery	Project Sirius: High Performance Computing @ AOP	Discussion Seminar, AOP	Research/AOP Training
19 May 2022	M. Burton	Our Place in the Cosmos 3/27	Astrobytes, AOP	Internal Outreach
19 May 2022	H. Dalglish	Dark Skies	Armagh Place Plan Launch Event, Armagh City Hotel, Armagh	Outreach

19 May 2022	J.S. Vink	Radiative Transfer and Massive Stars	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
23 May 2022	S. Bagnulo	New Insight into the Magnetism of Isolated White Dwarfs	Institute of Astrophysics of Andalusia, Spain	Research
24 May 2022	M. Burton with D. Eden	Our Galaxy – Molecular Clouds and Star Formation	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
24 May 2022	J.S. Vink	Introduction to Massive Stars	The Massive Star Research Group Discussion Meeting, AOP	Research
25 May 2022	H. Dalglish	Rewilding the Night: Dark Skies for People and Planet	Seminar, Queen's University Belfast	Research
26 May 2022	M. Burton	Our Place in the Cosmos 4/27	Astrobytes, AOP	Internal Outreach
09 Jun 2022	S. Bagnulo	A Night at the Telescopes	Astrobytes, AOP	Internal Outreach
13 Jun 2022	A. Christou	High-inclination NEAs as Meteor Stream Parent Bodies	Meteoroids 2022 Virtual Meeting	Research
13 Jun 2022	A. Humpage	Simulating the Evolution of Large, Near-Earth Meteoroid Streams and Their Properties	Meteoroids 2022 Virtual Meeting	Research
13 Jun 2022	C.S. Jeffery	The SALT Survey of Chemically-Peculiar Subdwarfs	sdOB10 - The 10th International Workshop on Hot Subdwarfs and Related Objects, University of Liege, Belgium	Research
13 Jun 2022	L. Scott	The SALT Survey of Helium-Rich Hot Subdwarfs: The Neon-Rich Binary EC20817-4939"	sdOB10 - The 10th International Workshop on Hot Subdwarfs and Related Objects, University of Liege, Belgium	Research
16 Jun 2022	M. Burton	Our Place in the Cosmos 5/27	Astrobytes, AOP	Internal Outreach
17 Jun 2022	M. Burton	"Our Place in the Cosmos" – Behind the Scenes	Seminar Programme, Department for Communities NI (via Zoom)	Outreach
17 Jun 2022	H. Dalglish	Dark Skies in Namibia: Celebrating Stars and Stories	Women in Dark Skies Web Talks, Mayo Dark Sky Park, Ballycroy, Co. Mayo, Ireland	Outreach
20 Jun 2022	M. Burton	Wisdom Begins With Wonder – A Vision for the Armagh Observatory and Planetarium	Stakeholder Event, AOP	Outreach
22 Jun 2022	E. Higgins	Very Massive Stars: Mass Loss Implementation and the Upper Initial Mass"	VFTS Meeting, Heidelberg, Germany	Research
23 Jun 2022	M. Burton	Our Place in the Cosmos 5/27	Astrobytes, AOP	Internal Outreach
28 Jun 2022	H. Dalglish	Light Pollution	House of Lords, London	Policy
28 Jun 2022	E. Wince	Black Holes Where They Shouldn't Be	Seminar, AOP	Research
29 Jun 2022	S. Bagnulo	Comet Polarimetry	Comet Interceptor, EnVisS Workshop (Online)	Research
30 Jun 2022	H. Dalglish	Dark Skies and Climate Action	Dark Skies and Climate Action Workshop, AOP	Outreach
04 Jul 2022	J. Rigney	Searching for Stellar Flares from Low Mass Stars Using ASKAP and TESS	Cool Stars 21, Toulouse, France	Research
11 Jul 2022	K. O. Çubuk	3D Molecular Cloud Distribution in the Southern Galactic Plane	National Astronomy Meeting, University of Warwick, England	Research
13 Jul 2022	C. Duffy	The New Robotic Telescope and Accreting Binaries	National Astronomy Meeting, University of Warwick, England	Research
13 Jul 2022	M. McMahon	Observatory Networking - Professional and Personal Relationships Over Four Centuries	Discovering Collections Discovering Communities (DCDC22) History Day Conference (online)	Outreach

14 Jul 2022	M. Sarzi	Fornax 3D: A Survey of Fornax with MUSE	VEGAS Collaboration Meeting, Naples, Italy	Research
02 Aug 2022	S. Bagnulo	Two (or more) Mechanisms for the Onset of Magnetism in White Dwarfs	Discussion Seminar, AOP	Research/AOP Training
02 Aug 2022	J.S. Vink	X-Shooting ULLYSES	Focus Meeting 4, IAU General Assembly, Busan, Korea (virtual)	Research
04 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
04 Aug 2022	J.G. Doyle	Simultaneous TESS and ASKAP Observations of Low Mass Stars	Solar-Stellar Connections, Flares, and Superflares, International Workshop, hosted by VIRAC, Latvia (online)	Research
04 Aug 2022	G. Ramsay	Super-Flares from Solar-Type and Low Mass Stars	Solar-Stellar Connections, Flares, and Superflares, International Workshop, hosted by VIRAC, Latvia (online)	Research
08 Aug 2022	M. Burton	Ireland's Historic Observatories: Their Intersection with Science, Culture and Politics	Division C (Education, Outreach & Heritage) meeting – via Zoom, IAU General Assembly, Busan, Korea	Research
10 Aug 2022	A. Sander	The Driving of Hot Star Winds	IAU Symposium 370 - Winds of stars and exoplanets, IAU General Assembly, Busan, Korea	Research
10 Aug 2022	J.S. Vink	Theory and Diagnostics of Hot Star Mass Loss	IAU Symposium 370, IAU General Assembly, Busan, Korea (virtual)	Research
11 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
15 Aug 2022	S. Bagnulo	A Volume Limited Spectropolarimetric Survey of White Dwarfs	22nd European Workshop on White Dwarfs, Universität Tübingen, Germany	Research
15 Aug 2022	C.S. Jeffery	Hot White Dwarfs from the SALT Survey of Helium-Rich Hot Subdwarfs	22nd European Workshop on White Dwarfs, Universität Tübingen, Germany	Research
6 Aug 2022	J. Landstreet	Rotation Periods and Surface Magnetic Field Structures of Young Weak-Field Magnetic White Dwarfs	22nd European Workshop on White Dwarfs, Universität Tübingen, Germany	Research
16 Aug 2022	J.S. Vink	Stellar Winds (Invited Review)	Stars 2020, Institute of Astronomy, University of Cambridge, England	Research
18 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
19 Aug 2022	M. Burton	The Music and Astronomy of William Herschel – Celebrating 200 Years	AOP	Outreach
23 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
25 Aug 2022	A. Humpage	Dispersion Rates of Resonant and Non-Resonant Near-Earth Families	CELTA ASI Summer School, University of Highlands & Islands (UHI), Sabhal Mòr Ostaig, Skye and UHI Inverness, Scotland	Research
30 Aug 2022	C. Duffy	Diverse Outbursting Behaviour in AM CVn System	AM CVn 4.5 (online)	Research

01 Sep 2022	D. Eden	MAJORS: Massive, Active, JCMT-Observed Regions of Star Formation	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
01 Sep 2022	M. Sarzi with C. Clarke	Detecting Planetary Nebulae with Adaptive Optics	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
02 Sep 2022	J. Rigney	Searching for Stellar Flares from Low Mass Stars Using ASKAP and TESS	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
02 Sep 2022	E. Wince	Black Holes Where They Shouldn't Be	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
09 Sep 2022	H. Alexander	Interpretation of Armagh Observatory and Planetarium History in the Planetarium Display Space	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	A. Black	Considering the Historic Architecture of the Observatory	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	M. Burton	Introduction to Armagh Observatory and Planetarium	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	M. McMahon	Oral History at Armagh Observatory and Planetarium	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	R. Nežič	Blending History and Science for the Public	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
11 Sep 2022	A. Christou	Extra-Terrestrial Occultations: The Beagle 2 Experiment	41st European Symposium on Occultation Projects, Granada, Spain (virtual)	Research
11 Sep 2022	A. Christou	A Proposal to Hold ESOP XLII in the City of Armagh, Northern Ireland, on 15-19 September 2023	41st European Symposium on Occultation Projects, Granada, Spain (virtual)	Research
23 Sep 2022	A. Christou	High-Inclination NEAs as Meteor Stream Parent Bodies	Europlanet Science Congress 2022, Granada, Spain	Research
23 Sep 2022	Z. Gray	The Return of Rosetta's Comet: Photometric and Polarimetric Observations of Comet 67P/CG in its 2021-22 Apparition	Europlanet Science Congress 2022, Granada, Spain	Research
23 Sep 2022	R. Nežič	Unusual Polarimetric Properties for Interstellar Comet 2I/Borisov	Europlanet Science Congress 2022, Granada, Spain	Research
25 Sep 2022	M. Burton	The Music and Astronomy of William Herschel (with Rod Alston)	Sligo Baroque Music Festival, The Model, Sligo, Co. Sligo, Ireland	Outreach
27 Sep 2022	J. Rigney	Low Frequency Radio Emission Associated with an Impulsive Flare and CME	Planetary, Solar, and Heliospheric Radio Emission Conference, Dublin	Research
30 Sep 2022	A. Christou	Prospects for Meteor Astronomy on Venus	Venus Science Conference, Ahmedabad, India (virtual)	Research
01 Oct 2022	Z. Gray, A. Humpage, E. Winch	Armagh-geddon	AOP	Outreach
04 Oct 2022	K.O. Çubuk	Nuffield Research Placements at Armagh Observatory and Planetarium	Nuffield Research Placement Celebration Event, The Long Gallery, Stormont, Belfast	Outreach
10 Oct 2022	M. Burton and M. McMahon	Armagh Dunsink Harvard Telescope Event	Dunsink Observatory, Dublin	Outreach
12 Oct 2022	C. Duffy	Gravitational Waves and the Gravitational Wave Optical Observer	Group Visit, AOP	Outreach
14 Oct 2022	J. Rigney	Searching for Stellar Flares from Low Mass Stars Using ASKAP and TESS	TESS Science Meeting #29	Research

18 Oct 2022	C. Duffy	VY Scl Systems	GOTO Science Meeting (online)	Research
19 Oct 2022	M. Sarzi	Planetary Nebulae and Their Role in the Cosmic Distance Ladder	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
27 Oct 2022	M. Burton	AOP Science & Education Park Redevelopment Project	Armagh, Banbridge & Craigavon Councillors and Officers Visit, AOP	Outreach Internal
27 Oct 2022	R. Nežić	Creepy Comets	Star Tracker Evening, AOP	Outreach Internal
28 Oct 2022	M.E. Bailey	The Human Orrery: Ground-Based Astronomy for All. PhD and Postdoc Training. Part 1	AOP	Teaching Internal
28 Oct 2022	M. Burton	Measuring the Heavens from Armagh	QUB Geography Field Trip, AOP	Teaching Internal
31 Oct 2022	M.E. Bailey	The Human Orrery: Ground-Based Astronomy for All. PhD and Postdoc Training. Part 2	AOP	Teaching Internal
07 Nov 2022	A. Christou	According to an Astronomer: What Apollo Taught us About the Moon	Astrobytes, AOP	Internal Outreach
07 Nov 2022	R. Nežić	Armagh Observatory: Astronomical Past, Present and Future	Sydney City Skywatchers (online)	Outreach
08 Nov 2022	S. Bagnulo, Z. Gray	Update from the VLT	Hybrid Observation Working Group Session, DART IT Meeting (online)	Research
10 Nov 2022	S. Bagnulo	Magnetism in Isolated White Dwarfs	Hybrid Solar Polarisation Workshop 10, Kyoto, Japan (online)	Research
11 Nov 2022	A. Sander	Organisation of the XShootU Collaboration	ULLYSES New Horizons Workshop, Lorentz Centre, University of Leiden, The Netherlands	Research
11 Nov 2022	J.S. Vink	Workshop Summary X-Shooting ULLYSES	ULLYSES New Horizons Workshop, Lorentz Centre, University of Leiden, The Netherlands	Research
14 Nov 2022	J. Rigney	The Sun and the (Low Mass) Stars: Searching for Stellar Flares and CMES on M Dwarfs	Seminar, STELLAR Consortium, Bulgaria Academy of Sciences (online)	Research
14 Nov 2022	M. Sarzi	Fornax 3D: A Survey of Fornax with MUSE	Seminar, Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil (online)	Research
15 Nov 2022	S. Bagnulo	The Origin of Magnetism in Isolated White Dwarfs: Observational Constraints	White Dwarfs from Physics to Astrophysics Conference, Kavli Institute for Theoretical Physics, UC Santa Barbara, USA	Research
16 Nov 2022	G. Ramsay	Super-Flares on the Sun and Other Stars. Multi-Messenger Astronomy and Wide-Field Optical Surveys.	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
17 Nov 2022	C.S. Jeffery	Project Sirius: High Performance Computing @ AOP	Discussion Seminar, AOP	Research/AOP Training
17 Nov 2022	R. Nežić	Telescopes: What They Are and How to Use Them	Johnston Central Library, Cavan, Co. Cavan, Ireland	Outreach
17 Nov 2022	J. Rigney	What are M dwarfs?	Open Night, Dunsink Observatory, DIAS, Dublin	Outreach
18 Nov 2022	M. Sarzi	Fornax 3D: A Survey of Fornax with MUSE	Seminar, Institute of Astronomy, University of Cambridge, England	Research
21 Nov 2022	C.S. Jeffery	According to an Astronomer: Ten Hottest Objects in the Universe	Astrobytes, AOP	AOP Training/Internal Outreach

22 Nov 2022	C.S.Jeffery	SALT White Dwarfs and Pre-White Dwarfs	Discussion Seminar, AOP	Research
24 Nov 2022	A.P. Monai	Star Families	Star Tracker Evening, AOP	Outreach
25 Nov 2022	E. Higgins	Torch Bearing Women in Astronomy	West Cork Music Festival Event, AOP	Outreach
30 Nov 2022	J.S. Vink	First Science with JWST	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
02 Dec 2022	Z. Gray	Astronomer's Guide to Polarimetric Observations	Nordic Optical Telescope & Isaac Newton Group of Telescopes Seminar Series, Santa Cruz de La Palma, Spain	Research
05 Dec 2022	K.O. Çubuk	Artemis Mission and Permanent Moon Base	Astrobytes, AOP	Internal Outreach
14 Dec 2022	J.G. Doyle	50 Telescopes and Counting	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
19 Dec 2022	M. McMahon	History of Astronomy in Ireland and Globally	Astrobytes, AOP	Internal Outreach
02 Dec 2022	Z. Gray	Astronomer's Guide to Polarimetric Observations	Nordic Optical Telescope & Isaac Newton Group of Telescopes Seminar Series, Santa Cruz de La Palma, Spain	Research
05 Dec 2022	M.E. Bailey	Education and Public Outreach at Armagh Observatory: Using Kinesthetic Learning to Bring Heaven Down to Earth in a Practical Way	Causeway U3A, Portstewart, Co. Antrim	Outreach
05 Dec 2022	K.O. Çubuk	Artemis Mission and Permanent Moon Base	Astrobytes, AOP	Internal Outreach
08 Dec 2022	L. Scott, A. Loni	Careers in Astronomy	Banbridge Academy, Banbridge, Co. Armagh	Outreach
19 Dec 2022	M. McMahon	History of Astronomy in Ireland and Globally	Astrobytes, AOP	Internal Outreach
09 Jan 2023	M. Burton	World Heritage and Astronomy	Northern Ireland Amateur Astronomy Society, Ballyclare High School, Co. Antrim	Outreach
10 Jan 2023	J.S. Vink	How Heavy is the Most Massive Star?	Heidelberg Joint Astronomical Colloquium, University of Heidelberg, Germany	Research
16 Jan 2023	C. Duffy	The Accretion Behaviour of Cataclysmic Variables Under Differing Magnetic Environments	Accretion and Magnetism Conference, Cape Town, South Africa	Research
18 Jan 2023	S. Bagnulo	Two (or more) Channels for the Onset of Magnetic Fields in White Dwarfs	Accretion and Magnetism Conference, Cape Town, South Africa (online)	Research
23 Jan 2023	S. Bagnulo	Becoming an Astronomer: For Those People Who Come In and Want to Have an Idea of What it Takes to Become a Full-Time Astronomer	Astrobytes, AOP	Outreach Internal
26 Jan 2023	C. Duffy	Big Telescopes of the World	Star Tracker Evening, AOP	Outreach
28 Jan 2023	J. Rigney	Radio Astronomy in Ireland	Astrofest 2023, Galway Astronomy Club, Menlo Park Hotel, Galway, Ireland	Outreach
02 Feb 2023	M. Burton	Measuring the Heavens – A Short History of Armagh Observatory	Isle of Man Astronomy Society, The Observatory, Foxdale, Isle of Man (via Zoom)	Outreach
03 Feb 2023	M. Burton	Ireland and the Herschels – Some Surprising Connections.	Herschel Society, Bath, England (Hybrid via Zoom)	Outreach
06 Feb 2023	M. Burton	Understanding the Stars and Where They Are in Our Sky and in the Galaxy	Astrobytes, DVL, AOP	Internal Outreach

09 Feb 2023	M. Burton	Ultra-hot Molecular Hydrogen in the Interstellar Medium ("emission from quasi-bound molecular hydrogen")	Seminar, AOP	Research
13 Feb 2023	J.S. Vink	Hot Star Winds	Munich Institute for Astro- and Particle Physics, Munich, Germany	Research
14 Feb 2023	M. Burton	Our Galaxy: Gas, Dust and Surveys	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
20 Feb 2023	S. Schlagenhauf	Exoplanets in the Habitability Zones of Stars: Finding Them and Learning Anything	Astrobytes, AOP	Internal Outreach
23 Feb 2023	C.S. Jeffery	Eight Super-Hot White Dwarfs	Seminar, AOP	Research
25 Feb 2023	M. McMahon, A. Marshall Lee, S. Schlagenhauf	Cosmic Conservation	AOP	Outreach
27 Feb 2023	M. McMahon	The Troughton Equatorial Telescope Network	Centre for Fusion, Space and Astrophysics, University of Warwick, England (online)	Outreach
27 Feb 2023	H. Alexander	A Brief Overview of the History of Armagh Observatory and Planetarium	Portadown Rotary Club, Seagoe Hotel, Portadown, Co. Armagh	Outreach
01 Mar 2023	S. Bagnulo	Introduction to Night Time Polarimetry	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
06 Mar 2023	D. Eden	Star Formation in the Milky Way...and Beyond	Northern Ireland Amateur Astronomy Society, Ballyclare High School, Co. Antrim	Outreach
07 Mar 2023	D. Eden	High-Mass Star Formation	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
15 Mar 2023	J. Rigney	Diving Deeper into the Radio Sky	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
21 Mar 2023	A.P. Monai	Population Studies of Exotic Hot Subdwarfs	Discussion Seminar, AOP	Research
22 Feb 2023	J.S. Vink	Radiative Transfer and the Most Massive Stars	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
23 Mar 2023	J. Rigney	Life Around Other Stars	Open Night, Dunsink Observatory, Dublin Institute for Advanced Studies, Dublin	Outreach
24 Mar 2023	Z. Gray	A Day in the Life of an Astronomer (video presentation)	Staring into Space - PhD Afternoon, AOP	Outreach
24 Mar 2023	A. Marshall Lee, A.P. Monai, S. Schlagenhauf, A. Humpage, Ethin Wince, Z. Gray	Staring into Space - PhD Afternoon	Staring into Space - PhD Afternoon, AOP	Outreach
27 Mar 2023	J. Rigney	Diving Deeper Into the Radio Sky	University College Dublin, Dublin	Outreach
29 Mar 2023	C.S. Jeffery	SALT and the Super-Hot Zombie Stars	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach

Education and Outreach: April 2022 – March 2023

Date	Event Description
Apr 2022 – Mar 2023	The Legendary Telescope Tours at Armagh Observatory
20 Apr 2022	Wee Critters – Interactive Animal Experience
28 Apr 2022	The Nature of the Night – See The Astropark Like Never Before
11 May 2022	IAU Conference 361: Massive Stars Near and Far, Slieve Russell Hotel, Ballyconnell, Co Cavan. Live Interactive Sessions in the Inflatable Star Dome
8 Jun 2022	Astropark Infinity Walks to Celebrate the launch of Disney and Pixar's Lightyear Movie
11 Jun to 31 Jul 2022	Brickosaurs Experience
30 Jun 2022	Dark Skies and Climate Action Workshop
1 Jul 2022	Story Time with Armagh City Library
7, 14, 21, 28 and 2, 20 Aug 2022	Jurassic Ark Encounters NI Workshop
4, 11, and 18 Aug 2022	Drop In Data Visualisation Laboratory Demonstrations
19 August 2022	Music and Astronomy of William Herschel, Celebrate 200 Years of William Herschel, Live Performance by the Sligo Baroque Orchestra
10 – 11 Sep 2022	European Heritage Open Days – Astropark Tours
Sep 2022 – Jan 2023	Temporary Exhibition "Like Gold to Airy Thinness Beat", Art on the International Space Station with The Moon Gallery
1 Oct 2022	Armagh-Geddon PhD Day
5 – 7 Oct 2022	Space Week, Space and Sustainability, Special Screening of Our Place in the Cosmos
20 Oct 2022	Bat Walk Around the Astropark with Northern Ireland Bat Group
27 Oct 2022	Spooky Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
29/30 Oct 2022	Potions & Explosions Live Science Show with Scientific Sue
29/30 Oct 2022	Tall Tales and Terror at Armagh Observatory
31 Oct – 4 Nov 2022	Drop In Data Visualisation Laboratory Demonstrations
16 Nov 2022	Artemis I Mission Launch
16 Nov 2022	Cavan Monaghan Science Festival Event: The Night Sky Through The Telescope, Johnston Central Library Cavan
19 Nov – 23 Dec 2022	Mission Santa, An Immersive Christmas Experience
24 Nov 2022	Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
25 Nov 2022	Thus She Shall Go To The Stars ... A Live Musical Performance in the Dome, Jessie Kennedy with The Celestial Strings. In association with The West Cork History Festival
26 Nov 2022	Armagh Georgian Day, Observatory Tour with Dr Rok Nežič
13 and 15 Dec 2022	Royal Institution Christmas Lecture Series. Live Stream. Professor Dame Sue Black will reveal the secrets of forensic science
14 Dec 2022	Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts. Apollo 17 Anniversary Special
26 Jan 2023	Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
16 Feb 2023	NI Science Festival 2023 Event: Shoot for the Stars, Astronomy Careers
18 – 19 Feb 2023	NI Science Festival 2023 Event: Bricks 4 Kidz Workshop
17 Feb 2023	NI Science Festival 2023 Event: Astropark Walking Tours
22 Feb 2023	NI Science Festival 2023 Event: Climate Tour in collaboration with the Northern Ireland Museums.
23 Feb 2023	NI Science Festival 2023 Event: Star Tracker Special – From Mercury with Love
24 Feb 2023	NI Science Festival 2023 Event: Little Astronomers
25 Feb 2023	NI Science Festival 2023 Event: Cosmic Conservation, Astronomy and Antiques
08 Mar 2023	Irish Week Event: CapCom Go As Gaeilge.

21 Mar 2023	Irish Astronomy Week Event: Introduction to Astrophotography with Paul Evans
22 Mar 2023	Irish Astronomy Week Event: Observatory Library Open Afternoon
23 Mar 2023	Irish Astronomy Week Event: Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
24 Mar 2023	Irish Astronomy Week Event: Look Up Dome Show
24 Mar 2023	Irish Astronomy Week Event: Staring into Space, PhD Day at Armagh Observatory and Planetarium

Intergalactic Craic Podcasts: April 2022 – March 2023

Date	Podcast Title
23 Jan 2023	S3 – What's the craic?
27 Jan 2023	S3Ep1 – Wee Bitta Craic: Welcome Ethan, Alice and Zuri!
10 Mar 2023	S3Ep2 – Wee Bitta Craic: Bout Ye Zuri?

Presenters: H Alexander, E Winch, A Humpage and Z Gray
All published via anchor.fm/intergalacticcraic

THE ARMAGH OBSERVATORY AND PLANETARIUM

THE CERTIFICATE AND REPORT OF THE COMPTROLLER AND AUDITOR GENERAL TO THE NORTHERN IRELAND ASSEMBLY

Opinion on financial statements

I certify that I have audited the financial statements of the Armagh Observatory and Planetarium for the year ended 31 March 2023 under the Armagh Observatory Planetarium (Northern Ireland) Order 1995. The financial statements comprise: the Statement of Financial Activities, the Balance Sheet, the Cash Flow Statement; and the related notes including significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom accounting standards including Financial Reporting Standard (FRS) 102, the Financial Reporting Standard applicable in the UK and Republic of Ireland (United Kingdom Generally Accepted Accounting Practice).

I have also audited the information in the Trustees' Annual Report that is described in that report as having been audited.

In my opinion the financial statements:

- give a true and fair view of the state of Armagh Observatory and Planetarium's affairs as at 31 March 2023 and of its total incoming resources and expenditure of resources for the year then ended;
- have been properly prepared in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102); and
- have been properly prepared in accordance with the Armagh Observatory Planetarium (Northern Ireland) Order 1995 and Department for Communities directions issued thereunder.

Opinion on regularity

In my opinion, in all material respects the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Basis for opinion

I conducted my audit in accordance with International Standards on Auditing (ISAs) (UK), applicable law and Practice Note 10 'Audit of Financial Statements and Regularity of Public Sector Bodies in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of this certificate.

My staff and I are independent of Armagh Observatory Planetarium in accordance with the ethical requirements that are relevant to my audit of the financial statements in the UK, including the Financial Reporting Council's Ethical Standard, and have fulfilled our other ethical responsibilities in accordance with these requirements.

I believe that the audit evidence obtained is sufficient and appropriate to provide a basis for my opinions.

Conclusions relating to going concern

In auditing the financial statements, I have concluded that Armagh Observatory Planetarium's use of the going concern basis of accounting in the preparation of the financial statements is appropriate.

Based on the work I have performed, I have not identified any material uncertainties relating to events or conditions that, individually or collectively, may cast significant doubt on the Armagh Observatory Planetarium's ability to continue as a going concern for a period of at least twelve months from when the financial statements are authorised for issue.

The going concern basis of accounting for Armagh Observatory Planetarium is adopted in consideration of the requirements set out in the Government Financial Reporting Manual, which require entities to adopt the going concern basis of accounting in the preparation of the financial statements where it anticipated that the services which they provide will continue into the future.

My responsibilities and the responsibilities of the Trustees and the Accounting Officer with respect to going concern are described in the relevant sections of this report.

Other Information

The other information comprises the information included in the Trustees' annual report other than the financial statements, the parts of the Trustees' described in that report as having been audited, and my audit certificate and report. The Trustees and the Accounting Officer are responsible for the other information included in the annual report. My opinion on the financial statements does not cover the other information and except to the extent otherwise explicitly stated in my report, I do not express any form of assurance conclusion thereon.

My responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements, or my knowledge obtained in the audit or otherwise appears to be materially misstated. If I identify such material inconsistencies or apparent material misstatements, I am required to determine whether this gives rise to a material misstatement in the financial statements themselves. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact.

I have nothing to report in this regard.

Opinion on other matters

In my opinion based on the work undertaken in the course of the audit:

- the parts of the Trustees' to be audited have been properly prepared in accordance with Department for Communities directions made under the Armagh Observatory Planetarium (Northern Ireland) Order 1995; and
- the information given in the Trustees' Annual Report the financial year for which the financial statements are prepared is consistent with the financial statements.

Matters on which I report by exception

In the light of the knowledge and understanding of the Armagh Observatory Planetarium and its environment obtained in the course of the audit, I have not identified material misstatements in the Trustees' Annual Report.

I have nothing to report in respect of the following matters which I report to you if, in my opinion:

- adequate accounting records have not been kept; or
- the financial statements and the parts of the Trustees Report to be audited are not in agreement with the accounting records; or
- certain disclosures of remuneration specified by the Government Financial Report Manual are not made; or
- I have not received all of the information and explanations I require for my audit; or
- the Governance Statement does not reflect compliance with the Department of Finance's guidance.

Responsibilities of the Board of Governors and Accounting Officer for the financial statements

As explained more fully in the Statement of the Responsibilities of the Governors and Accounting Officer the Governors and the Accounting Officer are responsible for:

- the preparation of the financial statements and for being satisfied that they give a true and fair view;
- such internal controls as the Trustees Accounting Officer determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error;
- ensuring the Trustees' Annual Report, which includes the Remuneration and Staff Report, is prepared in accordance with the Government Financial Reporting Manual;
- assessing the Armagh Observatory Planetarium's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Trustees and Accounting Officer anticipates that the services provided by Armagh Observatory Planetarium's will not continue to be provided in the future.

Auditor's responsibilities for the audit of the financial statements

My responsibility is to examine, certify and report on the financial statements in accordance with the Armagh Observatory Planetarium (Northern Ireland) Order 1995.

My objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error and to issue a certificate that includes my opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

I design procedures in line with my responsibilities, outlined above, to detect material misstatements in respect of non-compliance with laws and regulation, including fraud.

My procedures included:

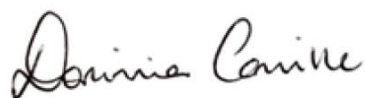
- obtaining an understanding of the legal and regulatory framework applicable to the Armagh Observatory Planetarium through discussion with management and application of extensive public sector accountability knowledge. The key laws and regulations I considered included Armagh Observatory Planetarium (Northern Ireland) Order 1995.
- making enquires of management and those charged with governance on Armagh Observatory Planetarium's compliance with laws and regulations;
- making enquiries of internal audit, management and those charged with governance as to susceptibility to irregularity and fraud, their assessment of the risk of material misstatement due to fraud and irregularity, and their knowledge of actual, suspected, and alleged fraud and irregularity;
- completing risk assessment procedures to assess the susceptibility of Armagh Observatory Planetarium's financial statements to material misstatement, including how fraud might occur. This included, but was not limited to, an engagement director led engagement team discussion on fraud to identify particular areas, transaction streams and business practices that may be susceptible to material misstatement due to fraud. As part of this discussion, I identified potential for fraud in the following areas: revenue recognition, expenditure recognition, and posting of unusual journals;
- engagement director oversight to ensure the engagement team collectively had the appropriate competence, capabilities, and skills to identify or recognise non-compliance with the applicable legal and regulatory framework throughout the audit;
- documenting and evaluating the design and implementation of internal controls in place to mitigate risk of material misstatement due to fraud and non-compliance with laws and regulations;
- designing audit procedures to address specific laws and regulations which the engagement team considered to have a direct material effect on the financial statements in terms of misstatement and irregularity, including fraud. These audit procedures included, but were not limited to, reading board and committee minutes, and agreeing financial statement disclosures to underlying supporting documentation and approvals as appropriate; and
- addressing the risk of fraud as a result of management override of controls by:
 - performing analytical procedures to identify unusual or unexpected relationships or movements;
 - testing journal entries to identify potential anomalies, and inappropriate or unauthorised adjustments;
 - assessing whether judgements and other assumptions made in determining accounting estimates were indicative of potential bias; and
 - investigating significant or unusual transactions made outside of the normal course of business.

A further description of my responsibilities for the audit of the financial statements is located on the Financial Reporting Council's website www.frc.org.uk/auditorsresponsibilities. This description forms part of my certificate.

In addition, I am required to obtain evidence sufficient to give reasonable assurance that the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Report

I have no observations to make on these financial statements.



Dorinnia Carville
Comptroller and Auditor General
Northern Ireland Audit Office
106 University Street
BELFAST
BT7 1EU

11 October 2023

Statement of Financial Activities for the year ended 31 March 2023

	Note	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Unrestricted Funds 2022 £	Restricted Funds 2022 £	Total Funds 2022 £
Income from:							
Charitable activities	2	2,502,195	1,035,208	3,537,403	2,174,574	1,739,637	3,914,211
Other trading activities	4	193,471	-	193,471	126,898	-	126,898
Total incoming resources		2,695,666	1,035,208	3,730,874	2,301,472	1,739,637	4,041,109
Expenditure on:							
Charitable activities	5	3,948,037	227,819	4,175,856	3,713,489	251,535	3,965,024
Other trading activities	7	110,013	-	110,013	69,057	-	69,057
Total outgoing expenditure		4,058,050	227,819	4,285,869	3,782,546	251,535	4,034,081
Net income / (expenditure)		(1,362,384)	807,389	(554,995)	(1,481,074)	1,488,102	7,028
Transfers between funds	15	833,469	(833,469)	-	1,502,448	(1,502,448)	-
Other recognised gains/(losses):							
Gains/(losses) on the revaluation of fixed assets and heritage assets	10	255,242	-	255,242	422,885	-	422,885
Actuarial gains less provisions on defined benefit pension scheme	15 & 19	2,411,000	-	2,411,000	1,534,000	-	1,534,000
Net Movement in Funds		2,137,327	(26,080)	2,111,247	1,978,259	(14,346)	1,963,913
Reconciliation of funds							
Total funds brought forward at 1 April 2022		10,435,116	174,108	10,609,224	8,456,857	188,454	8,645,311
Total funds carried forward at 31 March 2023		12,572,443	148,028	12,720,471	10,435,116	174,108	10,609,224

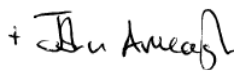
All amounts above relate to continuing operations of the organisation.
The notes on pages 66 to 78 form part of the financial statements.

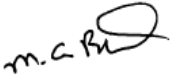
Armagh Observatory and Planetarium

Balance Sheet as at 31 March 2023

	Note	2023 £	2022 £
Fixed Assets			
Intangible assets	9	288,207	378,538
Tangible assets	10	9,885,719	9,600,160
Heritage Assets	11	2,698,595	2,698,595
Total fixed assets		12,872,521	12,677,293
Current assets			
Stocks	12	19,852	16,230
Debtors	13	181,025	81,628
Cash at bank and in hand	18	379,211	382,787
Total current assets		580,088	480,645
Creditors: amounts falling due within one year	14	(890,138)	(671,714)
Net current liabilities		(310,050)	(191,069)
Total assets less current liabilities		12,562,471	12,486,224
Creditors: amounts falling due after more than one year		-	-
Net assets excluding pension asset/(liability)		12,562,471	12,486,224
Defined benefit pension scheme asset/(liability)	19	158,000	(1,877,000)
Net assets		12,720,471	10,609,224
Funds			
Restricted funds	15	148,028	174,108
Unrestricted funds	15	5,010,569	4,910,146
Revaluation Reserves	15	7,403,874	7,401,970
Pension Reserve	15	158,000	(1,877,000)
Total Charity Funds		12,720,471	10,609,224

The financial statements on pages 63 to 78 were approved by the Board of Trustees of Armagh Observatory and Planetarium on 25 September 2023 and were signed on its behalf by:


 Chair of the Board of Trustees
 Archbishop John McDowell


 Accounting Officer
 Professor Michael Burton

Statement of cash flows for the year ended 31 March 2023

	Note	2023 £	2022 £
Net cash provided by operating activities	17	669,531	1,259,845
Cash flows from investing activities:			
Interest received		1,418	13
Purchase of intangible fixed assets	9	-	(203,568)
Purchase of tangible fixed assets		(683,100)	(1,149,080)
Sale of tangible fixed assets		8,575	8,857
		(673,107)	(1,343,778)
Increase / (decrease) in cash and cash equivalents		(3,576)	(83,933)

Further detail is reported in Notes 17 and 18.

Reconciliation of net cashflow to movement in net cash funds

		2023 £	2022 £
Increase / (decrease) in cash and cash equivalents in the year		(3,576)	(83,933)
Cash and cash equivalents at 1 April 2022		382,787	466,720
Cash and cash equivalents at 31 March 2023	18	379,211	382,787

The notes on pages 66 to 78 form part of the financial statements.

Notes to the financial statements for the year ended 31 March 2023

1 Summary of significant accounting policies

(a) Basis of accounting

These financial statements have been prepared in accordance with the historical cost convention as modified by the revaluation of certain assets. The accounts comply with relevant accounting standards and disclosure requirements issued by the Department of Finance. In all other aspects the financial statements comply with the Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS102) (Charities SORP (FRS102)).

The Trustees of Armagh Observatory and Planetarium confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2023.

The Trustees are satisfied that there are no material uncertainties related to events or conditions which cast significant doubt on the ability of Armagh Observatory and Planetarium to continue as a going concern.

(b) Incoming resources

Grant income from Department for Communities (DfC) is shown in the Statement of Financial Activities (SOFA) in the year in which it is received. Grants that relate to specific capital expenditure are initially recognised in the SOFA and transferred to a restricted fund, Government Grant for Fixed Assets. Where no restriction on the use of the assets exists the value is transferred to an unrestricted fund. Grants that relate to specific research projects are recognised in the Statement of Financial Activities and transferred to a restricted fund. Once the relevant conditions for recognition (entitlement and certainty of value) have been met, they are transferred to funds to match the relevant expenditure. Other grants are credited to the Statement of Financial Activities when receivable.

(c) Resources expended

Resources expended are accounted for on an accruals basis. Expenditure is classified under the principal charitable activities of Research, Education and Governance & Support.

(d) Pension scheme

The organisation provides pension benefits to its employees by participating in the Local Government Pension Scheme for Northern Ireland, administered by Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC), which is a defined benefit scheme. Annual contributions to the NILGOSC scheme are determined by the scheme and based on actuarial advice. The operating costs of providing retirement benefits to the organisation's employees are recognised in accounting periods in which the benefits are earned by employees, and the related finance costs and other changes in value of the assets and liabilities are recognised in the period in which they arise.

(e) Intangible fixed assets

Intangible fixed assets represent contributions to international astronomical research projects, financed by capital grant. They are identifiable, for example, as part of a major telescope installation. The organisation gains benefit in the form of research participation or collaboration, which in turn contributes to the research outputs. Intangible fixed assets are stated at cost and amortised over the expected life of the project.

(f) Tangible fixed assets

The cost of tangible fixed assets is their purchase cost or valuation together with any incidental costs of acquisition. Depreciation is calculated so as to write off the cost or valuation of tangible fixed assets, less their estimated residual values, on a straight-line basis over the expected useful economic lives of the assets concerned. Land is not depreciated.

The principal annual depreciation rates used are as follows:

Buildings	Remaining asset life as valued
Digistar	20%
Fixtures and fittings	20 - 50%
Office equipment	25%
Scientific equipment	10 - 25%
Exhibits	10 - 33%
Motor Vehicles	20%

Land and buildings are included in the balance sheet at depreciated replacement cost, estimated value in use or market value. Land and buildings are professionally revalued at least every 5 years in accordance with accounting guidance. Land and buildings were last revalued as at the 31st March 2023. Revaluation gains (losses) are transferred to a revaluation reserve. Land and buildings in years where no revaluation occurs are restated using indices.

The valuations of Land and Buildings have been undertaken having regard to International Financial Reporting Standards (IFRS) as applied to the United Kingdom public sector and in accordance with HM Treasury guidance, International Valuation Standards and the requirements of the Royal Institution of Chartered Surveyors Global Standards.

Other fixed assets (non Land & Buildings) with a life estimated over 5 years have a net book value of £64,924 at 31st March 2023. This accounts for 0.7% of the net book value of fixed assets. The Trustees do not consider it appropriate to carry out an annual indexation of such assets on grounds of immateriality.

Armagh Observatory and Planetarium

Notes to the financial statements for the year ended 31 March 2023 (continued)

(g) Heritage Assets

Armagh Observatory was founded in 1789 and from this date the Observatory has collected through its operations scientific items, books, furniture and other artefacts which would be considered heritage assets. It is not the policy of Armagh Observatory and Planetarium to acquire heritage assets but has collected such assets through donations and operations. At 31 March 2019, the majority (92% by value) of heritage assets were valued by Sotheby's of London for insurance purposes with reference to auction estimates for replacement. The remainder were valued by Ulster Museum and experienced members of management. It is policy to regularly review the valuation of heritage assets. The heritage assets are being documented on the Collections Database and environmental controls were further improved in 2023.

Heritage assets are summarised in four categories: Books; Clocks and watches; Scientific instruments; and Furniture, Artworks, etc, and are recorded in catalogues and on databases. Historic buildings which have heritage value are included within operational assets. These were included within the recent property revaluation as operational assets and continue to be used for operational purposes.

(h) Leases

IFRS 16 Leases replaces IAS 17 Leases and is effective with EU adoption from 1 January 2019. In line with the requirements of the FReM, IFRS 16 will be implemented, as interpreted and adapted for the public sector, with effect from 1 April 2023. IFRS 16 has the effect of largely eliminating the current 'off-balance sheet' treatment of operating leases under IAS 17. AOP have a small number of highly immaterial leases. Based on the AOP's review to date of operating leases associated with land, buildings, equipment and other assets there is likely to be minimal financial impact on the 2023/23 financial statements.

(i) Stocks

Stocks are stated at the lower of cost and net realisable value. In general, cost is determined on a first in first out basis. Provision is made where necessary for obsolete, slow moving and defective stocks.

(j) Debtors

Debtors comprise amounts due from customers, grants due, prepaid expenses and value added tax.

(k) Cash at bank and in hand

Cash held in bank accounts payable on demand and cash floats.

(l) Creditors

Creditors comprise payments due to suppliers and accruals for amounts due at the year end.

(m) Fund accounting

The organisation has various types of funds for which it is responsible, and which require separate disclosure. These are as follows:

Restricted funds

Grants or donations received which are earmarked by the donor for specific purposes. Such purposes are within the overall aims of the organisation.

Unrestricted funds

Unrestricted funds, comprising designated funds and undesignated funds, are those which are expendable at the discretion of the trustees in furtherance of the objectives of the organisation. In addition to expenditure on the provision of services, such funds may be held in order to finance capital investment and working capital.

Designated funds include the donated assets fund, the government grants fund and the general fund. The general fund is the day to day operating fund.

Donated assets are the buildings and grounds donated to the organisation in 1790 by its founder Archbishop Richard Robinson. The value is adjusted annually by any revaluation of the underlying assets.

The government grant fund represents the capital financing of the Charity's tangible fixed assets. The fund is reduced annually by a value equivalent to depreciation charged on the related assets.

Undesignated funds - These represent the revaluation reserve which records the movement from the revaluation of the Charity's assets and a pension reserve which matches the long term liability of an underfunded defined benefits pension scheme.

(n) Reserves policy

Armagh Observatory and Planetarium adopts a risk-based approach to establishing a sound system of control covering all types of risks to the aims and objectives of the organisation. There is a need to retain a sufficient level of unrestricted cash reserves to meet the risks associated with financial contingencies, uncertainties and demands. The Trustees do not believe there are any key assumptions or key sources of estimation uncertainty which could cause a material adjustment to the carrying amounts of assets and liabilities within the next reporting period.

Armagh Observatory and Planetarium budgets to operate on an annual basis within a balanced funding formula of grant in aid and self generated income. Annual operating surpluses / (deficits) are kept to a minimum and are transferred to an unrestricted general reserve at 31 March each year. The policy is reviewed on an annual basis. The level of general funds at 31 March 2023 was £1,068,393 (£658,224 at 31 March 2022).

Notes to the financial statements for the year ended 31 March 2023 (continued)

2 Income from charitable activities

	Note	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Total Funds 2022 £
Grant Income					
DfC Recurrent grant-in-aid		2,087,000	-	2,087,000	1,927,000
DfC In-year capital grant-in-aid		-	549,000	549,000	1,254,000
Total grant-in-aid from the DfC		2,087,000	549,000	2,636,000	3,181,000
Income from other grants and receipts	3	-	486,208	486,208	480,643
Total Grant Income		2,087,000	1,035,208	3,122,208	3,661,643
Operating Income					
Admissions		391,301	-	391,301	237,655
Profit/(loss) on disposal of fixed assets		8,575	-	8,575	8,857
Miscellaneous income		15,319	-	15,319	6,056
Total Operating Income		415,195	-	415,195	252,568
Total Income from Charitable Activities		2,502,195	1,035,208	3,537,403	3,914,211

3 Income from other grants and receipts

	Note	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Total Funds 2022 £
STFC Research and Studentship grants		-	295,229	295,229	385,289
UKRI COVID Support grant		-	-	-	49,520
UKRI Open Access block grant		-	4,193	4,193	-
Tourism NI grants		-	126,735	126,735	32,500
National Lottery Heritage Fund		-	42,624	42,624	-
Museums Association		-	14,500	14,500	-
JobStart scheme		-	2,925	2,925	13,306
Sundry donations		-	2	2	28
Total other grants and receipts	2	-	486,208	486,208	480,643

4 Income from other trading activities

	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Total Funds 2022 £
Shop income	178,752	-	178,752	113,308
Rental income	14,719	-	14,719	13,590
Total Income from other trading	193,471	-	193,471	126,898

5 Expenditure on charitable activities

	Note	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Total Funds 2022 £
Research	6	1,054,432	226,675	1,281,107	1,254,457
Education	6	1,453,599	1,144	1,454,743	1,410,589
Governance and Support	6	1,440,006	-	1,440,006	1,299,978
		3,948,037	227,819	4,175,856	3,965,024

Notes to the financial statements for the year ended 31 March 2023 (continued)

6 Expenditure on charitable activities

	Note	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Total Funds 2022 £
Research					
Staff costs		513,899	113,796	627,695	638,836
Direct costs		157,232	109,715	266,947	242,883
Support costs		110,029	3,164	113,193	113,216
Depreciation		273,272	-	273,272	259,522
	5	1,054,432	226,675	1,281,107	1,254,457
Education					
Staff costs		468,668	-	468,668	397,007
Direct costs		180,400	490	180,890	187,814
Support costs		254,147	654	254,801	290,392
Depreciation		550,384	-	550,384	535,376
	5	1,453,599	1,144	1,454,743	1,410,589
Governance and Support					
Staff costs		965,168	-	965,168	1,009,394
Direct costs		10,372	-	10,372	39,325
Support costs		429,377	-	429,377	218,005
Depreciation		35,089	-	35,089	33,254
	5	1,440,006	-	1,440,006	1,299,978

Included within Governance and Support costs are the following governance costs:

	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Total Funds 2022 £
Management Committee expenses	4,813	-	4,813	429
Internal Audit	9,852	-	9,852	10,086
External Audit	18,300	-	18,300	18,000
	32,965	-	32,965	28,515

The cost of audit shown above includes £18,300 fees payable to Northern Ireland Audit Office for statutory audit. NIAO does not provide any other service.

7 Expenditure on trading activities

	Unrestricted Funds 2023 £	Restricted Funds 2023 £	Total Funds 2023 £	Total Funds 2022 £
Trading				
Direct costs	110,013	-	110,013	69,057
	110,013	-	110,013	69,057

Notes to the financial statements for the year ended 31 March 2023 (continued)

8 Average staff numbers and related costs

	Permanent staff	Others	2023 Number	2022 Number
Average staff numbers	27.4	7.9	35.3	34.9

Staff costs comprise:

	Permanent staff £	Others £	2023 £	2022 £
Wages and salaries	1,172,056	169,562	1,341,618	1,298,400
Social security costs	125,302	16,806	142,108	132,074
Employer's pension contributions	218,849	31,956	250,805	238,763
Defined benefit pension additional service cost	327,000	-	327,000	376,000
	1,843,207	218,324	2,061,531	2,045,237

The number of employees whose employee benefits (excluding employer pension costs) exceeded £60,000 was:

	2023 Number	2022 Number
£60,001 - £70,000	1	1
£70,001 - £80,000	-	-
£80,001 - £90,000	1	1

The key management personnel of the organisation comprise the trustees and the Executive Director.

The total amount of employee benefits (including employer pension contributions) received by the Executive Director for his services to the organisation was £100,526 (2022: £101,661).

There was no remuneration paid to trustees during the year (2022: Nil). No travel and subsistence expenses were reimbursed to trustees (2022: Nil). Management Committee members incurred travel and subsistence expenses of £1,766 (2022: £429)

Average student numbers and related costs (not included above)

	2023 Number	2022 Number
PhD students	8.5	8.0

	2023 £	2022 £
Student maintenance grants & stipends	175,440	162,149

Notes to the financial statements for the year ended 31 March 2023 (continued)

9 Intangible fixed assets

	2023 £	2022 £
Cost		
At 1 April	622,018	418,450
Additions	-	203,568
Disposals	-	-
At 31 March	622,018	622,018
Depreciation		
At 1 April	243,480	153,150
Charge for year	90,331	90,330
Disposals	-	-
At 31 March	333,811	243,480
Net book value		
At 31 March 2023	288,207	378,538
At 31 March 2022	378,538	265,300

10 Tangible fixed assets

	Freehold Land & buildings £	Exhibits grounds and Astropark £	Assets under construction £	Digistar Projection System £	Scientific Equipment £	Other Equipment & Vehicles £	Total £
Cost or valuation							
At 1 April 2022	8,353,985	1,157,274	-	500,351	710,228	1,132,309	11,854,147
Asset revaluation	1,904	-	-	-	-	-	1,904
Additions	345,324	140,303	91,919	-	33,513	187,673	798,732
Disposals	-	(369,740)	-	-	(6,069)	(34,782)	(410,591)
At 31 March 2023	8,701,213	927,837	91,919	500,351	737,672	1,285,200	12,244,192
Depreciation							
At 1 April 2022	-	692,463	-	202,656	564,262	794,606	2,253,987
Adjustment for asset revaluation	(253,338)	-	-	-	-	-	(253,338)
Charge for year	253,338	174,661	-	99,232	50,327	190,857	768,415
Disposals	-	(369,740)	-	-	(6,069)	(34,782)	(410,591)
At 31 March 2023	-	497,384	-	301,888	608,520	950,681	2,358,473
Net book value							
At 31 March 2023	8,701,213	430,453	91,919	198,463	129,152	334,519	9,885,719
At 31 March 2022	8,353,985	464,811	-	297,695	145,966	337,703	9,600,160

Tangible fixed asset additions of £664,900 as shown above were funded by DfC in-year capital grant-in-aid. The remainder were funded by Tourism NI and Science Technology & Facilities Council.

Astropark is included in Land valuation. This has been shown as a separate asset classification for 50 years, and at nil NBV since March 2021. The disposal included within Exhibits Grounds and Astropark above reflects this.

If the land and buildings had not been valued, they would have been included at the following amounts:

	2023 £	2022 £
Cost	3,862,869	3,511,908
Aggregate depreciation	(1,183,129)	(1,106,149)
Net book value based on historic cost	2,679,740	2,405,759

Notes to the financial statements for the year ended 31 March 2023 (continued)

10 Tangible fixed assets (continued)

Included within Additions above are certain assets under construction:

	Exhibits £	Total £
Wind Tree and Solar Flower exhibit	91,919	91,919

Depreciation on tangible fixed assets for the year was £768,415 (2022: £737,822).

Land and buildings include grounds and buildings with a net book value of £2,143,316 (2022: £2,101,361) which were donated to the organisation in 1790 by Archbishop Richard Robinson, the founder of the organisation.

Armagh Observatory and Planetarium includes in fixed assets any expenditure over £1,500 (on an item or group of related items) which is expected to be used for more than a year.

11 Heritage assets

At Valuation	Books £	Clocks & Watches £	Scientific Equipment £	Furniture, Artworks, etc £	Total £
Carrying Amount at 1 April 2022	546,975	572,600	1,298,900	280,120	2,698,595
Additions	-	-	-	-	-
Revaluation	-	-	-	-	-
Disposals	-	-	-	-	-
Depreciation / impairment	-	-	-	-	-
Carrying Amount at 31 March 2023	546,975	572,600	1,298,900	280,120	2,698,595

It is policy to regularly review the valuation of heritage assets and to carry out a formal revaluation at least once every five years. Given that they were last valued in March 2019, and that the heritage assets remain in the same condition, the Trustees are content that this valuation is still appropriate.

Summary of heritage asset transactions

There were no purchases, donations, charges for impairment or disposals of heritage assets in the five years ended 31 March 2023. £60,061 of historic telescopes and £5,100 of meteorites were transferred from tangible fixed assets to heritage assets during the year ended 31 March 2019. Ordnance Survey maps of Ireland and map chests owned by Armagh Observatory & Planetarium but held in Robinson Library, Armagh, were valued for the first time in 2021-22 at £100,000.

12 Stocks

	2023 £	2022 £
Goods for resale	19,852	16,230

13 Debtors

	2023 £	2022 £
Trade debtors	14,733	12,933
Prepayments and accrued income	119,174	25,929
Other debtors	47,118	42,766
	181,025	81,628

14 Creditors: amounts falling due within one year

	2023 £	2022 £
Trade creditors	365,384	127,045
Accruals and sundry creditors	492,889	511,264
Taxation and social security	31,865	33,405
	890,138	671,714

Notes to the financial statements for the year ended 31 March 2023 (continued)

15 Statement of Funds

	At 1 April 2022	Income	Expenditure	Revaluation	Transfers	At 31 March 2023
	£	£	£	£	£	£
Restricted Funds						
Government grant for fixed assets	-	549,000	-	-	(549,000)	-
Other grants for fixed assets	-	133,833	-	-	(133,833)	-
Restricted resource grants	174,108	352,375	(227,819)	-	(150,636)	148,028
Total restricted funds	174,108	1,035,208	(227,819)	-	(833,469)	148,028
Unrestricted Funds						
Designated Funds						
Donated assets reserve	1,720,283	-	-	-	-	1,720,283
Government grant for assets	2,531,639	-	-	-	(309,746)	2,221,893
General fund	658,224	2,695,666	(4,058,050)	-	1,772,553	1,068,393
	4,910,146	2,695,666	(4,058,050)	-	1,462,807	5,010,569
Undesignated Funds						
Revaluation reserve - Land & Buildings	6,010,496	-	-	255,242	(253,338)	6,012,400
Revaluation reserve - Heritage Assets	1,391,474	-	-	-	-	1,391,474
Pension reserve	(1,877,000)	-	-	2,411,000	(376,000)	158,000
	5,524,970	-	-	2,666,242	(629,338)	7,561,874
Total Unrestricted Funds	10,435,116	2,695,666	(4,058,050)	2,666,242	833,469	12,572,443
Total Funds	10,609,224	3,730,874	(4,285,869)	2,666,242	-	12,720,471

Details of Transfers between funds

	£
Release of restricted resource grant available to offset overheads	(150,636)
Release of deferred capital grant	(858,746)
Transfer of external capital grant	(133,833)
Transfer of defined benefit pension service and interest cost	(376,000)
Transfer of depreciation adjustment on asset revaluation to general fund	(253,338)
General fund	1,772,553

16 Analysis of net assets between funds

	Pension Reserve	Revaluation Reserve	Unrestricted Funds	Restricted Funds	Total Funds
	£	£	£	£	£
Tangible fixed assets	-	6,012,400	4,161,526	-	10,173,926
Heritage assets	-	1,391,474	1,307,121	-	2,698,595
Current assets	-	-	432,060	148,028	580,088
Creditors: amounts falling due within one year	-	-	(890,138)	-	(890,138)
Pension scheme liability	158,000	-	-	-	158,000
Net assets/(liabilities)	158,000	7,403,874	5,010,569	148,028	12,720,471

17 Reconciliation of net expenditure to net cash flow from operating activities

	2023 £	2022 £
Net expenditure for the year per statement of financial activities	(554,995)	7,028
Adjustments for:		
Depreciation	858,746	828,152
Interest received	(1,418)	(13)
(Profit)/Loss on disposal of assets	(8,575)	(8,857)
Defined benefit pension scheme service and interest cost less contributions payable	376,000	436,000
(Increase)/decrease in stock	(3,622)	1,224
(Increase)/decrease in debtors	(99,396)	48,742
Increase/(decrease) in creditors	102,791	(52,431)
Net cash provided by operating activities	669,531	1,259,845

Notes to the financial statements for the year ended 31 March 2023 (continued)

18 Analysis of cash and cash equivalents

	31 March 2023 £	1 April 2022 £
Cash at bank and in hand	379,211	382,787
Total cash and cash equivalents	379,211	382,787

19 Pension scheme

Introduction

The disclosures below relate to the funded liabilities within the Northern Ireland Local Government Officers' Superannuation Pension Fund (the "Fund") which is part of the Local Government Pension Scheme (Northern Ireland) (the "LGPS") and certain related unfunded liabilities which have been separately disclosed. The LGPS is a funded defined benefit plan with benefits earned up to 31 March 2015 being linked to final salary. Benefits after 31 March 2015 are based on a Career Average Revalued Earnings scheme. Details of the benefits earned over the period covered by this disclosure are set out in 'The Local Government Pension Scheme Regulations (Northern Ireland) 2014' (as amended) and 'The Local Government Pension Scheme (Amendment and Transitional Provisions) Regulations (Northern Ireland) 2014' (as amended). The unfunded pension arrangements relate to termination benefits made on a discretionary basis upon early retirement in respect of members of the Local Government Pension Scheme under the 'Local Government (Early Termination of Employment) (Discretionary Compensation) Regulations (Northern Ireland) 2007'.

Funding / Governance Arrangements of the LGPS

The funded nature of the LGPS requires participating employers and their employees to pay contributions into the Fund, calculated at a level intended to balance the pension liabilities with investment assets. Information on the framework for calculating contributions to be paid is set out in 'The Local Government Pension Scheme Regulations (Northern Ireland) 2014' and the Fund's Funding Strategy Statement. The last actuarial valuation was at 31 March 2022 and the contributions to be paid until 31 March 2023 resulting from that valuation are set out in the Fund's Rates and Adjustment Certificate. The Northern Ireland Local Government Officers' Superannuation Committee is responsible for the governance of the Fund.

Assets

The assets allocated to the Employer in the Fund are notional and are assumed to be invested in line with the investments of the Fund for the purposes of calculating the return over the accounting period. The Fund holds a significant proportion of its assets in liquid investments. As a consequence there will be no significant restriction on realising assets if a large payment is required to be paid from the Fund in relation to an employer's liabilities. The assets are invested in a diversified spread of investments and the approximate split of assets for the Fund as a whole (based on data supplied by the Committee) is shown in the disclosures. The Committee may invest a small proportion of the Fund's investments in the assets of some of the employers participating in the Fund if it forms part of their balanced investment strategy.

The NILGOSC actuary, Aon Solutions UK Ltd (Aon), has provided the following details for the purposes of accounting for the Armagh Observatory and Planetarium's joint share of the scheme deficit in accordance with FRS 102 at 31 March 2023.

Key assumptions used by the actuary were:

	31/03/2023	31/03/2022
Discount rate	4.7%	2.8%
CPI inflation	2.7%	3.1%
Pension increases	2.7%	3.1%
Pension accounts revaluation rate	2.7%	3.1%
Salary increases	4.2%	4.6%

Mortality assumptions

	31/03/2023 Years	31/03/2022 Years
Males		
Pensioner member aged 65 at accounting date	22.2	21.8
Active member aged 45 at accounting date	23.2	23.2
Females		
Pensioner member aged 65 at accounting date	25.0	25.0
Active member aged 45 at accounting date	26.0	26.4

Notes to the financial statements for the year ended 31 March 2023 (continued)

19 Pension scheme (continued)

Asset Allocation

	Value at 31/03/2023	Value at 31/03/2022
Equities	40.0%	42.9%
Property	11.2%	10.0%
Government bonds	20.6%	24.7%
Corporate bonds	3.0%	2.2%
Multi Asset Credit	13.3%	13.1%
Cash	6.5%	4.0%
Other	5.4%	3.1%
Total	100.0%	100.0%

Reconciliation of funded and unfunded status to balance sheet

	Value at 31/03/2023 £'000	Value at 31/03/2022 £'000
Fair value of assets	10,690	11,620
Present value of funded defined benefit obligation	(10,530)	(13,495)
Funded status (deficit)	160	(1,875)
Present value of unfunded defined benefit obligation	(2)	(2)
Asset/(Liability) recognised on the balance sheet	158	(1,877)

The split of the liabilities at the last valuation between the various categories of members is as follows:

Active members	36%
Deferred pensioners	20%
Pensioners	44%

Amounts recognised in statement of financial activities

	Year to 31/03/2023 £'000	Year to 31/03/2022 £'000
Operating cost		
Current service cost	(579)	(620)
Financing cost		
Interest on net defined benefit liability	(49)	(60)
Pension expense recognised in statement of financial activities	(628)	(680)
Allowance for administrative expenses included in Current Service Cost	6	6

Amounts recognised in statement of funds

	Year to 31/03/2023 £'000	Year to 31/03/2022 £'000
Asset gains/(losses) arising during the period	(1,243)	584
Actuarial gains/(losses) due to changes in financial assumptions	5,024	-
Actuarial gains/(losses) due to changes in demographic assumptions	(55)	-
Actuarial gains/(losses) due to liability experience	(1,315)	950
Total amount recognised in statement of funds	2,411	1,534

Changes to the present value of defined benefit obligation

	Year to 31/03/2023 £'000	Year to 31/03/2022 £'000
Opening defined benefit obligation	13,497	13,801
Current service cost	579	620
Interest expense on defined benefit obligation	374	287
Contributions by participants	93	90
Actuarial gains/(losses) due to changes in financial assumptions	(5,024)	-
Actuarial gains/(losses) due to changes in demographic assumptions	55	-
Actuarial gains/(losses) due to liability experience	1,315	(950)
Net benefits paid out	(357)	(351)
Closing defined benefit obligation	10,532	13,497

Notes to the financial statements for the year ended 31 March 2023 (continued)

19 Pension scheme (continued)

Changes to the fair value of assets

	Year to 31/03/2023 £'000	Year to 31/03/2022 £'000
Opening fair value of assets	11,620	10,826
Interest income on assets	325	227
Remeasurement gains/(losses) on assets	(1,243)	584
Contributions by the employer	252	244
Contributions by participants	93	90
Net benefits paid out	(357)	(351)
Closing fair value of assets	10,690	11,620

Actual return on assets

	Year to 31/03/2023 £'000	Year to 31/03/2022 £'000
Interest income on assets	325	227
Gain/(loss) on assets	(1,243)	584
Actual return on assets	(918)	811

Sensitivity Analysis

Funded LGPS benefits

Discount rate assumptions

Adjustment to discount rate	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	10.362	10.530	10.698
% change in present value of total obligation	-1.6%		1.6%
Projected service cost (£m)	0.259	0.270	0.281
Approximate % change in projected service cost	-4.1%		4.2%

Rate of general increase in salaries

Adjustment to salary increase rate	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	10.551	10.530	10.509
% change in present value of total obligation	0.2%		-0.2%
Projected service cost (£m)	0.270	0.270	0.270
Approximate % change in projected service cost	0.0%		0.0%

Rate of increase to pensions in payment and deferred pension assumption, and rate of revaluation of pension account assumptions:

Adjustment to pension increase rate	+0.1%pa	Base Figure	-0.1%pa
Present value of total obligation (£m)	10.667	10.530	10.383
% change in present value of total obligation	1.4%		-1.4%
Projected service cost (£m)	0.281	0.270	0.259
Approximate % change in projected service cost	4.2%		-4.1%

Post retirement mortality assumption

Adjustment to mortality age rating assumption	-1 year	Base Figure	+1 year
Present value of total obligation (£m)	10.814	10.53	10.246
% change in present value of total obligation	2.7%		-2.7%
Projected service cost (£m)	0.280	0.270	0.260
Approximate % change in projected service cost	3.7%		-3.7%

Notes to the financial statements for the year ended 31 March 2023 (continued)

19 Pension scheme (continued)

The McCloud/Sargeant Judgement

AOP has already accounted for the estimated liability arising from the McCloud/Sargeant judgement. Aon has updated the McCloud/Sargeant liability as part of updating to the result of the 2022 valuation. The allowance will be updated to be in line with the method adopted in the 2022 funding valuation as follows:

- Full data was not available in the 2022 valuation data to calculate the McCloud/Sargeant liability accurately, so an approximate method has been used;
- Aon has calculated a percentage uplift to the post 2015 liabilities of active and deferred members who joined pre 2012 by age and sex, based on the proposed remedy, and assuming pay has increased in line with our assumptions from 2015 to the valuation date;
- Aon has assumed that the majority of pensioner and dependant members affected by McCloud will be small and/or eligible for the original underpin. Aon have therefore not included a liability for these members;
- Aon have used an age dependent uplift to estimate an overall adjustment to apply to the post 2015 liabilities in respect of pre 2012 joiners (based on the employer's membership data), having regard to the age profile of the pre 2012 joiners. The pre 2012 joiners have been identified by the date joined fund supplied for each member.
- As under the proposed remedy the period of protection will apply from 1 April 2015 to 31 March 2022, Aon have included the McCloud allowance within the past service liabilities of each employer. No allowance has been made within the current service cost over this accounting period.

Aon have assumed that GMPs of members whose State Pension Age (SPA) is on or after 6 April 2016 will increase at the full CPI inflation. This recognises the cost of the Government's commitment to compensate public service scheme members from the removal of the Additional Pension element of the State Pension from this date, and for the outcome of the Lloyds judgement which found GMPs to be illegally sex discriminatory. Government has recognised that this solution will not address all sex inequalities for a minority of members. Aon are expecting further guidance from the Department for Levelling Up, Housing and Communities (in England and Wales) and the Department for Communities (in Northern Ireland) (to an undefined timetable) on how they propose to deal with this. We expect any remaining sex inequalities to be small and we believe that our approach is reasonable.

20 Capital commitments

Capital commitments at 31 March 2023 totalled £125,000 (2022: £136,000) in respect of expenditure on projects commenced during the year. DfC has agreed funding for 2023/24.

21 Contingent liabilities

Pension liability - Goodwin judgement

In June 2020, an Employment Tribunal ruled, in relation to the Teachers' Pension that provisions for survivor's benefits of a female member in an opposite sex marriage are less favourable than for a female in a same sex marriage or civil partnership, and that treatment amounts to direct discrimination on grounds of sexual orientation. The chief secretary to the Treasury announced in a written ministerial statement on 20 July 2020 that he believed that changes would be required to other public sector pension schemes with similar arrangements. Changes to the NI Regulations were made on 24 March 2022 and came into effect on 18 April 2022. Those changes have not yet been reflected in the pensions data in note 19, but Aon advise that the impact is likely to be immaterial.

There were no other contingent liabilities at the 31st March 2023 (2022: Nil).

22 Remote contingent liabilities (Audited)

There were no remote contingent liabilities at the 31st March 2023 (2022: Nil).

23 Related-party transactions

None of the members of the Board of Governors, the Management Committee, the Director or other related parties have undertaken any material transactions with the Armagh Observatory and Planetarium during the year. The Armagh Observatory and Planetarium has had various material transactions with a number of Government Departments, Executive Agencies and Non-Departmental Public Bodies in Northern Ireland. Most of these transactions have been with DfC, Construction and Procurement Delivery (CPD), Strategic Investment Board (SIB), Tourism NI, and the Education Authority (EA). DfC provides recurrent and capital grant-in-aid (note 2), SIB provides professional advisory and consultancy services, Tourism NI provides marketing and capital grants (note 3), and CPD and EA are the Centres of Procurement Expertise for the organisation. The Royal School Armagh leases land for playing fields at a nominal rent.

No other related party transactions took place in the year, other than certain trustees' expenses already disclosed in note 8.

Notes to the financial statements for the year ended 31 March 2023 (continued)

24 Losses and special payments (Audited)

There were no losses or special payments during the year (2022: Nil).

25 Financial instruments

As the cash requirements of the Observatory and Planetarium are met through grants from DfC and other grant funding bodies, financial instruments play a more limited role in creating risk than would apply to a non-public sector body of a similar size. The majority of financial instruments relate to contracts to buy non-financial items in line with the Observatory's expected purchase and usage requirements and the Observatory and Planetarium is therefore exposed to little credit, liquidity or market risk.

26 Additional disclosures to comply with the Financial Reporting Manual (FReM)

FReM requires non-departmental public bodies to regard grant-in-aid received as contributions from controlling bodies giving rise to a financial interest in the residual interest of the body and hence accounting for as financing, that is by crediting them to income and expenditure reserve. In addition FReM requires grant-in-aid to be accounted for on a cash basis.

However, as the organisation is required to prepare accounts in accordance with the SORP for charities, DfC has given AOP permission to continue to treat grants as income. If AOP were required to comply with the FReM the result of this compliance would be as follows:

Statement of Financial Activities prepared under FReM

	Note	2023 £	2022 £
Incoming resources			
Incoming resources from research and other non-DfC grants	2	486,208	480,643
Operating income	2	415,195	252,568
Trading income	4	193,471	126,898
Total incoming resources		1,094,874	860,109
Resources expended			
Direct expenditure of the organisation		4,285,869	4,034,081
Total Resources expended		4,285,869	4,034,081
Net deficit for the year		(3,190,995)	(3,173,972)
Loss/(gain) on revaluation of Fixed Assets and Heritage Assets		255,242	422,885
Actuarial (loss)/gain on pension scheme		2,411,000	1,534,000
Amount transferred to funds		(524,753)	(1,217,087)

Analysis of funds prepared under the FReM

		2023 £	2022 £
Balance at 1 April 2022		10,609,224	8,645,311
Grant-in-aid received in the year	2	2,636,000	3,181,000
Net operating costs for the year		(524,753)	(1,217,087)
Balance at 31 March 2023		12,720,471	10,609,224

27 Events after the Reporting Date

1) Adjusting Events:

There were no events after the reporting date which would require adjustment to the financial statements.

2) Non-adjusting Events:

There were no events after the reporting date which would require disclosure in the financial statements.

The Accounting Officer authorised the issue of these financial statements on 11th October 2023.

The Armagh Observatory and Planetarium

Northern Ireland - Charity number 103948

Annual report

Armagh Observatory and Planetarium

Annual Report and Accounts For the year ended 31 March 2023

Laid before the Northern Ireland Assembly

under clause 8 of The Armagh Observatory and Planetarium (Northern Ireland) Order 1995,

as amended by Schedule 1, clause 6 of the Audit and Accountability (Northern Ireland)

Order 2003, by the Department for Communities

on

31 October 2023

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Any enquiries regarding this publication should be sent to
info@armagh.ac.uk or telephone 028 3752 3689.

Armagh Observatory and Planetarium

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The Trustees' Annual Report for the year ended 31 March 2023

The Board of Governors, who are the Trustees for Armagh Observatory and Planetarium (AOP) has pleasure in presenting its annual report and financial statements for this charity for the year ended 31 March 2023. These financial statements have been prepared in accordance with the accounting policies set out in note 1 to the accounts, with the guidance issued by the Department of Finance on the form and contents of the Annual Reports and Accounts of Executive Non-Departmental Public Bodies, *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* and Accounting and Reporting by Charities: Statement of Recommended Practice (SORP) applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102). The Remuneration and Staff report is prepared in accordance with direction set out in The Government Financial Reporting Manual (FRM) 2022-23.

The sponsor Department for Armagh Observatory and Planetarium is the Department for Communities (DfC) (the Department).

Background to Charitable Status

Historically the Armagh Observatory and the Armagh Planetarium were treated as being distinct institutions; being two component divisions of a single statutory corporation and arms-length body (ALB), 'The Governors of The Armagh Observatory and Planetarium' as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled 'An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever', and an Amendment ('The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938').

The principal function of the Armagh Observatory, founded in 1789 as part of Archbishop Richard Robinson's vision to see the creation of a university in the City of Armagh, is to undertake original research of a world-class academic standard that broadens and expands our understanding of astronomy and related sciences.

The Armagh Planetarium was founded by Dr Eric Mervyn Lindsay, the seventh director of the Armagh Observatory, and was officially opened on 1 May 1968. The Planetarium's primary activity is to disseminate scientific and technical knowledge of a wide range of science, technology, engineering, arts and mathematics (STEAM) subjects, and to promote public understanding of astronomy and science through its programme of educational services for schools and the wider public.

From 1 April 2016 the Charity Commission for Northern Ireland registered *The Governors of The Armagh Observatory and Planetarium*, (changed to *The Armagh Observatory and Planetarium* in 2023) as a charity under reference number NIC 103948.

Objectives and Activities

The organisation's statutory functions are set out at Article 4 of *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. The Order requires that 'the Governors shall, for the purpose of developing and improving the knowledge, appreciation and practice of astronomy and related sciences, maintain and manage the Armagh Observatory and Planetarium and may take such other action as the Governors may think proper for the purpose of acquiring or disseminating knowledge relating to astronomy and related sciences'.

In accordance with Paragraph 8(1) of Schedule 1 of *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*, the Armagh Observatory and Planetarium (AOP) Board of Governors has delegated the primary responsibility for the governance and management of AOP to a Management Committee with the statutory purpose of 'developing and improving the knowledge, appreciation and practice of astronomy and related sciences'.

The AOP Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department for Communities (our sponsor Department) and approved by the Minister and for promoting the efficient, economic and effective use of resources.

As the primary responsibility for the governance and management of AOP has been delegated to a Management Committee, the Governors consider the role of Charity Trustees would more appropriately align with their remit too. The Board of Governors has agreed in principle to this and discussions are currently ongoing with the Charity Commission of Northern Ireland to progress.

Armagh Observatory is the oldest scientific institution in Northern Ireland, and the longest continuously operating astronomical research institute in the UK and Ireland. Armagh Planetarium is also the oldest operating planetarium in the UK and Ireland.

Our Mission:

"Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all."

Our Vision:

"Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of."

The organisation operates on the international stage and is underpinned by core funding from the Department and the receipt of external grants from the UK Science and Technology Facilities Council (STFC), and other grant-awarding bodies.

A Strategic Plan for 2021-26 was launched in September 2021 and this is now being implemented. The strategy is built around four strategic themes – Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

As at 31 March 2023, there were 27.4 full time equivalent permanent employees which comprised approximately one-third Research, one-third Education and one-third Corporate. Additionally there were 5.4 full time equivalent temporary employees, some of whom were engaged on short term temporary projects. AOP also employs a number of casual staff on an ad hoc basis to meet operational needs. In addition, there is an Emeritus Director, an Emeritus Research Astronomer and 12 external research associates and academic visitors.

Public Benefits

The Trustees confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under section 4 of the Charities Act (Northern Ireland) 2008 (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2023. This is demonstrated in the following summary of Principal Activities which provides detail on how the organisation has delivered against its objectives and the public benefit which has flowed from this.

Principal Activities

Impact of Brexit

Some issues have been encountered with recruiting European nationals, claiming certain European research grants and importing some goods from Great Britain. EU residents now need to apply for a visa and pay a healthcare surcharge to live in the UK. For Post Doctoral Research Assistants (PDRAs) funded by the Science & Technology Facilities Council (STFC) such visa costs can be charged to the grant, but it is still unclear if a similar support can be offered to PhD students. UK Research and Innovation (UKRI) is presently reviewing their position in this respect, as STFC studentships are no longer restricted only to UK residents. Despite these issues, so far the United Kingdom exit from the European Union has had no significant impact on the overall operation of AOP.

Introduction to AOP Research and its International Standing

AOP is one of the oldest scientific research institutes in the UK and Ireland with a long-established reputation of research excellence. It is also one of very few astronomical institutions in the world to have a modern planetarium through which its research can be effectively communicated and where a research-informed outreach and public engagement activity can be sustained.

AOP is engaged in front-line research in several key areas of astrophysics. These range from the study of our Sun and the Solar System to that of distant galaxies, in keeping with the long and varied history of scientific achievements of the Armagh Observatory and with the desire to be perceived by the public as leaders in all strands of astronomical research that are communicated through the Planetarium.

Around a third of AOP research is funded by the award of project-specific external grants mainly from the STFC, together with several ad hoc grants. These grants support projects led by individual research astronomers with the provision of PhD scholarships, post-doctoral research assistant salaries, computing equipment and observation/conference travel funding. Early in 2021 AOP researchers secured two new STFC grants providing funding for additional Post-Doctoral Research Assistants (PDRAs) plus salary staff contribution and estate costs until March 2024, which adds up to similar funding secured early in 2020 and that is already funding a third PDRA until July 2023.

AOP research also requires the use of state-of-the-art observing and computing facilities internationally in order to obtain new astronomical data and allow their analysis. STFC and UK government support provides access to world-class international facilities, and AOP research staff regularly win telescope time on some of the best and most sought-after telescopes in the world such as the European Southern Observatory (ESO) Very Large Telescope (VLT) or the Hubble Space Telescope (HST).

In addition, through the AOP's membership of the UK SALT Consortium, its research staff have access to the 11-metre diameter Southern African Large Telescope (SALT). Similarly, AOP is also a founder member of the international consortia involved with the Gravitational-wave Optical Transient Observer (GOTO) project, a member of the UK consortia involved in building the detectors for Inouye Solar Telescope (IST), LOFAR (Low Frequency Array (DKIST) radio telescope project and a consortium member of the Cherenkov Telescope Array (CTA) gamma-ray observatory. In early 2022, AOP was also able to join the BlackGem International consortium, which has built telescopes on La Silla in Chile. Like GOTO, its prime goal is the detection of the optical counterpart of gravitational wave events. Compared to GOTO, BlackGem has a smaller field of view, but is able to go deeper and fainter. The two surveys are therefore highly complementary in their reach.

These facilities can be extremely expensive to run (e.g. the running cost of one observing night at VLT is about £16,000 and a mid-size observing program with HST would be ten times more) so that through the award of their use, the international astronomical community essentially entrusts AOP to make effective use of the data. On average AOP researchers secure telescope time corresponding to a value of around £250,000 per year.

AOP research staff also play a full role in the international astronomical community. For instance, they serve on committees of bodies such as the Royal Astronomical Society, the UK Science and Technology Facilities Council, the International Astronomical Union (IAU, with three commission vice-presidents and two former presidents), ESO and Transiting Exoplanet Survey Satellite (TESS) time allocation panels, assess grant and research proposals on behalf of external funding agencies, review scientific papers and edit international academic journals, and act as external PhD examiners in the UK and beyond. AOP researchers also sit on scientific advisory panels or lead specific projects with future ground-based observing facilities (Vera Rubin Observatory, ELT-METIS, VLT-BlueMUSE), space satellites and missions (ESA's future Plato and Comet Interceptor missions) and large-scale surveys (MOONs).

This financial year has also seen AOP submitting six STFC grant applications for PDRA funding starting in April 2024, which will support all of AOP's current line of research and also bringing AOP staff salary contributions and estate costs. This is the first time since 2020 that AOP could apply for such a major source of funding, with AOP being one of the first UK institutions to participate in the newly remodelled STFC grant scheme that effectively replaces the previous consolidated grant, allowing researchers in practice to apply for grants every two years instead of every three years.

Research Highlights

To provide a practical understanding of how the work of AOP research contributes to the region's international reputation and understanding of the cosmos, the following provides some highlights of the research undertaken at AOP in the past financial year. This draws from international collaborations and the award of observing time on highly competitive facilities, as well as direct support from the Department allowing AOP to participate in several key international projects (such as SALT, GOTO, IST, I-LOFAR, Comet Interceptor, CTA and BlackGem). Full bibliographic references can be found in the publication list appended to this report.

Stellar and Galaxy Evolution

Introduction

When we look up on a dark night, we may think that stars are immutable and isolated. Yet, although stars can live for as long as the age of the Universe, they can also undergo dramatic changes in matter of seconds. They are also not isolated from other stars. Some are found in pairs or tight groups and more generally stars are related to each other through the very way in which they form and evolve. Stars are indeed born from giant clouds of gas and return matter to those clouds, seeding the birth of new stars as they fade away or sometimes explode in dramatic events. Furthermore, stars produce the heavy elements necessary for the formation of rocky planets and of life as we know it.

In turn, the formation history of stars relates to the formation and evolution of the galaxies that contain them. Some galaxies indeed no longer appear to form stars, unlike the case of the Milky Way. This may depend on whether fresh gas is available around them, on whether they have collided with other galaxies in the past or possibly also on whether their central supermassive black hole suddenly becomes active and pours out tremendous amounts of energy capable of clearing its host galaxy of any star-forming gas material. Finally, galaxies are carried by the

general expansion of the Universe and the evolution of the dominant, yet unknown dark-matter material in which they themselves are embedded. Understanding the formation and evolutions of stars and galaxies therefore ultimately means understanding our origin in relation to the very fabric of the Universe.

Recent results

AOP stellar studies range from the most massive and brightest young stars to the faintest and ageing stars or stellar remnants such as white dwarfs and black holes.

The research in the group of Professor Jorick Vink is both theoretical and observational and is supported by STFC grants run in collaboration with Keele and York Universities. The theoretical work focuses on understanding of the formation of the heaviest stars and stellar black holes in the Universe. These stars are up to 10 million times brighter than the Sun. Key science questions involve the production of pair instability supernovae, where the entire star is disrupted, and one such event enriching galaxies with more heavy elements than all the lower mass stars combined. Recent papers lead by Vink's student Gautham Sabhahit and post-doctoral assistant Dr Erin Higgins uncovered that the most massive stars in our Milky Way evaporate entirely due to strong wind mass loss (*Higgins et al. 2022; Sabhahit et al. 2022*). On the observational side, Vink is leading an ESO-VLT Large Programme called XShooting ULLYSES (XShootU) with a team of 100 massive stars experts from around the globe trying to understand the stellar and mass-loss properties of massive star in pristine low-metallicity environments of the Large and Small Magellanic Clouds. These environments provide a key stepping stone to understand the very first stars in the distant Universe, which were likely very massive. In collaboration with Dr Jonathan Mackey and others, an IAU Symposium with over 200 participants was organised in Ballyconnell in County Cavan with the Topic: "Massive stars Near & Far".

The vast majority of stars will end their life as a "white dwarf", a very compact object with a mass comparable to that of the Sun but a size similar to that of the Earth. Stefano Bagnulo and AOP visiting astronomer John Landstreet are investigating the reasons why many white dwarfs possess a magnetic field, sometime much stronger than anything that could be produced in an Earth laboratory. They have concluded that whereas most white dwarfs are very rarely magnetic when they are young but become magnetic as they get old, the rare class of ultra-massive white dwarfs are magnetic since the very beginning of their formation (*Bagnulo & Landstreet 2022*). Bagnulo & Landstreet have also offered some explanations for the physical origin of the magnetic field and are continuing their studies thanks also to the award of more than 100 hours of time with the VLT in Chile and several more hours of telescope time at smaller telescopes. Bagnulo is capitalising on the impact of his research by the organisation of a 4-week workshop in Garching (Germany) on stellar magnetic fields at the Munich Institute for Astro and Particle Physics (<https://www.munich-iapp.de/magnetic-fields>, MIAPP) in October 2023 and will provide logistic support and funding for the participation of up to 45 researchers from all over the world.

Linking to external galaxies, Marc Sarzi has effectively concluded his survey of galaxies in the Fornax cluster producing studies that also relates directly to our understanding the latest stages of stellar evolution, publishing a comprehensive report of the use of the considerable amount of VLT telescope time (107h) that went into this project in the ESO messenger journal (*Sarzi & Iodice 2022*). In particular, the last stages of this collaboration saw a particularly important investigation into the properties of thin stellar disks in cluster galaxies, including those that are not immediately visible in images, but which are revealed only after a careful modelling of maps for the average motions and metal abundance (e.g. *Poci et al. 2022*). In this respect, AOP student Pablo Galan de Anta investigated how the interactions with other galaxies would affect such disks, potentially destroying them. For this he used large-scale cosmological simulations, showing that indeed such state-of-the-art models do not fully reproduce the properties of galaxies in Fornax-like clusters (*Galan de Anta et al. 2022*) suggesting, in particular, that numerical spurious effect may still affect such state-of-the-art simulations.

Finally, closer to home, Professor Michael Burton advanced our detailed understanding of the interstellar medium of the Milky Way that is in turn our closest laboratory for understanding the formation of stars (*Roueff, Burton, Geball & Abgrall 2023*). His work relates to his previous discovery of Hydrogen molecules in clouds of shocked gas in interstellar space that are at temperatures of around 5,000 degrees celsius. This is much higher than it was expected that such molecules could exist at. The discovery closes one mystery about how interstellar shock waves work but opens another about how the gas can get so hot and yet the molecules survive? The original discovery was made using the 8m Gemini telescope in Hawaii, with which Michael Burton and his colleague Tom Geballe measured two, extremely weak, high excitation infrared lines of the hydrogen molecule observed in a source known as Herbig Haro 7 (or HH7), a supersonic jet of gas coming from a newly forming star. These two lines remained unidentified until through correspondence with Evelynne Roueff in Paris it was realised that they came from energy levels lying above the hydrogen molecule's dissociation energy. Indeed, Evelynne had predicted the existence of such lines arising from quasi-stable levels that in classical physics should not exist, which is why Burton and Geballe could not understand the presence of such weak lines in the Gemini spectra. Yet, their detection provides clear evidence that the molecular gas must be dissociating, which led to the speculation that the very existence of ultra-hot, 5,000-degree molecular gas implies the constant formation of freshly formed hydrogen molecules.

This work is also close to the research of AOP's Öpik fellow, Dr David Eden who, by using the data from multiple James Clerk Maxwell Telescope (JCMT) Large Programs (a facility that AOP is a partner of), is investigating the

causes of star formation in the Milky Way and across the entire Universe. The first step to this is to determine on what scale the regulation of the star formation process is occurring. Previous work by Eden has identified that the regulation is on the scales of individual molecular clouds. As a result, the focus was placed on the individual molecular clouds in a large sample obtained from CHIMPS (CO Heterodyne Inner Milky Way Plane Survey). In *Rani, Moore, Eden & Rigby (2022)*, the star-formation efficiency was compared to the mode of turbulence, i.e., the driving force of the movement of the gas in these clouds, and it was determined that the star-formation efficiency increased if the turbulence was more compressive or collapsing, as opposed to solenoidal or swirling. The ramifications of this result are that simulations of astronomical systems need to take this into account when modelling star formation and shifts the focus on to the molecular cloud formation mechanisms as where the star-formation efficiency of a system is set.

The role of SALT

The South African Large Telescope (SALT) is the largest telescope in the Southern Hemisphere, providing unparalleled access to the skies for its shareholders, of whom AOP through its membership of the UK SALT consortium is one. Participation in this major international facility brings visibility throughout the worldwide research community and allows AOP and just a few other UK universities to engage in collaborations with other SALT international partners. In turn, through such partnerships, AOP receives a return in terms of telescope time allocation that is equivalent to roughly 10 times its contribution. In 2022 alone, over 230 AOP unique astronomical observations have been made, targeting some of the most exotic stars in the Universe. These contribute to a growing series of discovery papers and to the training of postgraduate research students at AOP. Participation in SALT also allows AOP to explore opportunities through the SALT Collateral Benefits Programme to develop links between local schools in Northern Ireland and in South Africa. AOP carries out the administration function for the UK SALT consortium, which includes four other academic partners – Keele University, Open University, University of Central Lancashire and University of Southampton.



The 10-metre diameter South African Large Telescope (SALT), in the semi-desert region of the Karoo, South Africa.

Using SALT, Simon Jeffery leads a survey of chemically peculiar subdwarf stars in the southern sky. These are stars that are in the final stages of their lives but their histories from birth to the present are very diverse. By exploring the abundances of key elements such as hydrogen, helium, carbon, oxygen, and iron, and of exotic elements such as lead and zirconium, these histories and internal physics can be explored. These AOP-led SALT observations have already led to a first data-release and are now building towards the second data-release, including classifications, coarse analyses and kinematics for nearly 400 hydrogen-deficient hot subdwarfs. A treasure trove of data for exotic stars is yielding exciting new discoveries. For instance, the hot subdwarfs BPS CS 22940-0009 and EC 20187-4939 are linked objects connecting extreme helium stars with hot subdwarfs (*Snowdon et al. 2022, Scott et al. 2023*). The survey has also discovered even more exotic stars – eight super-hot white dwarfs and pre-white dwarfs with surface temperatures between 100,000 and 200,000 degrees (*Jeffery et al. 2023*). Jorick Vink and a team of international astronomers are using SALT to study the long-term polarised light from the most famous Luminous Blue Variable Eta Carina, which is quite possibly the most massive star in the Milky Way. Thanks also to AOP's contribution SALT will continue to develop its instrumentation, and the introduction of a new near-infrared spectrograph will facilitate the study of star formation processes in nearby galaxies, with Sarzi already obtaining time to study star-forming galaxies in Fornax later in 2023. SALT has also proved essential in determining the nature of several short period binaries identified in the OmegaWhite Survey of the Galactic plane which set out to discover AM CVn binaries which can have orbital periods as short as 5 mins. Many were found to be short period pulsators, including four of the newly discovered class of Blue Luminous Variables (BLAPs), but one object was found to be a rare binary with an orbital period of 74 min containing a hot sdB star and a white dwarf (*Ramsay et al 2022*).

Transient and Periodic Variable Stars

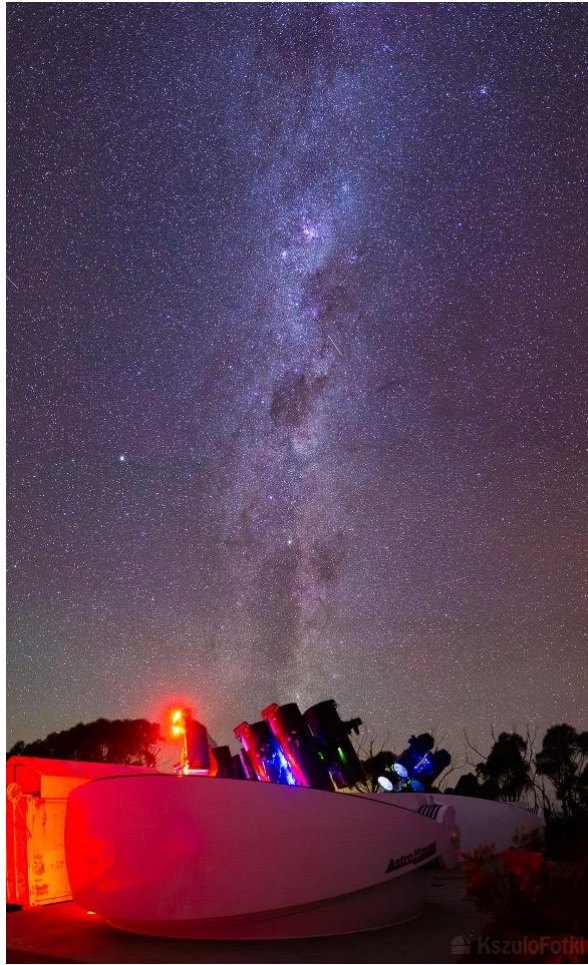
Introduction

Apart from the bright planets and the occasional comet, the night sky might appear to be unchanging, with stars being the same brightness and in the same place as they always are. However, astronomers from the ancient world detected new stars, “novae” or “supernovae”, which suddenly appeared in the night sky and then gradually faded from view over weeks or months. We now know that these “transient” events occur when one star circling a companion star unloads enough matter through the process of “accretion” to its companion to make it explode. Supernovae have now been used to show the universe is expanding. Other “variable stars” were first detected in the early 17th century when a star now called “Mira” was observed to change in its brightness on a timescale of nearly a year. We now know that Mira is a star several hundred times as large as the Sun, and contracts and expands in size over this “period” of one year. In fact, practically all stars are variable at some level. However, in many cases its only recently astronomers have been able to detect this variability.

By studying the brightness of stars in detail we can test physical models which are put forward to explain the observed behaviour. However, the diversity of variable stars requires different observing strategies. Explosive events can be extremely rare and short-lived, so that in order just to catch their initial rise to outburst it is necessary to observe the entire sky every night. On the other hand, targeted monitoring lasting many months is necessary to unravel the minute vibrations of Sun-like stars. Simon Jeffery and Gavin Ramsay have been using data from the Kepler and TESS satellites to better understand both the interior of stars and the accretion process. Further, Armagh astronomers have access to the GOTO and BlackGem telescopes (more of which below) which are used for many research areas especially transient sources.

Recent results

In the study of periodic phenomena, long continuous monitoring with extremely high accuracy has proved necessary to discover the signals due to exoplanets, star spots and gentle vibrations present in or around many stars. For these, space craft are essential to overcome poor weather and day light, with Kepler/K2 (NASA 2000-2018), TESS (NASA 2018-ongoing) and Plato (ESA, from 2026) being pivotal missions. Using TESS has discovered that the unseen companion stars in the four known hydrogen-deficient binaries all show a similar signature, either of a surface inhomogeneity or a low-order non-radial pulsation (*Jeffery 2023*). Using TESS data, Gavin Ramsay analysed optical data of 23 High Mass X-ray Binaries which contain a giant star and either a neutron star or Black Hole. His team found that all showed quasi-periodic behaviour on a timescale shorter than 1 day which typical of giant stars which are not in a binary. They also found evidence of two rare outbursts and showed the pulsation behaviour changed over the outburst (*Ramsay, Hakala & Charles 2022*). In another paper using TESS data the accretion flow in the magnetic accreting binary BY Cam was mapped as the flow rotated around the magnetic field of the white dwarf (*Mason et al 2022*). V652 Herculis is a large-amplitude pulsating extreme helium with a period of 0.1d and a significant shock at minimum radius (*Jeffery et al. 2015*). Simon Jeffery has developed new non-linear hydrodynamic models of the interior to show that a shock is generated whenever the pulsation amplitude is sufficiently large, and this is related to the luminosity of the star and its internal opacity (*Jeffery et al. 2022*). He has combined these hydro models with a radiative transfer code to model the time-varying spectrum of V652 Herculis, and to demonstrate how different parts of the star’s spectrum can be used to explore the behaviour of the shock as it travels through the stellar atmosphere (*Jeffery 2022*).



The new southern node of the Gravitational-wave Optical Transient Observer (GOTO) at Siding Spring Observatory, Australia (credit: Krzysztof Ulaczyk, University of Warwick).

AOP became a founding partner of the international project the *Gravitational-wave Optical Transient Observer* (GOTO) through a successful bid for funds from the Department of Culture, Arts and Leisure in January 2015. Its prime goal is to detect the optical counterpart of gravitational wave events such as the neutron star binary merger GW170817. The prototype GOTO node of telescopes was built in 2017 on the summit of the island of La Palma in the Canaries, which is one of the world's best sites to observe the night sky (Steeghs *et al* 2022). Early in 2020 GOTO was awarded £3.2m by STFC to allow a second node to be built on La Palma and two nodes in Australia which were installed in the first quarter of 2023. GOTO is now able to image the whole observable sky every few nights and is ready for the next gravitational wave observation run made by Ligo, Virgo and Kagara which is due to start late April 2023.

Using GOTO and other all-sky optical survey data, PhD student Chris Duffy investigated the long-term optical behaviour of a group of strongly magnetic cataclysmic variables called polars (Duffy *et al* 2022). Some of these systems can experience rapid fades in brightness which is due to the flow from the low mass star onto the more massive white dwarf. Different scenarios for why this happens were examined. This is just one example of the science which will be done using GOTO data over the years ahead which will include transients such as supernovae; galactic accreting binaries; pulsating variable stars and stars showing activity. Gavin Ramsay chairs the GOTO Executive Board that oversees and manages the project, including the development of the Australian node and the preparation of the next funding bid to STFC.

Solar Physics and Stellar Flares

Introduction

Aurora, or Northern Lights in the northern hemisphere, were seen over much of the UK and Ireland in the first few months of 2023. The link between aurora and flares from the Sun date back to Richard Carrington who observed a white light flare on the Sun from England in 1859, which was followed by aurora only 18 hours later that were recorded in Armagh. We now know that flares are caused by regions of strong magnetic activity on the Sun whose intensity

varies over the course of around 12 years. Although one of the wonders of the natural world, these auroral storms can also cause disruption to human activity: in 1989 the electricity grid in Canada was disrupted by a flare causing widespread blackouts. More recently, in February 2022, a solar storm caused 40 newly launched Starlink satellites to prematurely enter the Earth's atmosphere costing up to \$20m. The first flares from stars other than the Sun were seen from low-mass dwarf stars nearly a century ago. With space missions such as Kepler and TESS which can study many stars continuously for many days or months, we can now study flares from many types of stars which can be used to help us determine how often the Sun can release intense flares.

Solar Physics

Solar Physics at AOP is led by Leverhulme Emeritus Fellow Gerry Doyle who supervises final year PhD student Nived Vilangot Nhalii. In recent work, they report on properties of rapidly moving jets of plasma (called spicules) above the Sun's photosphere (its visible 'surface') with observations obtained with the highest time resolution using the CRisp Imaging Spectro-Polarimeter (CRISP) mounted on the Swedish 1m Solar Telescope on La Palma together with simultaneous observations made using Solar Dynamics Observatory satellite (*Nived et al 2022*). Nived found that at any one moment in time, there are nearly a million of these spicules on the Sun. It remains to be seen whether they are a significant heating source for the outer atmosphere of the Sun (the corona).

Stellar Flares

Gavin Ramsay and Gerry Doyle continue to study flares from low-mass stars and Solar type stars. We now know that many stars can produce flares which can be hundreds of times greater than events from the Sun. Over the last few years, we have found a population of very rapidly rotating low mass stars which appear to be flare inactive. Since we expect rapidly rotating stars to be very active this is a great surprise. Areas which we are pursuing include examining their emission in the ultra-violet; making more sensitive and rapid observations in the blue and examining specific spectral features. For instance, observations of a sample using the SAAO 1.9m telescope in South Africa revealed that one star show evidence of emission lines which appear to come and go. However, further investigations are continuing. Observations of the active star YZ CMi using Ultraspec on the Thai 2.4m national telescope revealed quasi periodic pulsations which allowed us to determine the size of the coronal loops which produced the flares. This gives insight to how flares are generated more generally.

The role of I-LOFAR



The Irish LOW Frequency ARray station (I-LOFAR) in Birr Castle, County Offaly (left) and a map of Europe showing all the various nodes of the LOFAR network (right).

The LOFAR (LOW Frequency ARray) array observes the sky at low frequency radio waves and is therefore complementary with the Square Kilometre Array being built in South Africa and Australia which observes at higher radio frequencies. In 2016 AOP joined I-LOFAR, the Irish consortium which now includes nine partners, through capital funding from DCAL. The Irish station at Birr Castle links up with stations in ten European countries and strengthens Irish North-South collaboration and the more recent formal links made between AOP, Dunsink Observatory and Birr. It is a prime example of 'big-data' science with all stations in Europe being recently upgraded to LOFAR 2.0 which allows faster data transfer and more rapid data reduction.

In collaboration with colleagues in Dublin Institute for Advanced Studies (DIAS), Gavin Ramsay and Gerry Doyle supervise Jeremy Rigney (the Lindsay studentship) who is using data from I-LOFAR and the full LOFAR array to study flares and outbursts from low mass stars and intense radio storms from the Sun. Rigney used radio observations made using the ASKAP array in Australia to study stars which were also being observed at the same time using the TESS satellite. By making the radio and optical observations simultaneously can reveal the physical processes at work. The resulting paper, *Rigney et al (2022)*, showed that four low mass stars were detected at radio wavelengths with two of them having shown very strong circular polarisation. These results give insight to what

causes the radio emission and the physical nature of their environment. Rigney is now analysing radio data obtained using I-LOFAR of an intense solar storm in May 2022.

Solar System Studies

Introduction

Our Solar System is an extraordinary natural laboratory to study the formation and evolution of planetary systems around the Sun and other stars. Our work here feeds into fundamental questions about how the Solar System and the Earth formed and the development of life in the Universe. Our study of comets, asteroids and planets impacts on models of solar system formation, the ever-present hazard to civilization if asteroids or comets hit our planet and on the origin of water and organic compounds necessary for life to exist. The space industry benefits from improved detailed knowledge and understanding of the near-Earth and interplanetary environment.

Recent results

Apostolos Christou reports on the ongoing investigation of small asteroids in Earth-like orbits, the so-called co-orbitals. These are among the most accessible targets for deep space exploration with some being easier to reach than the Moon, yet very little is otherwise known about them. Christou has been collaborating with Dr Galin Borisov, formerly a PDRA at AOP and now an Associate Professor at the Bulgarian National Astronomical Observatory (NAO), to observe the co-orbitals at every available opportunity and ascertain their physical properties. This programme continues to benefit from a standing agreement between AOP and NAO that grants Armagh researchers access to the 2m RCC telescope at Rozhen. A recent paper (*Borisov et al., 2023*) reports on observations of four co-orbital targets, monitoring their brightness over time to constrain their shape and spin rate. The largest asteroid in the study was Minor Planet (138175), an object smaller than a kilometre across. Our analysis shows a rotation period of ~14 hours during which the asteroid brightness changes by more than 50%, suggesting an elongated or bi-lobed "dumbbell" shape. Another asteroid, 2017 SL16, is roughly similar in size to the Observatory or Planetarium main buildings. Our observations show an extremely short rotation period of only 19 minutes, suggesting an internally cohesive asteroid like solid rock, as a strengthless agglomerate held together by gravity alone would have readily spun itself apart.

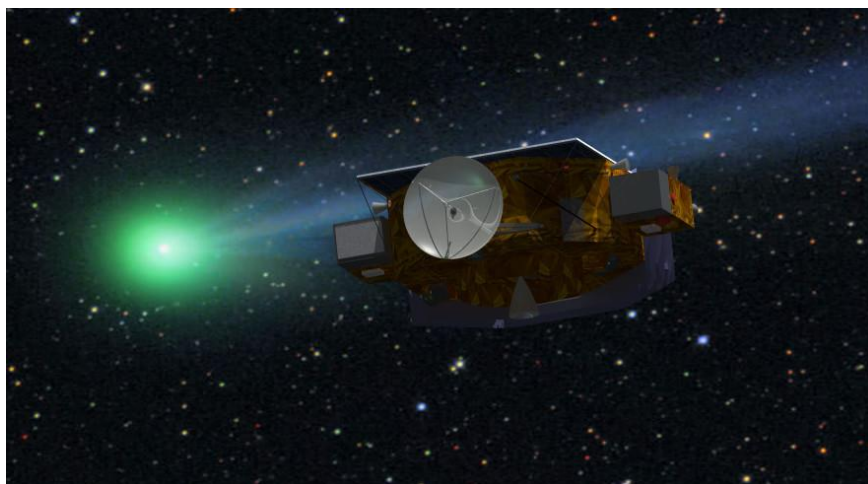
Christou is collaborating with Prof Stanley Dermott (U. Florida at Gainesville, FL, USA) and Dr Dan Li (NSF NOIRLab, Tucson, AZ, USA) to determine the origin of meteorites such as those currently on display in the Planetarium building exhibition area. Scientists examine meteorites in the laboratory to understand how planets like the Earth came together 4 billion years ago. Most meteorites arrive on our planet from a belt of asteroids between Mars and Jupiter. The processes that remove them from the belt and deliver them to Earth are still active today and can be studied through the current distribution of asteroids as a starting point. A recent paper in MNRAS (*Christou et al, 2022*) describes a new numerical method to precisely measure the meteorite removal rate at a given location. Mapping this quantity across the belt in future work will allow us to identify the most likely parent asteroids and source regions of meteorites.

Christou further reports the completion of a term of service within the Vera C. Rubin Early Career Prize selection committee under the Division of Dynamical Astronomy (or DDA) of the American Astronomical Society. Named after one of the most influential figures in 20th century astronomy and a strong advocate for the participation of women in science, this prestigious award recognises work by outstanding and impactful early career international researchers in Dynamical Astronomy or closely related fields. The roster of Rubin prize candidates is considered the "Top Gun" equivalent of Dynamical Astronomy professionals worldwide and, with only one Prize winner to select from a cadre of excellent candidates, the selection committee usually has their work cut out for them. Christou began his three-year term of service in the Spring of 2021 as the world was slowly coming out of lockdown conditions in response to the COVID pandemic. In 2023 Christou assumed the duties of committee Chair, being responsible for co-ordinating the work of committee members in selecting the winning nomination. With the selection process now successfully completed, the 2023 Rubin Prize winner is to be announced during the 54th Annual Meeting of the DDA to be held between 8-12 May at Michigan State University, USA.

Stefano Bagnulo and his PhD student Zuri Gray secured telescope time at the ESO VLT to study the consequences of the impact of Double Asteroid Redirection Test (DART), a planetary defence mission to test a method of deflecting an asteroid on course to hit Earth. DART arrived at near-Earth asteroid Didymos on September 26 2022. The spacecraft crashed into the asteroid's small moon Dimorphos, testing whether the kinetic impactor technique works. Because of the impact, dust clouds were ejected from Dimorphos, which was studied by Bagnulo and Gray from ground-based telescopes using polarimetric techniques (*Bagnulo, Gray & Granvik 2023*). Their work formulated two distinct scenarios for the formation of the dust on the surface of the impacted asteroid and has attracted international interest including through an official ESO press release.

Finally, AOP work on our Solar system links also to extra-solar planetary systems and in particular to the ESA's Plato mission, which is due to be launched towards the end of 2026, has a prime goal of identifying Earth sized planets around Solar type stars in its habitable zone. Gavin Ramsay is one of two ESA Plato Community Scientists and member of the Science Working Team. At the start of the mission, Plato will point at one particular area of the sky covering 2,250 square degrees for at least two years. Identifying the location of this field will be critical to the success of the mission and a final decision will be decided by the Science Working Team in June 2023.

The COMET INTERCEPTOR Space Mission



Artist impression of COMET INTERCEPTOR Space Mission

The European Space Agency (ESA) recently approved a space mission to encounter a comet coming from the edge of our Solar System; the launch is expected in 2028. A novel idea sets this mission apart. So far, spacecraft have approached comets that are already well known and have gone around the Sun already several times. Therefore, it is very likely that the comet material has been “processed” by solar radiation and the space environment, and it is no longer in pristine condition. By contrast, here we are interested in comets on their first trip around the Sun, made of unprocessed material preserved in the cold outer parts of the solar system. To achieve the goal of visiting such a new comet, the spacecraft will be launched before the comet is found and will wait in deep space for instructions. Once a suitable target comet is found, instructions will be sent from the ground to guide the spacecraft to the comet (hence the name **Comet Interceptor**). Studying the material brought for the first time to the heat and light of the Sun will give us the opportunity to look at the solar system as it was when it formed. AOP is contributing to the development of the instrument that will send to Earth comet images (including polarimetric images) obtained with a fish-eye lens. Stefano Bagnulo is an expert in polarimetric observations and is one of the co-Investigators of the project, and his PhD student Zuri Gray is also involved in the mission team. Most recently, Bagnulo has officially become co-I of the EnVisS instrument on-board Comet Interceptor, and member of the Comet Interceptor “Near Environment” working group. He has participated to the second CI Working Group meeting at the European Space Research and Technology Centre in March 2023.

Education and Community Outreach

Planetarium

AOP is a special place that brings together fundamental research and public curiosity about the nature of the cosmos, all within a heritage environment that is rich in scientific history. Four pillars underlie and support the public programme of AOP - education, inspiration, entertainment and outreach. The Planetarium was established in 1968 and is world-renowned as an innovative centre of excellence in promoting the public understanding of science.

At the Planetarium, the primary activity is the education and the dissemination of scientific and astronomical knowledge. The Planetarium also promotes an understanding of astronomy and science to a large audience base of all ages, from nursery to seniors via a school's educational programme and science offering to the wider public through both onsite and outreach means.

This year we achieved record-breaking numbers of 72,000 visitors to AOP. This was largely due to a very successful summer event “Brickosaurs” which consisted of an exhibition of a range of large-scale LEGO brick dinosaur models. The models were housed in an outdoor marquee during June/July 2022 with dinosaur activities and dome shows themed around the event. Credit to the education team who worked tirelessly to ensure that this was a success, each playing their role with Senior Education Officer Ria Mee overseeing the logistics of the event.

This year has seen us experiment with live music in the dome through orchestras which are detailed in the highlights

section below. This is a new use for the dome, and one in which provides a very unique venue and indeed selling point. We also utilised the dome to livestream the Artemis rocket launch. Although the first launch was abandoned, we had a full dome audience ready to witness history in Fulldome format. The second planned launch was set for 5.30am, and thus we ran a staff event where we streamed the live launch. This was a very unique and historic event, and one in which shows the power of Planetarium technology for a full immersion experience.

During 2021-22 we had changed our operational model to reflect the growing need to open at the weekends and our hours of opening changed from Monday-Saturday to Tuesday-Sunday and this has continued into 2022-23. This has also helped our non-school audience grow.

Towards the end of the 2022-23 financial year our school visitors reached the same level as they had been at pre-pandemic which is very encouraging, and our school bookings are very healthy going forward. Careers events continued with a partnership with School Employer Connections with Operations Manager Helen McLoughlin continuing to drive and deliver this element of our outreach.

Half-way through the year we changed our focus on outreach and with a dedicated Tours and Outreach Officer we explored the demand for offsite dome visits. This has proved to be a popular and worthwhile venture with Dr. Rok Nežič leading the delivery of the programme. Included were visits to schools, youth group organisations, Ulster University, Marble Arch Caves event, special schools and council festivals. With a new electric van, Rok has been increasing our outreach visibility which is having a positive impact on our bricks and mortar visitors with customers coming back for a fulldome show visit. We also partnered with the Royal Institution (RI) to conduct outreach on their behalf to secondary schools which has been a popular and worthwhile partnership, opening more opportunities to work with the RI and it has increased our outreach visibility.

Accessibility was a focus in 2022-23 ensuring that we have a place that is a "space for all". We introduced Makaton inclusion this year at the Planetarium as well as having Level 1 British Sign Language (BSL) and Irish Sign Language (ISL) translators. Our popular dome show "CapCom Go" was filmed in both BSL and ISL as well as Irish and Ulster Scots with the help of the DfC translation department. We also provided a BSL and ISL translation of our live Christmas experience "Mission Santa". Monthly relaxed-dome show sessions are now standard in our programme as well as relaxed event sessions for workshops. We have also renewed our JAM (Just A Minute) Card registration with all front-line staff JAM Card trained. This year we also set up a youth forum giving children with autism the opportunity to lead and show us what they need in order to make a successful visit to AOP. They have been driving change and they have been working on developing ideas for items such as sensory bags, sensory maps and increasing awareness of our accessibility through our website. This was made possible through an Association of Science and Discovery Centres (ASDC) Bold Futures fund for which we also set a target to increase our reach of special schools through outreach. We were getting an engagement level of 8% of special schools in previous years. By the end of March 2023, we had already increased that to a 35% engagement level.

During this year we were successful in some education and outreach funding bids as well as advertising bids. To note are the Tourism NI (TNI) marketing bids in which we received funding per season to help promote AOP. This funding has helped us to reach different audiences and grow our annual visitor figures. We also applied and were successful in an Association of Science and Discovery Centre's (ADSC) bid through "Bold Futures" for which the programme is listed above. Through the IAU we got seed funding to pilot an afterschool's programme which Education Officer Nick Parke is taking the lead to organise. Missions and Mindsets was a small funding bid that resulted in AOP joining a fully funded learning programme with the opportunity next year to apply for further programme funding.

Through our marketing activities we have produced a steady stream of good news stories from AOP, including highlighting the research we conduct, job roles throughout the organisation and promoting a visit to AOP.

We also participated in providing work experience for a Stranmillis College student which was a rich and valued learning experience.

Towards the end of the year, we installed two Astropark trails after successfully applying for TNI Experience funding. Following a successful tendering exercise, we developed a new kids Eco trail with a workbook, sculptures, clues and an augmented reality (AR) app around the grounds. There is also an adult app focusing on a tour of the grounds and Observatory. A lot of work across the organisation went into this new experience over the last year and these outdoor trails have already increased dwell time and been popular with visitors and locals. We aim to officially launch these trails in the new financial year.

Highlights from AOP's Programme of Events in 2022-23

In April we had our first official live music event in the new dome when the Southern Regional College music department performed a live musical rendition of the "Our Place in the Cosmos" soundtrack.

In May, Helen McLoughlin and Ria Mee brought the outreach dome to the Slieve Russell Hotel in county Cavan for the Massive Stars IAU conference and held both a schools and public event, our first outreach event since the start of the pandemic. A new climate temporary exhibition was launched this month also in Copernicus Hall.

June 2022 saw the introduction of Brickosaurs, after a two-year wait due to the pandemic. The install took place on week beginning 6 June with a marquee erected to house the dinosaurs. The exhibition opened to the public on June 11.

July was all about Brickosaurs. Over 17,000 people came to see the exhibition in July which surpasses any previous month's visitors on record. Adrian Dunbar came by for a visit to film for his new Channel 5 show as well.

In August we began presentations in our new Digital Visualisation Lab (DVL) which were very well received. Armagh Library held story time at AOP and we went to the library with our experiments from the Big Book of Experiments and Bright Ideas. The big event was the Artemis live streaming event in the dome - a first in terms of a live launch screened in the dome around the world. Although the launch was scrubbed, AOP received positive PR from the event through numerous BBC Newsline pieces and both online and newspaper articles. We also held our first concert in the dome with the Sligo Baroque Orchestra "The Music and Astronomy of William Herschel - Celebrating 200 years". The event was fully booked and we will want to replicate the success again in the future, merging live music with imagery on our dome.

In September, Rushmere Shopping Centre hired our outreach dome to give shoppers a unique experience. We also had stands at four local Southern Regional College campuses for freshers week. Members of the team attended the British Association of Planetaria (BAP) conference in Leicester and ASDC conference in Glasgow. The big event this month was the Observatories Network Conference which was a huge success and showcased the organisation using both the Planetarium and Observatory for conferencing opportunities.

October kicked off with a PhD Saturday where students planned workshops and delivered talks in our hall. For Space Week we delivered afternoon visual reality sessions where visitors got the chance to put on a headset and learn about climate change. An online careers event saw 340 secondary school pupils learn all about astronomy as a career. Interesting events that month also included a Bat Walk, the Partial Solar Eclipse event, the return of Startrackers. We had Tall Tales and Terror in the Observatory, Spooky Space in the Planetarium with some potions and explosions, DVL demos and Infrared talks.

November saw the Armaghi People of the Year Awards launch event. Rok Nežič visited Cavan, Laois and Dublin, and began outreach visits as part of the Royal Institution partnership. We had sold-out tours of the Observatory as part of the Georgian Day events in Armagh. "Our Place in the Cosmos" was featured at the Fulldome Film Festival in Plymouth. For Mission Santa, we held accessible sessions this month in BSL which were well received. Our second orchestra concert in the dome took place "Thus she shall go to the stars" featuring the work of astronomer Agnes Clerke. AOP's Erin Higgins worked with Senior Education Officer Ria Mee to put together some of the event which was screened on the dome.

December continued with sold-out Mission Santa dates and a trial of providing sessions for schools. We included sensory sessions, BSL and ISL interpreted events and engaged with community groups and special units in schools. We were involved with the Royal Institution Christmas Lectures and hope to build upon this for next year.

February half-term was very successful for AOP with sold-out dome shows and events. Events included DVL sessions, careers events and Lego Brick workshops. A GCSE Day was held this month where multiple schools came to enjoy a dome show, workshop and walk to the Observatory. The Armaghi Awards were held in the Copernicus Hall this month with 100 people in attendance.

March brought the launch of the Irish language translated "CapCom Go" with the help of the DfC translation department, Southern Regional College in Armagh, National Space Centre Leicester and Aonach Mhacha. We began our Bold Futures project which has been funded by ASDC. Outreach has been taking place at special schools and our youth forum met at the end of March to give us feedback and ideas on our programming and to create sensory bags and maps for us. Two trails have been installed around the grounds - a kids Eco trail with workbook and AR app and a more adult tour of the Astropark and Observatory.

History and Heritage

History & Heritage Policy

AOP boasts a collection of over thirty-one thousand historic documents, rare and antiquarian books, scientific instruments and photographs. This collection is unique on the Island of Ireland and one of the best-preserved observatory collections in the United Kingdom. The heritage policies that have been implemented ensure that the collection is cared for in accordance with best practice and has allowed ongoing historical research.

During 2022-23 the Observatory has continued to be open to the public for the 'Legendary Telescope Tour' package, which has been well received. The eMuseum has 485 objects available for public viewing on the Armagh.space website, with a goal of making 7,000 objects available by summer 2024. Since 2021-22, four new temporary exhibition cases have been filled in the Planetarium, with rotating displays. In addition, two new cases have been filled in the Planetarium Board Room.

In accordance with AOP's policy of making our collection available for the public and researchers to use we have continued to facilitate public information requests. The 2022-23 financial year brought 21 requests which were facilitated by the Museum Collections Officer. This is an increase of 7 requests over the 2021-22 year. In addition, AOP was host to the Observatory Networks Workshop Four, which was held in September 2022. This workshop saw the premier academics in the field of astronomical history gather in Armagh, and included sessions delivered by staff and students of AOP.

2022-23 introduced the second successful project supported by the National Lottery Heritage Fund. This project, 'Wisdom Begins With Wonder' is funded to run from May 2022 to June 2024 and has seen the successful implementation of a volunteer program. Since launching, the volunteer program has facilitated over one hundred hours of voluntary work in AOP, with more volunteers awaiting projects. The project has also funded the position of Museum Collections Officer from June 2022-May 2024, on a part time basis. This position is responsible for ongoing volunteer coordination, museum policy development, cataloguing and the facilitation of research requests.

In 2022-23 AOP was awarded Museum Accreditation by the Northern Ireland Museum Council and the Arts Council. This has been an objective of the Living Space Committee since 2019 and was successful thanks to the buy-in from across the organisation and the assistance of our Museum Mentor, Sean Barden, from the Armagh County Museum. The accreditation lasts for five years, at which point it will be reassessed. AOP has also been consulting with the Northern Ireland Museum Council on a wide range of ongoing challenges to the sector, and staff have attended four consultations and two training sessions. Since achieving Museum Accreditation, AOP has hosted visits from the Director of the Northern Ireland Museum Council twice.

AOP has also continued to publish historical research, and staff have been involved in a project to publish a book in conjunction with the International Planetarium Society. The team have also continued to provide access to the operated collection of historic scientific instruments. Over the winter observation period, four successful observation sessions were held with the Grubb 10-Inch telescope, and five staff and students were trained in its use. The Grubb 10-Inch and Calver telescopes have also undergone successful preventative conservation including the rebalancing of the Calver telescope and the removal and reattachment of the finder scopes.

Library & Archives

AOP's suite of technical equipment is complemented by a Library and Archives which, together, represent one of the premier specialist collections of their kind in the world. The Library, Archives and Historic Scientific Instruments collection contains a unique variety of historic books and manuscripts, images, photographic plates, scientific instruments, clocks and other artefacts concerning the development of modern astronomy from the Age of Enlightenment up to the present day with specific reference to the important discoveries and scientific contributions made by the international research community here at Armagh. The library also provides an essential reference resource for AOP research, and especially for its student and young researcher cohort. It contains approximately 3,400 textbooks, monographs, special reports, and conference proceedings covering nearly all disciplines in astronomy. Some 17,000 volumes from nearly 200 scientific journal titles include nearly complete runs of all the major astronomy journals, as well as journals of significant historical interest.

During 2022-23 the collection has been supplemented by approximately 20 new books on topics relevant to AOP research. Work continues on binding the backlog of unbound journals. Attention has been given to some of the more historical items, including the volumes of Nature from the 1890's and Popular Astronomy from the 1930's. A scoping audit of the remaining backlog has been carried out to inform future funding requirements.

Whilst still under enormous pressure for space, the AOP library is now an attractive space and a more effective research tool, with potential for further development and revenue generation, and increasingly demonstrating its potential for historical discovery as well as astronomical research.

Meteorological Record

As part of AOP's primary research role, staff and students take daily readings of a wide range of meteorological parameters at Armagh and maintain the Observatory's unique 228-year long meteorological record and databank. This is believed to be the longest daily climate series in the UK and Ireland from a single site (though the log book for the period June 1825 to December 1832 appears to have been lost), as well as being one of the longest in the world. The climate station has been continuously maintained since July 1795 with readings currently taken

every day at 09:00 (GMT). The World Meteorological Organisation (WMO) has recognised Armagh with Centennial Station status for its longevity and importance in contributing to the climate record.

Calibration of these data has enabled researchers and government agencies to use the Armagh series for reports and research into global warming. The data contributes to the UK Meteorological Office's main climate database and are released to the general public on a monthly basis through press releases and on our climate website (<http://www.climate.armagh.ac.uk/archives.html>) whilst also contributing to the UK Meteorological Office's main climate database.

Climate change is a subject of strategic importance for Northern Ireland as we move into an era of rapid climate variability, and the Armagh's unique climate record provides an exceptionally long historical baseline, enabling better informed judgements to be made as to how Northern Ireland's climate has responded and is responding to climate change world-wide. In order to inform the public about the impacts of climate change, AOP has introduced a movable exhibition on the subject into the Planetarium exhibition area in the Copernicus Hall. This is centred around an interactive Puffersphere presentation on climate change, together with supporting exhibits around the room which expand on local impacts. The exhibition has been designed to be readily mounted / demounted so that it can be moved and reassembled quickly when the Copernicus Hall is being used for other activities and events.

An automated weather station (AWS) was installed by the Met Office in 2019, sampling the weather every minute. This now provides the primary source of weather data in the Met Office records (e.g., temperature, pressure, rain fall, windspeed) since it is automatically uploaded to the Met Office. However, manual collection still continues, and provides the only source for some of the data collected (e.g. sunshine, grass temperature) at Armagh. We have now placed the measuring instruments inside a second Stevenson Screen within an expanded meteorological enclosure. This is to ensure that the AWS enclosure is identical to those used by the Met Office in their UK-wide network. In doing this we also changed the fencing around the weather station to make it less visually intrusive.

We developed a series of python scripts to store, analyse and provide access to the weather data base via the weather webpages. This includes both the manual data as well as the (recent) automated weather station data. Research Assistant Tom Watts wrote the necessary code. This takes the monthly observers log, provides a means of entering the information via an online log, and in addition automatically downloads the data received from the automated station, to ingest these data sets into a new database. Analysis scripts then allow this database to be interrogated, e.g. to find climate extrema over any date range of interest. This can then be examined from the website: <https://weather.armagh.space>. This includes enquiring about weather on any single day (as might be used in a visitor display in the Planetarium), as well as examining the data set over any period of interest and searching for climate records (extrema) over a period of interest. The automated weather station data is now also available to inspect online, in addition to the manual data. Plotting tools allow the user to see the weather over any time period, as well as to find when extrema in the various measured parameters occurred.

The Met Office changed their method of provision of data from the automated station to us in April. It is no longer sent it via a daily email digest. We have developed code to access this data direct from the Met Office repository. This has had the added benefit of AOP now being able to provide real time weather data (including conditions for the past 24 hours) for Armagh via our web pages (see <https://weather.armagh.space/aws-live.php>), including for visitors to the Planetarium.

The three new PhD students were trained in weather observations (Andrew Marshall-Lee, Asish Monai, Saskia Schlagenhauf), and then accredited as Level 1 Met Observers by the Director. This forms part of their PhD training in the techniques of scientific data measurement and analysis.

Information about the weather record in Armagh has now been transferred from the previous climate website (climate.armagh.ac.uk), updated, and had extensive new material added; see armagh.space/weather. This includes information about the history of the weather record, on the instruments used, the log book, and on publications. Rok Nežič has primarily compiled the material for these web pages.

On 18 July 2022 our manual station recorded a maximum temperature of at 31.2°C, the second hottest ever measured in Armagh (only exceeded by the 31.3°C on 22 July of the previous year). Record temperatures were measured across the UK during this period, notably exceeding 40°C in some locations in England on 19 July. The average temperature on 18 July in Armagh (the average of max and min values) was the highest ever recorded here, i.e. since 1844 when we starting recording min/max temperatures. Overall, 2022 was the warmest year ever recorded, with a mean daily temperature of 10.8°C (average of all max & min values across the year). The next two most-warmest years are 2007 (10.6°C) and 2021 (10.5°C).

In March 2023 our Met Station measured 140.5mm of precipitation, the highest March figure ever recorded since rainfall records began in 1838. November 2022 was also the sunniest November in Armagh for 98 years with 89.8 hours of sunshine, 50% higher than the long-term average.

Support

AOP is committed to ensuring fit for purpose governance and support services to support the delivery of organisational objectives.

Information and Communications Technology (ICT)

The comprehensive research computer facilities are used primarily for numerical analysis, computer modelling and data reduction. The computers and peripherals are largely funded by DfC, but occasionally by external research grants. Staff require access to high-end Apple Mac and Linux workstations. In addition to this, Corporate and Education is serviced within a Windows and Office 365 environment.

An ICT Strategy was approved in October 2022 and progress against the Action Plan's ongoing support commitments, continuous focus and short, medium and long-term activities are considered by the Audit and Risk Assurance Committee (ARAC) each quarter.

AOP continues to modernise and improved its centralised ICT hub. In 2022-23 all primary MacBook laptops and six compute servers were replaced.

AOP is continually implementing measures to improve its resilience against cyber security measures without disproportionately inhibiting the ICT requirements of researchers. An ICT Risk Assessment is reviewed quarterly and considered at ARAC. ARAC also receives received quarterly updates on implementation of patching and software updates.

Finance

AOP has a well-established finance function. Financial policies and procedures are continually being enhanced to ensure that the organisation meets the governance standards required. This includes the application of public sector procurement controls, meeting prompt payment targets and providing regular and ad hoc financial information within the organisation and to the Department.

AOP continues to experience significant cost pressures within a core budget that has remained static for 6 years. In 2022-23 it was able to mitigate this through an additional resource allocation and exceptional income from admissions and trading sales which greatly exceeded expectations.

Human Resources

A Human Resources Action Plan 2022-23 has been implemented to include:

- Maintaining a Fit for Purpose Organisation Structure – recruitment of 4 new staff; maintaining a pool of casual employees; preparation of new skills-gap paper; inclusion of succession planning questions in appraisal cycle; preparation of organisational planning report for 2023-24 Business Plan and budgeting process; identification of short term opportunities to plug skills gaps with short term projects or engagements and recruitment activity as required in-year;
- Continual review of Operating Models – implementation of formal hybrid working arrangements; monitoring and reporting on new arrangements; supporting Education Team Officers with employee working arrangements; review of staffing needs in context of budgets and affordability;
- Employing and Investing in Motivated and Engaged Staff – agree and implement actions arising from Staff Survey and engagement event; consideration of Concordat to support the career development of Researchers; supporting annual appraisal process; completing/revising a rolling training plan; review implementation of training plans in the context of available budget; prepare business case for special bonus scheme; conduct annual staff engagement survey; development of internal engagement plan; preparation for two significant engagement events; supporting the Health and Wellbeing of PhD students;
- Fair and Equitable Employment Policies and Procedures – completion of annual Fair Employment return; achievement of Bronze Diversity Mark Award; preparation of Project Juno Champion application; review of policies and induction and refresher training in policies.

A Human Resources Strategy 2022-26 has been developed and approved along with the Q1 Action Plan for 2023-24.

Diversity and Inclusion

AOP has an obligation under Section 75 of the Northern Ireland Act to ensure that equality of opportunity and good relations are central to policy making, policy implementation and review as well as service delivery. AOP monitor the composition of their workforce in terms of community background and sex and use an equal opportunities monitoring form questionnaire. AOP complete an annual Fair Employment Monitoring return to the Equality Commission detailing staff composition and that of job applicants to AOP posts.

In the AOP Strategic Plan 2021-26 we state that having Fair and Equitable Employment Policies and Procedures is one of our key elements in delivering high standards. AOP have a number of policies in place including an Equal Opportunities Policy.

AOP signed up for Diversity Mark Accreditation in December 2021, formally applied for the Bronze Award in July 2022 and was awarded the Bronze Award in November 2022. Three Equality, Diversity and Inclusion targets have been set as follows:

- To develop an Equality, Diversity and Inclusion Strategy;
- To increase the number of female research staff at AOP from 2 to 4; and
- To increase female representation on the AOP Management Committee from 3 to 5.

AOP achieved Juno Practitioner status in June 2019. This is an award scheme that recognises and rewards university physics departments, schools of physics, and related institutes and organisations that can demonstrate they have taken action to address gender equality at all levels and to foster a more inclusive working environment. We applied for Juno Champion status in April 2023. This application will involve satisfying the following 6 Juno Principles:

- Principle (1) Robust organisational framework - A robust organisational framework to deliver equality of opportunity and reward;
- Principle (2) Appointment and Selection - Appointment and selection processes and procedures that encourage men and women to apply for academic posts at all levels;
- Principle (3) Career Progression and Promotion - Departmental structures and systems that support and encourage the career progression and promotion of all staff and enable everyone to progress and continue in their careers;
- Principle (4) Open and Inclusive Culture - Departmental organisation, structure, management arrangements and culture that are open, inclusive and transparent, and encourage the participation of all staff;
- Principle (5) Flexible Working - Flexible approaches and provisions that enable individuals, at all career and life stages, to optimise their contribution to their department, their institution and to science, engineering and technology; and
- Principle (6) Professional Conduct - An environment where professional conduct is embedded into departmental culture and behaviour.

Governance

Governance and accountability continue to be strengthened and improved and risks reduced as demonstrated by external and internal audit reviews. Actions arising from effectiveness reviews undertaken by both ARAC and the Management Committee have also resulted in enhanced arrangements.

One outstanding Internal Audit recommendation, relating to Record Management, is currently being addressed. A retention and disposal schedule is awaiting consideration by the Public Record Office of Northern Ireland (PRONI). The organisation has moved towards paperless record management systems which will be easier to manage and control in accordance with the approved Retention and Disposal policy.

Estates Management

AOP manages an extensive estate which includes 9 separate buildings, including the Grade A listed Observatory and a circa 20-acre historic estate. There are also several leases associated with land and property.

During the year AOP has prepared an Outline Business Case (OBC) for redevelopment. AOP views this project as imperative to future proof its role into the next generation. The case for change is predicated by an estate that is outdated and misaligned to expectations of modern-day visitors and future opportunities. The OBC was approved by the Board of Governors in May 2023, and submitted to the Department for consideration.

NetZero

AOP's international research standing, and unique record of uninterrupted meteorological observations has allowed AOP to effectively communicate on the issue of climate change (CC) to the general public, in particular since the design and installation of a temporary exhibition in the Planetarium and through AOP's participation in 2021 at the COP26 conference in Glasgow. This has also prompted AOP to lead by example in the CC arena, in particular by joining the UK Government SME Climate Hub by committing to reduce by 50% its CO2 emission 2030.

As an initial step in this direction, DfC funding was granted to facilitate a carbon baselining exercise to capture both the present carbon footprint of AOP and to indicate a set of emission reduction measures (ERMs) that could

eventually half such a carbon footprint. This study indicated that the Planetarium building and its operation are the main source of both direct (e.g. through heating oil consumption) and indirect (e.g. by consuming electricity generated elsewhere) CO2 emission. Trying to reduce or optimise emission in the Planetarium should therefore be a priority, although in the long term a new and energy efficient building would be desirable. Meanwhile, it is the AOP grounds that offer the wider scope for reducing AOP's footprint either through green energy generation or the carbon offsetting through the planting of trees.

Moving in this direction, in the last financial year Department for the Economy (DfE) capital funding was obtained to change the internal lighting of the Bell building and the Planetarium based on more efficient LED technology and to install two green energy power generation stations based on wind and solar power on AOP grounds. While the latter will certainly not generate sufficient power to cover the need of the Planetarium, they will serve to illustrate the role that new technologies will play in harnessing even more efficiently the energy from winds and our Sun, thus adding to AOP's education offering. Finally, a NetZero committee with representative from all of AOP's main team, including also students, has been meeting regularly to discuss and implement additional ERMs and more generally good practice in terms of ecological sustainability.

Achievements and Performance

The targets set for AOP in the 2022-23 Business Plan are shown in the following table. Actual performance achieved is shown along with the corresponding achievement in the previous financial year, where applicable.

Targets were achieved or exceeded in many areas; however, there were 6 targets not met. Failure to meet a number of the missed targets is beyond AOP's control in that they are reliant upon external factors. In particular, capital funding is required to achieve Urban Night Sky Place accreditation; the joint development Masterplan project was dissolved in-year and it was anticipated that a major funding stream would be live to make application in pursuance of AOP's future development. Targets relating to school visitors and cosmic classroom events were not achieved due to a combination of the level of schools returning post-Covid and an increase in dome outreach. The objective of submitting an OBC for AOP's future development within one year was ambitious. Significant progress has been made, however, there has been slight slippage in the timeline.

KPI	Description	Target	As at 31 March 2023	As at 31 March 2022 (where applicable)	Comments
1	Attract 55,000 visitors (to include 43,000 public visitors and 12,000 school visitors)	55,000	Public 62,793	37,345	Bookings overall exceeding pre-pandemic levels. 2021-22 target affected by Covid-19.
			School 9,381	n/a	Total 72,174 visitors - School visitor target unachievable due to the level of schools returning.
2	Achieve £486,000 income from admissions and sales	£486,000	£570,851	£364,553	2021-22 target affected by Covid-19.
3	Achieve an 80% satisfaction rating of 4 or above out of 5	80%+ evaluation ratings ≥ 4	88.67%	93%	
4	Achieve 75 number bed nights from a collaboration with local accommodation providers	75	182	New KPI	
5	Deliver 2 new school programmes (ecology and GCSE)	2	2	New KPI	
6	Deliver 4 events focused on the work of astronomers and PhD students	4	7	New KPI	
7	Deliver 20 cosmic classroom events (10 paid and 10 free for schools with low educational achievement in STEM)	20	Paid 2	Paid 20	Paid - unachievable due to level of schools visiting and increase in dome outreach
			Free 11	Free 7	

KPI	Description	Target	As at 31 March 2023	As at 31 March 2022 (where applicable)	Comments
8	Press coverage: 15 positive press releases for print media 3 broadcast TV coverage	15 3	68 6	New KPI	
9	Deliver one pilot event to raise awareness of the Armagh-Birr-Dunsink partnership	1	1	New KPI	
10	Achieve recognition as an Urban Dark Sky Place			Unachievable	Capital funding required to deliver
11	Publish 50 articles in referenced scientific journals	50	85	67	
12	Scientific Outreach: 12 scientific talks at international conferences 12 public talks by scientists	12 12	39 43	New KPI	
13	Admit 3 new PhD students in October 2022	3	3	2	
14	Attract 8 number of external bookings for events or seminars	8	14	New KPI	
15	Facilitate 6 onsite scientific visits	6	26	New KPI	
16	Develop one non-astronomy partnership in the use of DVL facilities	1	1	New KPI	
17	Create 1 externally funded non-astronomy PhD	1	1	New KPI	
18	Create 2 new Puffersphere applications in house	2	2	New KPI	
19	Develop one new educational workshop using VR	1	1	New KPI	
20	Submit an OBC for AOP future development			New KPI	Slight slippage in the timeline. Submitted May 2023.
21	Secure outline planning approval for a joint development Masterplan in partnership with ABC Council			New KPI	KPI obsolete as joint development Masterplan project dissolved
22	Submit one major funding application in pursuance of AOP future development	1		12	It had been anticipated that PEACE PLUS would be live. An expression of interest was submitted.
23	Deliver 1 community/schools climate change event	1	3	9	
24	Achieve £320,000 funding from scientific sources to support AOP research	£320,815	£359,339	£420,000	Reduction in Covid-19 supplementary funding

Progress Key: Complete, Not Achieved

Financial Review

Operating Results

In the financial year to 31 March 2023, the value of charity funds increased by £2,111m, summarised below.

		2023	2022
		£	£
Total incoming resources		3,730,874	4,041,109
Total outgoing resources		(4,285,869)	(4,034,081)
Net income / (expenditure)		(554,995)	7,028
Gains on the revaluation of fixed assets		255,242	422,885
Actuarial gains on defined benefit pension scheme		2,411,000	1,534,000
Net movement in funds for the year		2,111,247	1,963,913
Movement in Unusable Funds			
Capital financing			
Capital grants received		549,000	1,254,000
Government grant fund		(858,746)	(828,152)
Revaluation reserve		1,904	185,428
Pension reserve		2,035,000	1,098,000
Movement in Usable Funds			
Restricted		(26,080)	(14,346)
Unrestricted		410,169	268,983
		2,111,247	1,963,913

The total income for the year was £3.731m, a decrease of £0.310m from 2021-22, mainly due to a decrease in DfC capital grant income of £0.705m, offset by increases in DfC Recurrent grant-in-aid of £0.160m, operating income of £0.163m and trading income of £0.065m.

Expenditure was £4.286m, an increase of £0.252m from the previous year. Staff costs continue to be the largest component of operational expenditure, comprising 62% of all direct costs.

Unrestricted operating costs are funded primarily by DfC grant-in-aid. The balance of such unrestricted operating costs is funded by contributions from external grants, operating income, trading activities and miscellaneous income. We continue to seek other funding streams to maintain this important source of funds. In 2022-23 the Department provided 71% of the total income through recurrent and capital grant allocations (2021-22: 79%).

Net Assets

Net assets at 31 March 2023 were £12.720m (31 March 2022: £10.609m).

Reserves

The AOP reserves policy is included in note 1 of the accounts. Total accumulated funds are as follows:

Funds at 31st March	2023	2022
	£	£
Restricted funds	148,028	174,108
Unrestricted funds	5,010,569	4,910,146
Revaluation Reserve	7,403,874	7,401,970
Pension Reserve	158,000	(1,877,000)
Total Charity Funds	12,720,471	10,609,224

Going Concern

The Trustees are satisfied that the organisation is a going concern on the basis that it has a reasonable expectation that it will continue in operation for the foreseeable future. The financial statements are therefore prepared on a going concern basis.

Pension Reserve

AOP is a member of Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) which manages Local Government Pension Scheme (LGPS) Northern Ireland, which in turn provides a defined benefits pension to employees. The scheme moved into surplus during the year and at 31 March 2023 the surplus was calculated by independent actuaries at £158,000 (2022: deficit £1,877,000). The assets, defined benefit obligation and current service cost shown in note 19 to the accounts have been calculated based on the data and results of the 2022 triennial actuarial valuation. AOP is able to recognise the surplus in full at this accounting date because we can gain an economic benefit from payment of reduced contributions below the cost of the expected FRS102 service costs in the future.

Key Risks and Uncertainties

At year end, the key risks were identified as:

- Reputation – loss of confidence in AOP's ability to deliver acceptable level of research of international value;
- Engagement:
 - Visitors – failure to provide experiences that attract new and returning visitors and/or failure to engage local pride in AOP as a cherished asset;
 - Partners and collaborators – failure to attract support and commitment from key stakeholders to be able to deliver future vision;
- Resources:
 - Staff - failure to maintain an appropriately skilled, highly motivated and engaged workforce of sufficient capacity to satisfactorily deliver AOP objectives;
 - Budget – insufficient or poor management of budget could result in objectives not being met and/or value for money not being achieved;
- Asset Management:
 - Buildings and Heritage – failure to plan for the long term development needs of the estate and assets resulting in increasing reliance on remedial intervention and failure to protect heritage assets from irreparable decline;
 - Other physical assets including ICT – failure to plan for the upkeep and renewal of plant and equipment resulting in reduced service delivery; and
- Governance and Planning:
 - Failure to embed best practice approaches to corporate governance and risk management resulting in loss of confidence and reputational damage and/or legal challenge;
 - Inadequate information/data security measures resulting in information breaches and/or cyber security breaches.

As part of the Risk Management Strategy, management regularly review the inherent level of risk for each of the above and how the risk is currently managed. An Action Plan is documented to reduce the level of risk, mindful of the risk appetite of the organisation. This Risk Register is reviewed on a quarterly basis by the Audit and Risk Assurance Committee and approved by the Management Committee. Many of the above risks derive from the uncertainty around funding. Until AOP has both a budget appropriate to its needs and long-term security of funding, this situation is likely to continue. In managing these funding risks, the organisation has developed and maintained close communication links with the Department and submitted in-year monitoring bids for additional funding while carefully monitoring spend and budgets. For many of the above risks all reasonable steps within AOP's control are being taken to manage the risk.

The above risks also take account of recommendations from internal and external audit investigations and reports. Significant progress has been made in addressing the weaknesses identified in previous years and considerable effort has been put into the management of these risks going forward.

Plans for Future Periods

In October 2021, AOP published a new Strategy for 2021-26 with four key themes of Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

Leading on from this AOP has prepared a Business Plan for 2023-24 for consideration by the Department. The business plan has been developed in the context of an unclear and uncertain, political and financial environment, however AOP remains focused and optimistic towards continued achievements within its key priority areas.

AOP, in conjunction with Dublin Institute of Advanced Studies, Dunsink Observatory, and Birr Science and Heritage Foundation, have embarked since September 2022 on a formal strategic process to develop an inter-institutional partnership for mutual benefit. This takes place in acknowledgement of the potential for strengthening the partner institutions' collaborative working capacity and for wider impact on a transboundary basis. This also includes taking into account a context of emerging opportunities for strengthening the long-standing north-south connections between Armagh, Dunsink and Birr in a way which maintains the integrity of each partner's core mission, and promotes the intrinsic value of scientific knowledge and heritage represented by the body of work carried out over the three sites since their establishment and ongoing. This will continue to be a key area of work in 2023-24 and will include submission of an application for consideration to be included in the Republic of Ireland Tentative List for UNESCO World Heritage Status as a transnational bid.

Following on from completion of a draft Outline Business Case for future development AOP will continue to work with partners and stakeholders to identify funding opportunities and other resources to move the project forward to the next phase of planning.

Structure, Governance and Management

Armagh Observatory and Planetarium is a single statutory corporation and arms-length body (ALB). ‘The Governors of The Armagh Observatory and Planetarium’ are as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*.

This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled ‘*An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever*’, and an Amendment of 1938 (‘The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938’).

AOP is a registered charity under the title “The Armagh Observatory And Planetarium”.

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one Department nominee;
- one Queen’s University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

The Armagh Observatory and Planetarium (Northern Ireland) Order 1995 (the Order) places a statutory duty on “the Governors of Armagh Observatory and Planetarium” to maintain and manage AOP with the purpose of “developing and improving the knowledge, appreciation and practice of astronomy and related sciences.”

The Board of Governors (the Board) has retained a role to ensure that the culture and character, history and patrimony embodied in AOP are protected and preserved and that the institution is managed in line with the statutory purpose outlined in the Order. This role will normally be fulfilled through an Annual Review meeting (visitation) where the Board will receive assurance as to the management and performance of AOP from the Management Committee.

Management Committee of Armagh Observatory and Planetarium

The Board has delegated primary responsibility for the governance and management of AOP to a Management Committee. The Management Committee has corporate responsibility for ensuring that AOP fulfils the aims and objectives set by the Department and approved by the Minister and for promoting the efficient, economic and effective use of resources. The Management Committee provides leadership, challenge, oversight, support and encouragement to the Director and staff.

The Management Committee comprises:

- three nominees from the Board of Governors;
- six nominees from the Department appointed through open competition;
- one nominee of Queen’s University, Belfast;
- one nominee of the Science and Technology Facilities Council (STFC);
- one nominee of the Dublin Institute for Advanced Studies (DIAS);
- a Chair appointed through open competition; and
- up to three additional members co-opted by the Board of Governors. This is by exception and subject to Departmental approval.

The following committees are established as sub-committees of the Management Committee.

Audit and Risk Assurance Committee (ARAC)

The ARAC is a sub-committee of the Management Committee established in accordance with DAO (DFP) 06/13 - Corporate governance in central government departments: Code of Good Practice NI 2013, and in line with the HM Treasury Audit and Risk Assurance Committee Handbook (DoF 03/18) to advise the Board of Governors, the Management Committee and the Director of AOP as Accounting Officer and to support them in their responsibilities for issues of organisational risks, internal control, governance and their associated assurances and in reviewing the reliability and integrity of these assurances.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee is a sub-committee of the Management Committee and provides advice and recommendations to the Management Committee on employment issues.

Research and Education Advisory Committee

The Research and Education Advisory Committee is a sub-committee of the Management Committee and advises it on research and education issues.

Redevelopment Committee

The Redevelopment Committee is a sub-committee of the Management Committee and was established to develop an Outline Business Case for redevelopment proposals.

Further details on the membership of these Committees are set out in the Governance Statement on pages 30 to 39.

Reference and Administrative Details

Name of the Charity

The charity is registered and operates under the title of The Armagh Observatory And Planetarium.

Charity number

Registered with the Charity Commission for Northern Ireland 103948.

Principal Office

College Hill, Armagh, BT61 9DG

Trustees (and Board of Governors)

Archbishop J McDowell, (Chair)
The Very Revd Dean S Forster
The Venerable Archdeacon T Scott (to 30 January 2023)
The Venerable Archdeacon E Cairns
The Venerable Archdeacon Dr P Thompson
Revd Canon W M Adair
Revd Canon W J A Dawson
Revd Canon M Hagan* (from 23 April 2023)
Revd Canon D Hilliard
Revd Canon J Moore (to 22 February 2023)
Revd Canon B Paine
Revd Canon R J N Porteus
Mr G Cox
Professor A Fitzsimmons
Mr R Wilson
Archbishop E Martin
Ms S Leslie*

**Pending the outcome of ongoing discussions with CCNI, Ms Leslie and Revd Canon Hagan have not been registered as a Charity Trustees.*

Director and Accounting Officer

Professor Michael Burton

Auditors

Northern Ireland Audit Office, 106 University Street, BELFAST, BT7 1EU

Internal Auditors

Cavanagh Kelly, 36-38 Northland Row, Dungannon, BT71 6AP

Bankers

Danske Bank, Donegal Square West, Belfast, BT1 6JS

Register of Interests

A Register of Interests is maintained for Board and Committee Members and the Executive Team and is available for inspection at the Principal Address. Declared Interests by Board and Committee Members and the Director are available on the AOP website – www.armagh.space.

Related party transactions are shown in note 23 of the accounts.

Gifts

AOP adheres to the limits and rules laid out in its Management Statement approved by the Department and the guidance in Managing Public Money Northern Ireland (MPMNI). There were no gifts made or accepted during the 2022-23 financial year that exceeded these limits.

Personal data related incidents

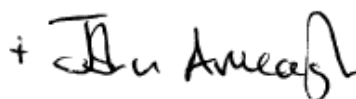
AOP has considered the requirement to report personal data related incidents. It is content that there were no such incidents in the year ended 31 March 2023.

Disclosure of Audit Information

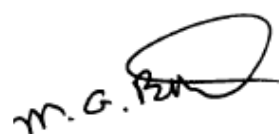
So far as the Accounting Officer is aware, there is no relevant audit information of which AOP's auditors are unaware. The Accounting Officer has taken all necessary steps to make himself aware of any relevant audit information and to establish that AOP's auditors are aware of that information.

Events after the end of the reporting period

There have been no events since the end of the financial year requiring disclosure.



Archbishop John McDowell
Chair of the Board of Trustees
Date: 2 October 2023



Professor Michael Burton
Director
Date: 2 October 2023

Remuneration and Staff Report

The remuneration and staff report sets out AOP's remuneration policy for Board members and senior managers, reports on how that policy has been implemented and sets out the amounts awarded to the Director. In addition, the report provides details on remuneration and staff that users see as key to accountability.

Remuneration Policy

The pay remit for the Northern Ireland (NI) public sector, including senior civil servants (SCS) in the NICS, is normally approved by the Minister of Finance. In the absence of a functioning Executive, the 2022-23 NI public sector pay award was announced by the Permanent Secretary, Department of Finance in April 2023.

Annual AOP pay awards are made in the context of the wider Northern Ireland public sector pay policy. The pay awards for 2022-23 were paid in May 2023. The pay of staff (other than post-doctoral research assistants who are paid in accordance with academic scales in use by Queens University, Belfast) is based on a system of pay scales for each grade, including SCS, containing a number of pay points from minimum to maximum, allowing progression towards the maximum based on performance.

Board Members

Board members do not receive any remuneration. They receive travel and subsistence allowances at rates and on conditions determined by AOP, subject to Departmental approval. No Board member receives pension benefits or makes pension contributions in their capacity as a Board member.

Service Contracts

The Director of AOP, Professor Michael G. Burton, is the person in a senior position having authority and responsibility for directing and controlling the activities of the organisation. The service contract of the Director commenced on 1 August 2016.

Current terms and conditions for staff are those set out in various policies and individual employment contracts. Senior staff are permanent employees of AOP. The notice period for senior staff is three months. Termination payments are in accordance with contractual terms and those of the principal Civil Service Pension Scheme (NI).

Director's Remuneration (including Salary and Pension Entitlements) (Audited Information)

The following tables provide details of the remuneration and pension entitlements of the Director of the organisation.

Single Total Figure of Remuneration of Director							
	Salary (£'000)		Pension Benefits* (£'000)		Total (£'000)		Percentage Change
Official	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	
M.G. Burton	80-85	85-90	14	23	95-100	105-110	(9.7%)

**The value of pension benefits accrued during the year is calculated as (the real increase in pension multiplied by 20) plus (the real increase in any lump sum) less (the contributions made by the individual). The real increases exclude increases due to inflation and any increase or decrease due to a transfer of pension rights.*

'Salary' includes gross salary to the extent that it is subject to UK taxation. There was no overtime, benefit-in-kind, bonus or other allowances. The salary of the Director shown above is based on the Northern Ireland Senior Civil Service Grade 5 pay scale.

Compensation on early retirement or for loss of office

No payment for compensation on early retirement or for loss of office has been made (2021-22: £nil).

AOP Fair Pay Disclosures

AOP is required to disclose the relationship between the remuneration of the Director and the lower quartile, median and upper quartile remuneration of the organisation's workforce. The banded remuneration of the Director in the financial year 2022-23 was £80,000 - £85,000 (2021-22: £85,000 - £90,000). The relationship between the mid-point of this band and the remuneration of AOP's workforce is disclosed below.

2022-23	25th percentile	Median	75th percentile
Total remuneration	£18,783	£29,731	£37,373
Pay ratio	4.4:1	2.8:1	2.2:1

2021-22	25th percentile	Median	75th percentile
Total remuneration	£18,783	£29,307	£39,324
Pay ratio	4.7:1	3.0:1	2.2:1

Total remuneration includes salary, overtime and performance related bonuses. It does not include severance payments, employer pension contributions and the cash equivalent transfer value of pensions. Remuneration ranged from £18,783 to £82,500.

The percentage changes in respect of AOP are shown in the following table. It should be noted that the calculation for the Director is based on the mid-point of the band within which their remuneration fell in each year.

Percentage change for:	2022-23 v 2021-22	2021-22 v 2020-21
Average employee salary and allowances	2.4%	-2.9%
Director's salary and allowances	-5.7%	6.1%
Average employee performance pay and bonuses	14.9%	-24.0%

No performance pay or bonus was payable to the Director in these years.

Pension Entitlements (Audited Information)

Official	Accrued pension at pension age as at 31/03/23	Real increase in pension at pension age	Accrued Lump Sum at 31/03/23	Real Increase in Lump Sum	CETV at 31/03/23	CETV at 31/03/22	Real Increase in CETV
	£'000	£'000	£'000	£'000	£'000	£'000	£'000
M.G. Burton	12	1	-	-	179	144	13

The CETVs above have been calculated in accordance with guidance from the Department of Finance in Employer Pension Notice EPN 12-2022. When calculating the real increase in CETV and the pension benefits accrued during the year 2022-23 for the single total figure of remuneration, NILGOSC takes account of inflation. The CPI increase for September 2022 was 10.1%. The in-service revaluation rate for the Career Average Revalued Earnings Scheme was also 10.1%.

Pension Scheme

Pension benefits are provided through the Northern Ireland Local Government Officers' Superannuation Committee Pension Scheme (NILGOSC). Retirement pension will be based on 1/49th of salary paid in year and pension is based on career average earnings. Details can be obtained at <http://www.nilgosc.org.uk>.

Active members of the pension scheme will receive an Annual Benefit Statement. The accrued pension quoted is the pension the member is entitled to receive when they reach their scheme pension age, or immediately on ceasing to be an active member of the scheme if they are at or over pension age.

Employee contribution rates for all members for the period covering 1 April 2022 to 31 March 2023 are as follows:

Pensionable Pay	Contribution Rate
£0 to £15,400	5.5%
£15,401 to £23,700	5.8%
£23,701 to £39,500	6.5%
£39,501 to £48,000	6.8%
£48,001 to £95,100	8.5%
More than £95,100	10.5%

Employer contribution rates are determined by the Scheme's actuary every three years. Following the results of the 2022 actuarial valuation, the Committee agreed with its actuary the employer contributions and deficit recovery contributions for the following three years, effective from 1 April 2023. The next valuation is due as at 31 March 2025.

Cash Equivalent Transfer Values

A Cash Equivalent Transfer Value (CETV) is the actuarially assessed capitalised value of the pension scheme benefits accrued by a member at a particular point in time. The benefits valued are the member's accrued benefits and any contingent spouse's pension payable from the scheme. A CETV is a payment made by a pension scheme or arrangement to secure pension benefits in another pension scheme or arrangement when the member leaves a scheme and chooses to transfer the benefits accrued in their former scheme. The pension figures shown relate to the benefits that the individual has accrued as a consequence of their total membership of the pension scheme, not just their service in a senior capacity to which disclosure applies. The CETV figures include the value of any pension benefit in another scheme or arrangement which the individual has transferred to the NICS pension arrangements. They also include any additional pension benefit accrued to the member as a result of their purchasing additional years of pension service in the scheme at their own cost. CETVs are calculated in accordance with The Occupational Pension Schemes (Transfer Values) (Amendment) Regulations 2015 and do not take account of any actual or potential benefits resulting from Lifetime Allowance Tax which may be due when pension benefits are taken.

Real increase in CETV

This reflects the increase in CETV effectively funded by the employer. It does not include the increase in accrued pension due to inflation, contributions paid by the employee (including the value of any benefits transferred from another pension scheme or arrangement) and uses common market valuation factors for the start and end of the period. However, the real increase calculation uses common actuarial factors at the start and end of the period so that it disregards the effect of any changes in factors and focuses only on the increase that is funded by the employer.

Total Permanently Employed Staff Costs (Audited Information)

	Permanent staff £	Others ¹ £	2022-23 £	2021-22 £
Wages and salaries	1,172,056	169,562	1,341,618	1,298,400
Social security costs	125,302	16,806	142,108	132,074
Employer's pension contributions	218,849	31,956	250,805	238,763
Defined benefit pension additional service cost	327,000	-	327,000	376,000
	1,843,207	218,324	2,061,531	2,045,237

¹ "Others" includes £13,501 for agency staff

Average staff numbers (Audited Information)

	Permanent staff	Others ²	2022-23 Total Number	2021-22 Total Number
Average staff numbers	27.4	7.9	35.3	34.9

² "Others" includes 5.4 fixed term, 2.2 casuals and 0.3 agency staff

Staff Composition – permanent employees (full time equivalent)

	Male	Female
Directors/senior managers	2.6	2.0
Other employees	8.9	13.9

Staff Turnover

	2022-23	2021-22
Leavers as a percentage of average staff in post	3.1%	8.9%

Sickness Absence (Audited Information)

Staff sickness for the period 1 April 2021 to 31 March 2023 totalled 126 days (2022: 101 days) which equates to an average per FTE of 1.66% (2022: 1.37%).

Expenditure on External Consultancy (Audited Information)

Expenditure on external consultancy during the year was £nil (2021-22: £nil).

Off-payroll Engagements (Audited Information)

There were no “off-payroll” engagements in place as at 31 March 2023, nor were any arrangements entered into between 1 April 2022 and 31 March 2023.

Exit Packages (Audited Information)

Exit package cost band	No of compulsory redundancies	No of other departures agreed	Total no. of exit packages by cost band	Total no. of exit packages by cost band
	2022-23	2022-23	2022-23	2021-22
Total no. of exit packages	-	-	-	-
Total resource cost	Nil	Nil	Nil	Nil

Statement of the Responsibilities of the Governors and Accounting Officer

Under the Audit and Accountability (Northern Ireland) Order 2003, the Governors are responsible for preparing for each financial year and for preparing a statement of accounts in the form and on the basis set out as the Department for Communities, with the approval of the Department of Finance, shall direct. The accounts are prepared on an accruals basis and must give a true and fair view of the state of affairs of AOP and of its income and expenditure, Statement of Financial Activities and cash flows for the financial year.

In preparing the accounts, the Accounting Officer is required to comply with the requirements of the Government Financial Reporting Manual and in particular to:

- observe the accounts direction issued by the Department of Finance, including the relevant accounting and disclosure requirements, and apply suitable accounting policies on a consistent basis;
- make judgements and estimates on a reasonable basis;
- state whether applicable accounting standards as set out in the Government Financial Reporting Manual have been followed, and disclose and explain any material departures in the accounts;
- prepare the accounts on a going concern basis; and
- confirm that the Annual Report and Accounts as a whole is fair, balanced and understandable and take personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

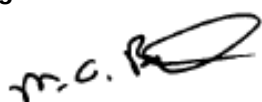
The Department for Communities has appointed Professor M.G. Burton as Accounting Officer of AOP. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding AOP's assets, are set out in Managing Public Money Northern Ireland.

Statement of Disclosure of Information to the Auditors

So far as the Accounting Officer of Armagh Observatory and Planetarium, in office at the date of the approval of these financial statements, is aware:

- there is no relevant audit information relating to these respective charitable organisations of which the auditors are unaware;
- he has taken all the steps that he ought to have taken as Accounting Officer in order to make himself aware of any relevant audit information relating to these charitable organisations and to establish that the auditors are aware of that information;
- he confirms that the Annual Report and Accounts as a whole is fair, balanced and understandable; and
- he confirms that he takes personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

Signed:



Professor Michael Burton
Accounting Officer for Armagh Observatory and Planetarium

Date: 2 October 2023

Governance Statement

AOP is a Non-Departmental Public Body established under The Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

1. Compliance with Corporate Governance Code

In 2013 the Department of Finance and Personnel published Corporate Governance in Central Government Departments: Code of Good Practice NI. The Code draws on best practice in the public, private and charity sectors by: reinforcing the importance of corporate governance as a pre-requisite to achieving good financial management; reflecting changes in governance best practice, including increased emphasis on good leadership; and promoting better governance arrangements within departmental families.

The Code is written for departments, concentrating throughout on key principles which will have wider application for other parts of the public sector. Such bodies (including arms-length bodies (ALBs)) are encouraged to consider and adopt the practices set out in the Code wherever it is relevant and practical and suits their business needs.

AOP in so far as they are relevant for an arms-length body, complies with the principles of good practice in the Corporate Governance Code.

2. Governance Framework

Accounting Officer

Name	Accounting Officer
Professor Michael Burton – Director and Chief Executive	From 1 September 2016 onwards

Board of Governors

AOP is governed by a Board of Governors. Membership of the Board of Governors consists of:

- the Church of Ireland Archbishop of Armagh;
- the Dean of the Church of Ireland Cathedral of Armagh;
- the other members of the Chapter of the Church of Ireland Cathedral of Armagh;
- one DfC nominee;
- one Queen's University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

During 2022-23 two Members of the Chapter of the Church of Ireland Cathedral of Armagh retired. Revd Canon M Hagan was appointed in 2023-24 to one of these positions and the second currently remains vacant.

BOARD OF GOVERNORS			
GOVERNOR	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 1)
Archbishop J McDowell (Chair)	28 April 2020	None	1
The Dean Very Revd S Forster	14 February 2021	None	1
The Venerable Archdeacon T Scott	9 November 2006	30 January 2023 (Retired)	1
The Venerable Archdeacon E Cairns	13 December 2020	None	0
The Venerable Archdeacon Dr P Thompson	13 January 2019	None	0
Revd Canon W M Adair	10 September 2008	None	0
Revd Canon W J A Dawson	1998	None	0
Revd Canon M Hagan	From 23 April 2023	None	0
Revd Canon D Hilliard	13 March 2016	None	1
Revd Canon J Moore	13 March 2016	22 February 2023 (Retired)	1
Revd Canon W B Paine	7 May 2017	None	0
Revd Canon R J N Porteus	1998	None	0
Professor A Fitzsimmons	18 April 2019	1 May 2024	0
Mr R Wilson	1 December 2019	30 November 2024	1
Archbishop E Martin	1 January 2021	31 December 2025	1
Ms S Leslie	From 1 June 2021	31 May 2026	1
Mr G Cox	1 March 2021	28 February 2026	1

At the annual meeting on 26 April 2022, the Board of Governors endorsed the continuing membership of Revd Canon Adair, Mr Cox and Mr Wilson as its nominees on the Management Committee and agreed to extend the Chair of the Management Committee's appointment for a further 5 year term.

The Board received an update on a confidential land matter; the appointment of a Management Committee Sub-Group relating to the matter and established the parameters for convening a Special Meeting.

The Board formally resolved to change the registered charity name and to delegate the role of Trustee to the members of the Management Committee, once the process of name change had been concluded.

The Board approved the draft Partnership Agreement with DfC and delegated authority to the Chair to sign it and to the Management Committee to approve the necessary changes required as a result of its implementation. It also granted the Management Committee authority to delegate some of its activities to its Sub-Committees and to approve the necessary changes required to Terms of Reference as a result.

The Board reviewed a written report from the Chair of the Management Committee and the minutes from the Management Committee and the Audit and Risk Assurance Committee meetings between June 2022 and March 2023 (draft).

The Board formally retrospectively approved the Annual Report and Accounts 2020-21 and approved the 2021-22 draft Annual Report and Accounts, subject to minor amendments and delegated authority to the Management Committee to approve the accounts and to the Archbishop to sign them off on its behalf when completed. The Board noted the Management Report for 2021-22 which included the Director's Report, Corporate Plan Objectives, Key Performance Indicators and the Risk Register as at April 2022.

The Board approved the draft 2022-23 Business Plan.

The Board is satisfied that comprehensive arrangements are in place to ensure that high-quality information is received to enable it to make informed decisions. Internal controls are in place to validate the accuracy and completeness of information presented to the Board.

Management Committee of Armagh Observatory and Planetarium

There were no changes to the Management Committee membership during 2022-23. The term of appointment for the Chair of the Management Committee was extended for a further 5 years and the term of appointment for both Professor Harra and Mr Brown extended by one year, from 30 April 2023 to 30 April 2024. Mr McGurgan's term of appointment ended on 30 April 2023, leaving one public appointment vacancy which will not be filled until March 2024.

MANAGEMENT COMMITTEE			
MEMBER	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 4)
Mr J Briggs (Chair)	1 January 2018	31 December 2027	4
Professor L Harra	1 November 2014	30 April 2024	3
Mr S Brown	1 November 2014	30 April 2024	3
Mr P McGurgan (to 30 April 2023)	1 November 2014	To 30 April 2023	1
Professor M Mathioudakis	11 November 2016	10 November 2026	3
Mr R Wilson	1 December 2019	30 November 2024	2
Dr C Jackman	1 January 2021	31 December 2025	2
Dr M Darnley	1 January 2021	31 December 2025	2
Mr P Kennedy	1 March 2021	28 February 2026	3
Dr K Lemon	1 March 2021	28 February 2026	4
Mr E Rooney	1 March 2021	28 February 2026	4
Mr G Cox	19 May 2021	18 May 2026	3
Rev Canon W M Adair	15 September 2021	14 September 2026	0
VACANT (from 1 May 2023)			

During 2022-23 the Management Committee considered a wide range of business. The Management Committee held their first full in-person meeting in June 2022, which was the first such meeting for over two years.

In June 2022 the Management Committee reviewed AOP's draft Operating Framework, an operational document developed as part of the Partnership Agreement. Coinciding with the June meeting, a number of engagement activities were held over a two-day period.

At its October 2022 meeting the Management Committee noted that the 2022-23 Business Plan had been approved by Minister Deirdre Hargey MLA on 23 September 2022.

A 'task and finish' working group to consider issues arising from the Management Committee Effectiveness review was established in June 2022. It met in August and November 2022 and in December 2022 the Management Committee approved its recommendations to approve a Policy Approval Process Paper, and implementation of its recommendations, and to establish a principle for meeting dates for 2024 and beyond.

In December 2022 the Committee agreed to further engagement with the Charity Commission in relation to a proposed name change to the Registered Charity.

A Special Meeting of the Management Committee took place in March 2023 to consider a draft Outline Business Case for AOP's redevelopment project, prior to consideration by the Board of Governors.

At each of its meetings throughout the year the Committee received a report from the Director, updates from its sub-committees and approved relevant reports. Regular governance reports such as the Bi-Annual Assurance Statement, the Risk Register, Key Performance Indicators and Finance monitoring reports were reviewed and approved. The Committee considered and noted amendments to policies that had been reviewed in line with the policy review process and approved new policies as appropriate.

During the year the Armagh Leisure Village Development Proposal was withdrawn and the Management Committee's attention was re-focused on AOP's Vision and redevelopment. The Committee received regular updates on progress from its Redevelopment Sub-Committee.

Internal controls are in place to validate the accuracy and completeness of information presented to the Management Committee.

Audit and Risk Assurance Committee

The Audit and Risk Assurance Committee is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

AUDIT AND RISK ASSURANCE COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 3)
Mr S Brown Chair (from June 2021)	2
Professor L Harra	3
Mr P Kennedy	2
Dr K Lemon (from 4 May 2023)	0
Mr P McGurgan (to 30 April 2023)	1
Mr E Rooney	3

During 2022-23 the Audit and Risk Assurance Committee considered reports from Internal Audit on progress against the audit plan and progress on outstanding recommendations; reports from external audits on the 2021-22 Annual Report and Accounts; the 2022-23 external audit strategy; review of the Accounting Officer's Assurance Statement and review of the Risk Register. Throughout the year particular attention was given to ICT related risks, including data and cyber security.

The Committee is satisfied that the integrated approach, the frequency of meetings, the breadth of the business undertaken, the skills of Members and the range of attendees at meetings of the Committee has allowed the Committee to meet the governance requirements of the organisation and assisted the Management Committee to demonstrate its stewardship of the public resources with which it is charged.

The Committee is satisfied that the organisation has robust risk management arrangements in place which are in line with the good practice in the HM Treasury 'Orange Book' and are reviewed regularly by the Management Committee.

There were 6 Internal Audit recommendations from prior years outstanding, 5 of which have been completed. The Committee is satisfied that the remaining outstanding recommendation has been implemented by AOP as far as possible, but that its completion is beyond AOP's control. There were 11 new internal audit recommendations in 2022-23, of which 3 remain outstanding, having not reached the date of implementation during the financial year.

Staffing Policy and Remuneration Committee

The Staffing Policy and Remuneration Committee's membership is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

STAFFING POLICY AND REMUNERATION COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 4)
Mr E Rooney (Chair)	4
Mr S Brown	3
Mr J Briggs	4
Dr K Lemon	4
M P Kennedy	3

In 2022-23, amongst other matters, the Committee considered:

- staffing and recruitment, including Skills Gaps Analysis and Strategic Workforce Planning;
- staff related policies, including new Hybrid Working and Volunteer Policies;
- staff survey and engagement; and
- updates on a range of Human Resources issues including progress against the Human Resources Strategy and Action Plan.

AOP's application for the Diversity Mark (Bronze Award) was successful.

Research and Education Advisory Committee

The Research and Education Advisory Committee's membership is drawn from the Management Committee and comprises a minimum of four and maximum of five members.

RESEARCH AND EDUCATION ADVISORY COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 3)
Prof L Harra (Chair)	3
Prof M Darnley	3
Dr K Lemon	3
Prof M Mathioudakis	2

In 2022-23, amongst other matters, the Committee considered:

- education and outreach;
- concordat to support the career development of researchers;
- Research Excellence Framework (REF);
- funding opportunities; and
- new STFC Consolidated Grants.

Redevelopment Sub-Committee

The Redevelopment Sub-Committee's membership is drawn from the Management Committee and comprises of six members.

REDEVELOPMENT SUB-COMMITTEE	
MEMBER	MEETINGS ATTENDED (max. 11)
Mr S Brown (Chair)	11
Mr J Briggs	5
Mr G Cox	4
Mr P Kennedy	9
Dr K Lemon	4
Mr E Rooney	10

The primary purpose of the Sub-Committee was to drive the 'Development of AOP Science and Education Park' Project forward, and oversee the delivery of the outcomes and benefits, most notably initially an Outline Business Case (OBC) by March 2023. In doing so, its primary functions included:

- Providing leadership and direction - championing the project as appropriate within AOP and with stakeholders, and supporting the SRO.
- Taking decisions – members must have the authority to take / recommend decisions to the SRO
- Challenging and scrutiny - all aspects of Project and project delivery.

It was a very ambitious and challenging timetable and there was a little slippage in the completion of the OBC.

This is a 'task and finish' sub-committee which will continue until the OBC is approved, following which appropriate governance for the next stage of the project will be considered.

Conflicts of Interest

The organisation maintains a register of interests to ensure that potential conflicts of interest can be identified and addressed in advance of Board, Management Committee and other Committee discussions. The register is formally revisited on an annual basis. Where conflicts exist, they are recorded in the Committee minutes and the Chair of the meeting decides the most appropriate way of managing the conflict. This may include that member not taking part in discussions or making decisions on certain matters or being excluded for part or all of that meeting.

The Register of Interests for Board of Governors, Management Committee and senior staff is published on the AOP website in accordance with central government guidance.

Directors and Secretary

Professor Michael Burton, Director and Accounting Officer.

The Corporate Manager provides a range of secretarial support services to the Board of Governors, Management Committee and Audit and Risk Assurance Committee, the HR and Policy Officer provides secretarial support to the Staffing Policy and Remuneration Committee and the Executive Officer to the Research and Education Advisory Committee.

3. Business Planning and Risk Management

Business Planning

'Our mission is the pursuit of knowledge and understanding of the cosmos, and the sharing of that knowledge in order to inspire future generations and enrich the intellectual, economic, social and cultural life of all.'

'Our vision is to be recognised as an international centre of scientific excellence for the pursuit of astronomy and the public understanding of science, for our capacity for innovation and our extraordinary heritage, a place our community can be proud of.'

The pillars that support us are – Knowledge, Legacy, People and Engagement.

The five year strategy is built around four strategic themes - Enduring Relevance, National and International Standing, Offering More and Pursuing our Priorities.

The Strategic Plan aligns closely with the aims and objectives of AOP's sponsor branch, the Department for Communities, and with the broader aims and objectives of the Northern Ireland Executive's Programme for Government. The organisation's Strategic Plan 2021-26 received Departmental approval on 17 August 2021.

The work of the Observatory encompasses both internationally acclaimed research and a unique cultural heritage - scientific, historical, architectural - as well as maintaining the unique daily climate series (the longest daily series from a single site in the UK and Ireland) and undertaking a world-class programme of science in the community, which complements the Planetarium's main business of education.

The Planetarium's main business is education, and all age and social groups are welcome to visit. The educational programmes and demonstrations are designed to include participation by children of pre-nursery age up to senior citizens and all age groups in between. The primary educational aim of the Planetarium is to endorse and promote the Science, Technology, Engineering, Arts and Mathematics (STEAM) agenda which promotes scientific careers to young people. All of the ancillary activities support the primary aim, with the additional target of offering excellent value for money, both to the visitors taking part and to the public purse. The Planetarium maintains a focus on being inclusive so that all children can enjoy the Planetarium experience.

Full details of all AOP's activities are provided in comprehensive Annual Reports which are available online at: www.armagh.space

No Ministerial Directions have been issued regarding the work of AOP.

Risk Management

Risk Management is an essential element of AOP's corporate governance framework and is closely linked to the system of internal control and business planning process. A robust risk management process assists AOP in identifying and managing issues which may hinder the achievement of objectives. The arrangements are regularly reviewed.

As well as ensuring that there is an effective system in place to deal with threats to AOP's aims and objectives, the organisation encourages a proactive approach to innovation and well-managed risk taking where there is potential to realise sustainable improvements in the organisation's research and educational services. For this reason, the organisation's Risk Appetite is 'Open'.

The Management Committee sets the risk appetite for AOP. The Accounting Officer, Senior Management Team and other staff are responsible for ensuring that residual risks are reduced to a level as low as reasonably practicable and wherever possible consistent with the level of risk appetite established by the Management Committee.

Updates are provided to the Audit and Risk Assurance Committee on the development and implementation of the risk management process across AOP. The Audit and Risk Assurance Committee provides the Accounting Officer with objective advice on issues concerning the risk, control and governance of the organisation and the associated assurances. An update on the main points considered by the Audit and Risk Assurance Committee is provided to the Management Committee following each meeting and the Management Committee has access to all papers for the Audit and Risk Assurance Committee.

4. Fraud and Information Risk

The Accounting Officer has overall responsibility for managing the risk of fraud including:

- developing a fraud risk profile and undertaking a regular review of the fraud risks associated with each of the key organisational objectives in order to keep the profile current;
- establishing an effective fraud prevention policy and fraud response plan, commensurate with the level of fraud risk identified in the fraud risk profile;
- designing an effective control environment to prevent fraud commensurate with the fraud risk profile;
- operating appropriate pre-employment screening measures;
- establishing appropriate mechanisms for reporting fraud risk issues, reporting significant incidents of fraud, and coordinating assurances about the effectiveness of fraud prevention policies to support the Governance Statement;
- liaising with the Audit and Risk Assurance Committee;
- ensuring that all staff are aware of the organisation's fraud prevention policy and know what their responsibilities are in relation to combating fraud;
- ensuring fraud awareness training is provided as appropriate and, if necessary, more specific fraud prevention training and development is provided to relevant staff;
- ensuring that vigorous and prompt investigations are carried out if fraud occurs, is attempted or is suspected by the establishment of a Fraud Investigation Oversight Group;
- ensuring, where appropriate, legal and/or disciplinary action against perpetrators of fraud;
- ensuring, where appropriate, disciplinary action against supervisors where supervisory failures have contributed to the commission of fraud;
- ensuring, where appropriate, disciplinary action against staff who fail to report fraud;
- taking appropriate action to recover assets and losses;
- ensuring that appropriate action is taken to minimise the risk of similar frauds occurring in future; and
- ensuring that an anti-fraud culture is promoted throughout the organisation in line with the seven Nolan Principles of Public Life.

Risks to data and information held by the organisation are owned and managed by individuals designated as information asset owners. The Executive Officer responds to requests for information under the Data Protection and Freedom of Information Acts following consultation with the Accounting Officer and the organisation's governing committees, as appropriate.

AOP operates a Raising a Concern (Whistleblowing) Policy which informs all members of the organisation of the standards of behaviour expected of them in carrying out their duties, and to provide information on the procedures to follow if a situation arises in which they are required to act in a way which is believed by them to be illegal, improper, or in breach of the Nolan Principles.

5. Governance and Accountability

AOP seeks to achieve excellence in good governance, in particular the precepts: (1) leadership; (2) effectiveness; (3) accountability and (4) sustainability.

The Chair of the Board of Governors has a particular leadership responsibility for securing the sustainability and vitality of the organisation in the long term; giving advice and direction in formulating AOP's forward look and overall strategy; ensuring that account is taken of guidance provided by the Minister or the Department; promoting the efficient and effective use of staff and other resources; encouraging high standards of probity amongst staff and Board and committee members alike; and ensuring that the Board and its committees meet at regular intervals throughout the year and that the Minutes of meetings accurately record the decisions taken and, where appropriate, the views of individual Board members.

Within AOP, leadership is exercised by the Director and his Senior Management Team who are responsible for the management and effective operation of their organisation. Their operational responsibilities include:

- developing, implementing and monitoring the strategic and operational plans;
- undertaking financial management and Accounting Officer responsibilities;
- managing and developing a team of highly qualified professional and administrative staff;
- identifying and attracting sources of external income;
- promoting their respective organisations in relevant local, national and international arenas; and
- promoting Public Understanding of Science with the objective of improving the level of scientific literacy in the community and to ensure a strong link with government policy and the STEM agenda.

Members of the Board of Governors and of the Management Committee and their various sub-committees exercise an effective challenge function on the leadership team in accord with their respective roles in the organisation. They also provide guidance and advice on strategic and operational matters such as Human Resource issues, accountability and relationships with stakeholders.

The members of these committees are drawn from a wide community background within, and beyond, Northern Ireland, and provide the organisation with a correspondingly wide range of expert knowledge and advice. All the committees of AOP operate with full transparency and accountability, and over the last year have proved effective in the discharge of their duties and responsibilities.

It was agreed by the Board of Governors and the Management Committee that the governance arrangements in place, in line with guidance, removed the need for the current Board of Governors to complete an internal self-assessment of its effectiveness.

The Board of Governors and supporting Committees receive assurances from the Director and his Senior Management Team and Internal Audit that the governance and accountability processes are being managed effectively.

6. Sources of Independent Assurance

Internal Audit

CavanaghKelly was appointed as Internal Auditors for the 3 years 2020-21 to 2022-23. Their work was carried out in accordance with the Public Sector Internal Audit Standards.

During the year, the Audit and Risk Assurance Committee considered reports on the following areas:

Audit Assignment	Assurance Rating
Education and Community Outreach	Satisfactory
HR, including performance management	Satisfactory
Purchasing and Procurement	Satisfactory
Internal Audit Follow Up 2022-23	N/A

An overall 'satisfactory' internal audit assurance opinion has been provided.

Of the new issues identified by internal audit during 2022-23 there were no priority one issues.

The Internal Audit Charter; Internal Audit Strategy 2023-2026 and Annual Internal Audit Plan 2023-24 will be considered at a future meeting when the new internal audit contract has been awarded.

External Audit

The Comptroller and Auditor General (C&AG) is required to audit the financial statements under *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. The C&AG is responsible for reporting whether in their opinion the financial statements give a true and fair view of the state of the Armagh Observatory and Planetarium's affairs and of its income and expenditure, and whether they and the part of the Remuneration Report to be audited have been properly prepared in accordance with *The Armagh Observatory and Planetarium (Northern Ireland) Order*

1995 and DfC directions made thereunder. The C&AG is required to report whether, in her opinion, in light of the knowledge and understanding of AOP and its environment obtained in the course of the audit, she has identified any material misstatements in the Trustees' Annual Report and whether the information which comprises the Statement of the Responsibilities of the Governors and Accounting Officers and Governance Statement, as included within the Annual Report, is consistent with the financial statements. She also reports on whether, in her opinion, in all material respects, the expenditure and income presented in the financial statements have been applied to the purposes intended by the Assembly and whether the financial transactions conform to the authorities which govern them.

A representative from the Northern Ireland Audit Office is invited to all Audit and Risk Assurance Committee meetings.

7. Review of the Effectiveness of the System of Internal Governance

The system of internal governance is designed to manage risk to a reasonable level, rather than to eliminate all risk of failure to achieve certain policies, aims and objectives; it can therefore only provide reasonable and not absolute assurance of effectiveness. The system of internal governance is based on an ongoing process designed to identify and prioritise risks to the achievement of the AOP policies, aims and objectives; to assess the likelihood of the events occurring and the impact should they be realised; and to manage the risks effectively, efficiently and economically. The system of internal governance has been in place in AOP for the year ended 31 March 2023 and up to the date of approval of the annual accounts, and accords with Department of Finance guidance.

As previously detailed in Section 2, the responsibilities of the Accounting Officer include the need to maintain a sound system of internal control which supports the achievement of the organisation's policies, aims and objectives. The review of the effectiveness of the system of internal governance has been informed by the assurances provided by relevant parties such as: Internal Audit and the Senior Management Team. Where weaknesses have been identified these have been promptly drawn, through normal reporting mechanisms, to the attention of the Audit and Risk Assurance Committee, Management Committee and/or Board of Governors, as appropriate.

The main procedures in place to monitor the effectiveness of the system of internal governance are as follows:

- ongoing independent assessment of the Observatory's research outputs;
- regular reports by financial staff on progress against principal financial targets and the projected financial outcome for the year and progress reports by staff responsible for major projects;
- detailed progress reports to the Management Committee and Board of Governors at their regular meetings and inclusion of performance measures and results against targets in the annual operating plan;
- annual reports on the system of internal control from internal auditors to the Audit and Risk Assurance Committee;
- regular Accountability meetings with officials from the Sponsor Department to consider operational and strategic issues and matters relating to the system of internal control;
- Bi-Annual Assurance Statements submitted to the Sponsor Department;
- periodic review of the AOP Risk Register by the Audit and Risk Assurance Committee, the Management Committee, the Accounting Officer and Senior Management Team and the Sponsor Department;
- continuous assessment of the quality of research through peer review of grant applications, applications for telescope time, and the submission of scientific papers to academic journals of international standing by Armagh Observatory staff;
- peer review of the research quality, capability and output of the Observatory, and through participation in an objective external Assurance Committee, which provide an opinion on the adequacy and effectiveness of the system and contain recommendations for improvement; and
- annual reports from Northern Ireland Audit Office to the Audit and Risk Assurance Committee, the Management Committee and the Board of Governors on the annual accounts, providing an opinion on the state of affairs of the organisation and its total incoming resources and expenditure of resources.

All reports based on the internal and external audits include opinions on the adequacy and effectiveness of risk management and the control framework in place. These matters are considered by the Audit and Risk Assurance Committee and are reported by the Audit and Risk Assurance Committee Chair to the Management Committee and the Board of Governors.

Weaknesses identified in AOP's control systems and internal governance are set out within the next section. Upon identification, plans were immediately put into place to address these issues.

8. Internal Governance Divergences

There is currently one outstanding internal audit recommendation from prior years, which has been partially implemented:

Recommendation	Priority	Status
GDPR – the draft Records Management Policy and Retention and Disposal Schedules should be finalised as soon as possible.	Medium	Draft policy and schedules with PRONI for consideration. Completion pending confirmation by PRONI.

During its audit for 2022-23, NIAO identified three priority 1 issues to be addressed by management in their areas of responsibility, with recommendations as follows:

- (i) Recommended that AOP seek to put in place an appropriate contract arrangement to cover the cloud services being provided by Microsoft Azure beyond the 2023-24 year close.

Management Response:

AOP are named on the NICS collaborative agreement ID 3095831 Collaborative Call Off Contract for Microsoft Licensing Solutions Partner (LSP). With the assistance of the contractor, AOP is actively progressing the transfer of Microsoft Azure services to the Collaborative Contract, with an expected completion no later than 31 October 2023. No material cost savings are anticipated through use of the Collaborative Contract.

- (ii) Recommended AOP seek to put measures in place to ensure that appropriate checks on expenditure and purchase orders are carried out to ascertain whether or not a contract is in place for the services required, so that appropriate approval can be sought either through the normal procurement process or a Direct Award Contract (if required) before any expenditure is incurred.

Management Response:

With immediate effect, AOP will intensify its financial procedures relating to procurement of goods and services valued in the range of £5,000-£30,000 to ensure that Financial Policies are complied with. Additional training will be provided for staff.

- (iii) Recommended that AOP only drawdown funds as they are needed and seek departmental approval if this is not going to be the case.

Management Response:

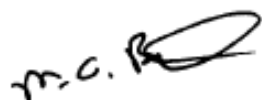
When dome shows are purchased at year end, it is inevitable that they will not be used until the new financial year. In this instance, an opportunity was taken to delay the first showing in order to extend the end date of the license. AOP will ensure such extension does not occur in future if it will breach drawdown rules.

9. Conclusion

Armagh Observatory and Planetarium has an effective governance structure and is operating to a high standard of integrity and probity.

In signing this report, I have taken assurances, where available, from the Audit and Risk Assurance Committee and I will continue to monitor the Internal Audit and Northern Ireland Audit Office recommendations to ensure that all issues are appropriately addressed.

To the best of my knowledge this report provides a fair and accurate reflection of the business of AOP and of the status of the controls and checks that have been put in place to regulate and inform the organisation's committees.



Signed:

Date: 2 October 2023

Professor Michael Burton
Accounting Officer
Armagh Observatory and Planetarium

Refereed Journal Publications: April 2022– March 2023

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Presentations: April 2022 – March 2023

Date	AOP Speaker	Title	Location/Mode	Category
05 Apr 2022	S. Bagnulo	Introduction to Polarimetry	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
06 Apr 2022	D. Eden	What Causes Stars to Form?	Seminar, Astrophysics Research Institute, Liverpool John Moores University, Liverpool	Research
07 Apr 2022	M. Sarzi	How to Get Observing Time on the Largest Ground and Space Telescopes in the World	Astrobytes, AOP	Internal Outreach
12 Apr 2022	G. Ramsay	Super-flares on the Sun and Solar Type Stars	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
24 Apr 2022	J. Rigney	Low Mass Stars at Radio Wavelengths	Dunsink Observatory, Dublin Institute for Advanced Studies, Dublin	Outreach
22 Apr 2022	A. Christou	The Three Body Problem in Action: A Guided Tour of the Coorbital Zoo	Seminar, Grupo de Dynamical Orbital e Planetologia (GDOP) - Faculdade de Engenharia de Guaratinguetá, UNESP, Sao Paolo, Brazil (online)	Research
25 Apr 2022	E. Higgins	Constraining Physical Processes in Pre-Supernova Massive Star Evolution	Lorentz Workshop: 'Bridging Stellar Evolution and Feedback Together', Lorentz Center, Leiden, The Netherlands	Research
27 Apr 2022	D. Eden	SKA: Current Status and Pathfinder Science	Astrobytes, AOP	Internal Outreach
28 Apr 2022	H. Dalglish	The Nature of the Night	The Nature of the Night Event, AOP	Outreach
28 Apr 2022	C.S. Jeffery	Guts, Bangs, Branes, Strings and Multiverse	Astrobytes, AOP	Internal Outreach
28 Apr 2022	A. Sander	The Dependencies of Wolf-Rayet-Type Mass-Loss and the Consequences for their Ionizing Feedback	Workshop, Bringing Stellar Evolution and Feedback Together, Lorentz Center, Leiden, The Netherlands	Research
05 May 2022	M. Burton	Our Place in the Cosmos 2/27	Astrobytes, AOP	Internal Outreach
10 May 2022	G. Sabhahit	The Metallicity (in) Dependence of the Humphreys-Davidson Limit	International Astronomical Union Symposium 361, Ballyconnell, Co Cavan, Ireland	Research
11 May 2022	G. Ramsay	What Does An Astronomer Do	Astrobytes, AOP	Internal Outreach
11 May 2022	M. McMahon	The Grounds of Armagh Observatory	Armagh and District History Group Meeting, AOP	Outreach
16 May 2022	C. Duffy	CV in ZTF and Other All Sky Surveys	ZTF Consortium Meeting, University of Warwick, England	Research
17 May 2022	H. Dalglish	Globular Clusters Young and Old	IOP Three Minute Wonder Competition, Royal Institution, London	Outreach
17 May 2022	C.S. Jeffery	Project Sirius: High Performance Computing @ AOP	Discussion Seminar, AOP	Research/AOP Training
19 May 2022	M. Burton	Our Place in the Cosmos 3/27	Astrobytes, AOP	Internal Outreach
19 May 2022	H. Dalglish	Dark Skies	Armagh Place Plan Launch Event, Armagh City Hotel, Armagh	Outreach

19 May 2022	J.S. Vink	Radiative Transfer and Massive Stars	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
23 May 2022	S. Bagnulo	New Insight into the Magnetism of Isolated White Dwarfs	Institute of Astrophysics of Andalusia, Spain	Research
24 May 2022	M. Burton with D. Eden	Our Galaxy – Molecular Clouds and Star Formation	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
24 May 2022	J.S. Vink	Introduction to Massive Stars	The Massive Star Research Group Discussion Meeting, AOP	Research
25 May 2022	H. Dalglish	Rewilding the Night: Dark Skies for People and Planet	Seminar, Queen's University Belfast	Research
26 May 2022	M. Burton	Our Place in the Cosmos 4/27	Astrobytes, AOP	Internal Outreach
09 Jun 2022	S. Bagnulo	A Night at the Telescopes	Astrobytes, AOP	Internal Outreach
13 Jun 2022	A. Christou	High-inclination NEAs as Meteor Stream Parent Bodies	Meteoroids 2022 Virtual Meeting	Research
13 Jun 2022	A. Humpage	Simulating the Evolution of Large, Near-Earth Meteoroid Streams and Their Properties	Meteoroids 2022 Virtual Meeting	Research
13 Jun 2022	C.S. Jeffery	The SALT Survey of Chemically-Peculiar Subdwarfs	sdOB10 - The 10th International Workshop on Hot Subdwarfs and Related Objects, University of Liege, Belgium	Research
13 Jun 2022	L. Scott	The SALT Survey of Helium-Rich Hot Subdwarfs: The Neon-Rich Binary EC20817-4939"	sdOB10 - The 10th International Workshop on Hot Subdwarfs and Related Objects, University of Liege, Belgium	Research
16 Jun 2022	M. Burton	Our Place in the Cosmos 5/27	Astrobytes, AOP	Internal Outreach
17 Jun 2022	M. Burton	"Our Place in the Cosmos" – Behind the Scenes	Seminar Programme, Department for Communities NI (via Zoom)	Outreach
17 Jun 2022	H. Dalglish	Dark Skies in Namibia: Celebrating Stars and Stories	Women in Dark Skies Web Talks, Mayo Dark Sky Park, Ballycroy, Co. Mayo, Ireland	Outreach
20 Jun 2022	M. Burton	Wisdom Begins With Wonder – A Vision for the Armagh Observatory and Planetarium	Stakeholder Event, AOP	Outreach
22 Jun 2022	E. Higgins	Very Massive Stars: Mass Loss Implementation and the Upper Initial Mass"	VFTS Meeting, Heidelberg, Germany	Research
23 Jun 2022	M. Burton	Our Place in the Cosmos 5/27	Astrobytes, AOP	Internal Outreach
28 Jun 2022	H. Dalglish	Light Pollution	House of Lords, London	Policy
28 Jun 2022	E. Wince	Black Holes Where They Shouldn't Be	Seminar, AOP	Research
29 Jun 2022	S. Bagnulo	Comet Polarimetry	Comet Interceptor, EnVisS Workshop (Online)	Research
30 Jun 2022	H. Dalglish	Dark Skies and Climate Action	Dark Skies and Climate Action Workshop, AOP	Outreach
04 Jul 2022	J. Rigney	Searching for Stellar Flares from Low Mass Stars Using ASKAP and TESS	Cool Stars 21, Toulouse, France	Research
11 Jul 2022	K. O. Çubuk	3D Molecular Cloud Distribution in the Southern Galactic Plane	National Astronomy Meeting, University of Warwick, England	Research
13 Jul 2022	C. Duffy	The New Robotic Telescope and Accreting Binaries	National Astronomy Meeting, University of Warwick, England	Research
13 Jul 2022	M. McMahon	Observatory Networking - Professional and Personal Relationships Over Four Centuries	Discovering Collections Discovering Communities (DCDC22) History Day Conference (online)	Outreach

14 Jul 2022	M. Sarzi	Fornax 3D: A Survey of Fornax with MUSE	VEGAS Collaboration Meeting, Naples, Italy	Research
02 Aug 2022	S. Bagnulo	Two (or more) Mechanisms for the Onset of Magnetism in White Dwarfs	Discussion Seminar, AOP	Research/AOP Training
02 Aug 2022	J.S. Vink	X-Shooting ULLYSES	Focus Meeting 4, IAU General Assembly, Busan, Korea (virtual)	Research
04 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
04 Aug 2022	J.G. Doyle	Simultaneous TESS and ASKAP Observations of Low Mass Stars	Solar-Stellar Connections, Flares, and Superflares, International Workshop, hosted by VIRAC, Latvia (online)	Research
04 Aug 2022	G. Ramsay	Super-Flares from Solar-Type and Low Mass Stars	Solar-Stellar Connections, Flares, and Superflares, International Workshop, hosted by VIRAC, Latvia (online)	Research
08 Aug 2022	M. Burton	Ireland's Historic Observatories: Their Intersection with Science, Culture and Politics	Division C (Education, Outreach & Heritage) meeting – via Zoom, IAU General Assembly, Busan, Korea	Research
10 Aug 2022	A. Sander	The Driving of Hot Star Winds	IAU Symposium 370 - Winds of stars and exoplanets, IAU General Assembly, Busan, Korea	Research
10 Aug 2022	J.S. Vink	Theory and Diagnostics of Hot Star Mass Loss	IAU Symposium 370, IAU General Assembly, Busan, Korea (virtual)	Research
11 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
15 Aug 2022	S. Bagnulo	A Volume Limited Spectropolarimetric Survey of White Dwarfs	22nd European Workshop on White Dwarfs, Universität Tübingen, Germany	Research
15 Aug 2022	C.S. Jeffery	Hot White Dwarfs from the SALT Survey of Helium-Rich Hot Subdwarfs	22nd European Workshop on White Dwarfs, Universität Tübingen, Germany	Research
6 Aug 2022	J. Landstreet	Rotation Periods and Surface Magnetic Field Structures of Young Weak-Field Magnetic White Dwarfs	22nd European Workshop on White Dwarfs, Universität Tübingen, Germany	Research
16 Aug 2022	J.S. Vink	Stellar Winds (Invited Review)	Stars 2020, Institute of Astronomy, University of Cambridge, England	Research
18 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
19 Aug 2022	M. Burton	The Music and Astronomy of William Herschel – Celebrating 200 Years	AOP	Outreach
23 Aug 2022	M. Burton	Public Demonstration of Astronomy with a Data Visualisation Laboratory	AOP	Outreach
25 Aug 2022	A. Humpage	Dispersion Rates of Resonant and Non-Resonant Near-Earth Families	CELTA ASI Summer School, University of Highlands & Islands (UHI), Sabhal Mòr Ostaig, Skye and UHI Inverness, Scotland	Research
30 Aug 2022	C. Duffy	Diverse Outbursting Behaviour in AM CVn System	AM CVn 4.5 (online)	Research

01 Sep 2022	D. Eden	MAJORS: Massive, Active, JCMT-Observed Regions of Star Formation	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
01 Sep 2022	M. Sarzi with C. Clarke	Detecting Planetary Nebulae with Adaptive Optics	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
02 Sep 2022	J. Rigney	Searching for Stellar Flares from Low Mass Stars Using ASKAP and TESS	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
02 Sep 2022	E. Wince	Black Holes Where They Shouldn't Be	Irish National Astronomy Meeting, Dunsink Observatory, Dublin	Research
09 Sep 2022	H. Alexander	Interpretation of Armagh Observatory and Planetarium History in the Planetarium Display Space	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	A. Black	Considering the Historic Architecture of the Observatory	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	M. Burton	Introduction to Armagh Observatory and Planetarium	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	M. McMahon	Oral History at Armagh Observatory and Planetarium	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
09 Sep 2022	R. Nežič	Blending History and Science for the Public	Contemporary Observatory Networks, Observatory Networks Conference, AOP	Research
11 Sep 2022	A. Christou	Extra-Terrestrial Occultations: The Beagle 2 Experiment	41st European Symposium on Occultation Projects, Granada, Spain (virtual)	Research
11 Sep 2022	A. Christou	A Proposal to Hold ESOP XLII in the City of Armagh, Northern Ireland, on 15-19 September 2023	41st European Symposium on Occultation Projects, Granada, Spain (virtual)	Research
23 Sep 2022	A. Christou	High-Inclination NEAs as Meteor Stream Parent Bodies	Europlanet Science Congress 2022, Granada, Spain	Research
23 Sep 2022	Z. Gray	The Return of Rosetta's Comet: Photometric and Polarimetric Observations of Comet 67P/CG in its 2021-22 Apparition	Europlanet Science Congress 2022, Granada, Spain	Research
23 Sep 2022	R. Nežič	Unusual Polarimetric Properties for Interstellar Comet 2I/Borisov	Europlanet Science Congress 2022, Granada, Spain	Research
25 Sep 2022	M. Burton	The Music and Astronomy of William Herschel (with Rod Alston)	Sligo Baroque Music Festival, The Model, Sligo, Co. Sligo, Ireland	Outreach
27 Sep 2022	J. Rigney	Low Frequency Radio Emission Associated with an Impulsive Flare and CME	Planetary, Solar, and Heliospheric Radio Emission Conference, Dublin	Research
30 Sep 2022	A. Christou	Prospects for Meteor Astronomy on Venus	Venus Science Conference, Ahmedabad, India (virtual)	Research
01 Oct 2022	Z. Gray, A. Humpage, E. Winch	Armagh-geddon	AOP	Outreach
04 Oct 2022	K.O. Çubuk	Nuffield Research Placements at Armagh Observatory and Planetarium	Nuffield Research Placement Celebration Event, The Long Gallery, Stormont, Belfast	Outreach
10 Oct 2022	M. Burton and M. McMahon	Armagh Dunsink Harvard Telescope Event	Dunsink Observatory, Dublin	Outreach
12 Oct 2022	C. Duffy	Gravitational Waves and the Gravitational Wave Optical Observer	Group Visit, AOP	Outreach
14 Oct 2022	J. Rigney	Searching for Stellar Flares from Low Mass Stars Using ASKAP and TESS	TESS Science Meeting #29	Research

18 Oct 2022	C. Duffy	VY Scl Systems	GOTO Science Meeting (online)	Research
19 Oct 2022	M. Sarzi	Planetary Nebulae and Their Role in the Cosmic Distance Ladder	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
27 Oct 2022	M. Burton	AOP Science & Education Park Redevelopment Project	Armagh, Banbridge & Craigavon Councillors and Officers Visit, AOP	Outreach Internal
27 Oct 2022	R. Nežić	Creepy Comets	Star Tracker Evening, AOP	Outreach Internal
28 Oct 2022	M.E. Bailey	The Human Orrery: Ground-Based Astronomy for All. PhD and Postdoc Training. Part 1	AOP	Teaching Internal
28 Oct 2022	M. Burton	Measuring the Heavens from Armagh	QUB Geography Field Trip, AOP	Teaching Internal
31 Oct 2022	M.E. Bailey	The Human Orrery: Ground-Based Astronomy for All. PhD and Postdoc Training. Part 2	AOP	Teaching Internal
07 Nov 2022	A. Christou	According to an Astronomer: What Apollo Taught us About the Moon	Astrobytes, AOP	Internal Outreach
07 Nov 2022	R. Nežić	Armagh Observatory: Astronomical Past, Present and Future	Sydney City Skywatchers (online)	Outreach
08 Nov 2022	S. Bagnulo, Z. Gray	Update from the VLT	Hybrid Observation Working Group Session, DART IT Meeting (online)	Research
10 Nov 2022	S. Bagnulo	Magnetism in Isolated White Dwarfs	Hybrid Solar Polarisation Workshop 10, Kyoto, Japan (online)	Research
11 Nov 2022	A. Sander	Organisation of the XShootU Collaboration	ULLYSES New Horizons Workshop, Lorentz Centre, University of Leiden, The Netherlands	Research
11 Nov 2022	J.S. Vink	Workshop Summary X-Shooting ULLYSES	ULLYSES New Horizons Workshop, Lorentz Centre, University of Leiden, The Netherlands	Research
14 Nov 2022	J. Rigney	The Sun and the (Low Mass) Stars: Searching for Stellar Flares and CMES on M Dwarfs	Seminar, STELLAR Consortium, Bulgaria Academy of Sciences (online)	Research
14 Nov 2022	M. Sarzi	Fornax 3D: A Survey of Fornax with MUSE	Seminar, Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil (online)	Research
15 Nov 2022	S. Bagnulo	The Origin of Magnetism in Isolated White Dwarfs: Observational Constraints	White Dwarfs from Physics to Astrophysics Conference, Kavli Institute for Theoretical Physics, UC Santa Barbara, USA	Research
16 Nov 2022	G. Ramsay	Super-Flares on the Sun and Other Stars. Multi-Messenger Astronomy and Wide-Field Optical Surveys.	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
17 Nov 2022	C.S. Jeffery	Project Sirius: High Performance Computing @ AOP	Discussion Seminar, AOP	Research/AOP Training
17 Nov 2022	R. Nežić	Telescopes: What They Are and How to Use Them	Johnston Central Library, Cavan, Co. Cavan, Ireland	Outreach
17 Nov 2022	J. Rigney	What are M dwarfs?	Open Night, Dunsink Observatory, DIAS, Dublin	Outreach
18 Nov 2022	M. Sarzi	Fornax 3D: A Survey of Fornax with MUSE	Seminar, Institute of Astronomy, University of Cambridge, England	Research
21 Nov 2022	C.S. Jeffery	According to an Astronomer: Ten Hottest Objects in the Universe	Astrobytes, AOP	AOP Training/Internal Outreach

22 Nov 2022	C.S.Jeffery	SALT White Dwarfs and Pre-White Dwarfs	Discussion Seminar, AOP	Research
24 Nov 2022	A.P. Monai	Star Families	Star Tracker Evening, AOP	Outreach
25 Nov 2022	E. Higgins	Torch Bearing Women in Astronomy	West Cork Music Festival Event, AOP	Outreach
30 Nov 2022	J.S. Vink	First Science with JWST	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
02 Dec 2022	Z. Gray	Astronomer's Guide to Polarimetric Observations	Nordic Optical Telescope & Isaac Newton Group of Telescopes Seminar Series, Santa Cruz de La Palma, Spain	Research
05 Dec 2022	K.O. Çubuk	Artemis Mission and Permanent Moon Base	Astrobytes, AOP	Internal Outreach
14 Dec 2022	J.G. Doyle	50 Telescopes and Counting	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
19 Dec 2022	M. McMahon	History of Astronomy in Ireland and Globally	Astrobytes, AOP	Internal Outreach
02 Dec 2022	Z. Gray	Astronomer's Guide to Polarimetric Observations	Nordic Optical Telescope & Isaac Newton Group of Telescopes Seminar Series, Santa Cruz de La Palma, Spain	Research
05 Dec 2022	M.E. Bailey	Education and Public Outreach at Armagh Observatory: Using Kinesthetic Learning to Bring Heaven Down to Earth in a Practical Way	Causeway U3A, Portstewart, Co. Antrim	Outreach
05 Dec 2022	K.O. Çubuk	Artemis Mission and Permanent Moon Base	Astrobytes, AOP	Internal Outreach
08 Dec 2022	L. Scott, A. Loni	Careers in Astronomy	Banbridge Academy, Banbridge, Co. Armagh	Outreach
19 Dec 2022	M. McMahon	History of Astronomy in Ireland and Globally	Astrobytes, AOP	Internal Outreach
09 Jan 2023	M. Burton	World Heritage and Astronomy	Northern Ireland Amateur Astronomy Society, Ballyclare High School, Co. Antrim	Outreach
10 Jan 2023	J.S. Vink	How Heavy is the Most Massive Star?	Heidelberg Joint Astronomical Colloquium, University of Heidelberg, Germany	Research
16 Jan 2023	C. Duffy	The Accretion Behaviour of Cataclysmic Variables Under Differing Magnetic Environments	Accretion and Magnetism Conference, Cape Town, South Africa	Research
18 Jan 2023	S. Bagnulo	Two (or more) Channels for the Onset of Magnetic Fields in White Dwarfs	Accretion and Magnetism Conference, Cape Town, South Africa (online)	Research
23 Jan 2023	S. Bagnulo	Becoming an Astronomer: For Those People Who Come In and Want to Have an Idea of What it Takes to Become a Full-Time Astronomer	Astrobytes, AOP	Outreach Internal
26 Jan 2023	C. Duffy	Big Telescopes of the World	Star Tracker Evening, AOP	Outreach
28 Jan 2023	J. Rigney	Radio Astronomy in Ireland	Astrofest 2023, Galway Astronomy Club, Menlo Park Hotel, Galway, Ireland	Outreach
02 Feb 2023	M. Burton	Measuring the Heavens – A Short History of Armagh Observatory	Isle of Man Astronomy Society, The Observatory, Foxdale, Isle of Man (via Zoom)	Outreach
03 Feb 2023	M. Burton	Ireland and the Herschels – Some Surprising Connections.	Herschel Society, Bath, England (Hybrid via Zoom)	Outreach
06 Feb 2023	M. Burton	Understanding the Stars and Where They Are in Our Sky and in the Galaxy	Astrobytes, DVL, AOP	Internal Outreach

09 Feb 2023	M. Burton	Ultra-hot Molecular Hydrogen in the Interstellar Medium ("emission from quasi-bound molecular hydrogen")	Seminar, AOP	Research
13 Feb 2023	J.S. Vink	Hot Star Winds	Munich Institute for Astro- and Particle Physics, Munich, Germany	Research
14 Feb 2023	M. Burton	Our Galaxy: Gas, Dust and Surveys	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
20 Feb 2023	S. Schlagenhauf	Exoplanets in the Habitability Zones of Stars: Finding Them and Learning Anything	Astrobytes, AOP	Internal Outreach
23 Feb 2023	C.S. Jeffery	Eight Super-Hot White Dwarfs	Seminar, AOP	Research
25 Feb 2023	M. McMahon, A. Marshall Lee, S. Schlagenhauf	Cosmic Conservation	AOP	Outreach
27 Feb 2023	M. McMahon	The Troughton Equatorial Telescope Network	Centre for Fusion, Space and Astrophysics, University of Warwick, England (online)	Outreach
27 Feb 2023	H. Alexander	A Brief Overview of the History of Armagh Observatory and Planetarium	Portadown Rotary Club, Seagoe Hotel, Portadown, Co. Armagh	Outreach
01 Mar 2023	S. Bagnulo	Introduction to Night Time Polarimetry	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
06 Mar 2023	D. Eden	Star Formation in the Milky Way...and Beyond	Northern Ireland Amateur Astronomy Society, Ballyclare High School, Co. Antrim	Outreach
07 Mar 2023	D. Eden	High-Mass Star Formation	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
15 Mar 2023	J. Rigney	Diving Deeper into the Radio Sky	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach
21 Mar 2023	A.P. Monai	Population Studies of Exotic Hot Subdwarfs	Discussion Seminar, AOP	Research
22 Feb 2023	J.S. Vink	Radiative Transfer and the Most Massive Stars	QUB/AOP PGR Lecture Series, Queen's University Belfast	Research
23 Mar 2023	J. Rigney	Life Around Other Stars	Open Night, Dunsink Observatory, Dublin Institute for Advanced Studies, Dublin	Outreach
24 Mar 2023	Z. Gray	A Day in the Life of an Astronomer (video presentation)	Staring into Space - PhD Afternoon, AOP	Outreach
24 Mar 2023	A. Marshall Lee, A.P. Monai, S. Schlagenhauf, A. Humpage, Ethin Wince, Z. Gray	Staring into Space - PhD Afternoon	Staring into Space - PhD Afternoon, AOP	Outreach
27 Mar 2023	J. Rigney	Diving Deeper Into the Radio Sky	University College Dublin, Dublin	Outreach
29 Mar 2023	C.S. Jeffery	SALT and the Super-Hot Zombie Stars	Irish Astronomical Association Lecture, Queen's University Belfast	Outreach

Education and Outreach: April 2022 – March 2023

Date	Event Description
Apr 2022 – Mar 2023	The Legendary Telescope Tours at Armagh Observatory
20 Apr 2022	Wee Critters – Interactive Animal Experience
28 Apr 2022	The Nature of the Night – See The Astropark Like Never Before
11 May 2022	IAU Conference 361: Massive Stars Near and Far, Slieve Russell Hotel, Ballyconnell, Co Cavan. Live Interactive Sessions in the Inflatable Star Dome
8 Jun 2022	Astropark Infinity Walks to Celebrate the launch of Disney and Pixar's Lightyear Movie
11 Jun to 31 Jul 2022	Brickosaurs Experience
30 Jun 2022	Dark Skies and Climate Action Workshop
1 Jul 2022	Story Time with Armagh City Library
7, 14, 21, 28 and 2, 20 Aug 2022	Jurassic Ark Encounters NI Workshop
4, 11, and 18 Aug 2022	Drop In Data Visualisation Laboratory Demonstrations
19 August 2022	Music and Astronomy of William Herschel, Celebrate 200 Years of William Herschel, Live Performance by the Sligo Baroque Orchestra
10 – 11 Sep 2022	European Heritage Open Days – Astropark Tours
Sep 2022 – Jan 2023	Temporary Exhibition "Like Gold to Airy Thinness Beat", Art on the International Space Station with The Moon Gallery
1 Oct 2022	Armagh-Geddon PhD Day
5 – 7 Oct 2022	Space Week, Space and Sustainability, Special Screening of Our Place in the Cosmos
20 Oct 2022	Bat Walk Around the Astropark with Northern Ireland Bat Group
27 Oct 2022	Spooky Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
29/30 Oct 2022	Potions & Explosions Live Science Show with Scientific Sue
29/30 Oct 2022	Tall Tales and Terror at Armagh Observatory
31 Oct – 4 Nov 2022	Drop In Data Visualisation Laboratory Demonstrations
16 Nov 2022	Artemis I Mission Launch
16 Nov 2022	Cavan Monaghan Science Festival Event: The Night Sky Through The Telescope, Johnston Central Library Cavan
19 Nov – 23 Dec 2022	Mission Santa, An Immersive Christmas Experience
24 Nov 2022	Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
25 Nov 2022	Thus She Shall Go To The Stars ... A Live Musical Performance in the Dome, Jessie Kennedy with The Celestial Strings. In association with The West Cork History Festival
26 Nov 2022	Armagh Georgian Day, Observatory Tour with Dr Rok Nežič
13 and 15 Dec 2022	Royal Institution Christmas Lecture Series. Live Stream. Professor Dame Sue Black will reveal the secrets of forensic science
14 Dec 2022	Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts. Apollo 17 Anniversary Special
26 Jan 2023	Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
16 Feb 2023	NI Science Festival 2023 Event: Shoot for the Stars, Astronomy Careers
18 – 19 Feb 2023	NI Science Festival 2023 Event: Bricks 4 Kidz Workshop
17 Feb 2023	NI Science Festival 2023 Event: Astropark Walking Tours
22 Feb 2023	NI Science Festival 2023 Event: Climate Tour in collaboration with the Northern Ireland Museums.
23 Feb 2023	NI Science Festival 2023 Event: Star Tracker Special – From Mercury with Love
24 Feb 2023	NI Science Festival 2023 Event: Little Astronomers
25 Feb 2023	NI Science Festival 2023 Event: Cosmic Conservation, Astronomy and Antiques
08 Mar 2023	Irish Week Event: CapCom Go As Gaeilge.

21 Mar 2023	Irish Astronomy Week Event: Introduction to Astrophotography with Paul Evans
22 Mar 2023	Irish Astronomy Week Event: Observatory Library Open Afternoon
23 Mar 2023	Irish Astronomy Week Event: Star Tracker, An Evening of Stargazing and Planet Spotting with Our Experts
24 Mar 2023	Irish Astronomy Week Event: Look Up Dome Show
24 Mar 2023	Irish Astronomy Week Event: Staring into Space, PhD Day at Armagh Observatory and Planetarium

Intergalactic Craic Podcasts: April 2022 – March 2023

Date	Podcast Title
23 Jan 2023	S3 – What's the craic?
27 Jan 2023	S3Ep1 – Wee Bitta Craic: Welcome Ethan, Alice and Zuri!
10 Mar 2023	S3Ep2 – Wee Bitta Craic: Bout Ye Zuri?

Presenters: H Alexander, E Winch, A Humpage and Z Gray
All published via anchor.fm/intergalacticcraic

THE ARMAGH OBSERVATORY AND PLANETARIUM

THE CERTIFICATE AND REPORT OF THE COMPTROLLER AND AUDITOR GENERAL TO THE NORTHERN IRELAND ASSEMBLY

Opinion on financial statements

I certify that I have audited the financial statements of the Armagh Observatory and Planetarium for the year ended 31 March 2023 under the Armagh Observatory Planetarium (Northern Ireland) Order 1995. The financial statements comprise: the Statement of Financial Activities, the Balance Sheet, the Cash Flow Statement; and the related notes including significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom accounting standards including Financial Reporting Standard (FRS) 102, the Financial Reporting Standard applicable in the UK and Republic of Ireland (United Kingdom Generally Accepted Accounting Practice).

I have also audited the information in the Trustees' Annual Report that is described in that report as having been audited.

In my opinion the financial statements:

- give a true and fair view of the state of Armagh Observatory and Planetarium's affairs as at 31 March 2023 and of its total incoming resources and expenditure of resources for the year then ended;
- have been properly prepared in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102); and
- have been properly prepared in accordance with the Armagh Observatory Planetarium (Northern Ireland) Order 1995 and Department for Communities directions issued thereunder.

Opinion on regularity

In my opinion, in all material respects the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Basis for opinion

I conducted my audit in accordance with International Standards on Auditing (ISAs) (UK), applicable law and Practice Note 10 'Audit of Financial Statements and Regularity of Public Sector Bodies in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of this certificate.

My staff and I are independent of Armagh Observatory Planetarium in accordance with the ethical requirements that are relevant to my audit of the financial statements in the UK, including the Financial Reporting Council's Ethical Standard, and have fulfilled our other ethical responsibilities in accordance with these requirements.

I believe that the audit evidence obtained is sufficient and appropriate to provide a basis for my opinions.

Conclusions relating to going concern

In auditing the financial statements, I have concluded that Armagh Observatory Planetarium's use of the going concern basis of accounting in the preparation of the financial statements is appropriate.

Based on the work I have performed, I have not identified any material uncertainties relating to events or conditions that, individually or collectively, may cast significant doubt on the Armagh Observatory Planetarium's ability to continue as a going concern for a period of at least twelve months from when the financial statements are authorised for issue.

The going concern basis of accounting for Armagh Observatory Planetarium is adopted in consideration of the requirements set out in the Government Financial Reporting Manual, which require entities to adopt the going concern basis of accounting in the preparation of the financial statements where it anticipated that the services which they provide will continue into the future.

My responsibilities and the responsibilities of the Trustees and the Accounting Officer with respect to going concern are described in the relevant sections of this report.

Other Information

The other information comprises the information included in the Trustees' annual report other than the financial statements, the parts of the Trustees' described in that report as having been audited, and my audit certificate and report. The Trustees and the Accounting Officer are responsible for the other information included in the annual report. My opinion on the financial statements does not cover the other information and except to the extent otherwise explicitly stated in my report, I do not express any form of assurance conclusion thereon.

My responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements, or my knowledge obtained in the audit or otherwise appears to be materially misstated. If I identify such material inconsistencies or apparent material misstatements, I am required to determine whether this gives rise to a material misstatement in the financial statements themselves. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact.

I have nothing to report in this regard.

Opinion on other matters

In my opinion based on the work undertaken in the course of the audit:

- the parts of the Trustees' to be audited have been properly prepared in accordance with Department for Communities directions made under the Armagh Observatory Planetarium (Northern Ireland) Order 1995; and
- the information given in the Trustees' Annual Report the financial year for which the financial statements are prepared is consistent with the financial statements.

Matters on which I report by exception

In the light of the knowledge and understanding of the Armagh Observatory Planetarium and its environment obtained in the course of the audit, I have not identified material misstatements in the Trustees' Annual Report.

I have nothing to report in respect of the following matters which I report to you if, in my opinion:

- adequate accounting records have not been kept; or
- the financial statements and the parts of the Trustees Report to be audited are not in agreement with the accounting records; or
- certain disclosures of remuneration specified by the Government Financial Report Manual are not made; or
- I have not received all of the information and explanations I require for my audit; or
- the Governance Statement does not reflect compliance with the Department of Finance's guidance.

Responsibilities of the Board of Governors and Accounting Officer for the financial statements

As explained more fully in the Statement of the Responsibilities of the Governors and Accounting Officer the Governors and the Accounting Officer are responsible for:

- the preparation of the financial statements and for being satisfied that they give a true and fair view;
- such internal controls as the Trustees Accounting Officer determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error;
- ensuring the Trustees' Annual Report, which includes the Remuneration and Staff Report, is prepared in accordance with the Government Financial Reporting Manual;
- assessing the Armagh Observatory Planetarium's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Trustees and Accounting Officer anticipates that the services provided by Armagh Observatory Planetarium's will not continue to be provided in the future.

Auditor's responsibilities for the audit of the financial statements

My responsibility is to examine, certify and report on the financial statements in accordance with the Armagh Observatory Planetarium (Northern Ireland) Order 1995.

My objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error and to issue a certificate that includes my opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

I design procedures in line with my responsibilities, outlined above, to detect material misstatements in respect of non-compliance with laws and regulation, including fraud.

My procedures included:

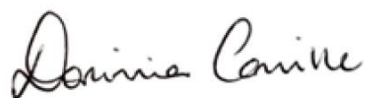
- obtaining an understanding of the legal and regulatory framework applicable to the Armagh Observatory Planetarium through discussion with management and application of extensive public sector accountability knowledge. The key laws and regulations I considered included Armagh Observatory Planetarium (Northern Ireland) Order 1995.
- making enquires of management and those charged with governance on Armagh Observatory Planetarium's compliance with laws and regulations;
- making enquiries of internal audit, management and those charged with governance as to susceptibility to irregularity and fraud, their assessment of the risk of material misstatement due to fraud and irregularity, and their knowledge of actual, suspected, and alleged fraud and irregularity;
- completing risk assessment procedures to assess the susceptibility of Armagh Observatory Planetarium's financial statements to material misstatement, including how fraud might occur. This included, but was not limited to, an engagement director led engagement team discussion on fraud to identify particular areas, transaction streams and business practices that may be susceptible to material misstatement due to fraud. As part of this discussion, I identified potential for fraud in the following areas: revenue recognition, expenditure recognition, and posting of unusual journals;
- engagement director oversight to ensure the engagement team collectively had the appropriate competence, capabilities, and skills to identify or recognise non-compliance with the applicable legal and regulatory framework throughout the audit;
- documenting and evaluating the design and implementation of internal controls in place to mitigate risk of material misstatement due to fraud and non-compliance with laws and regulations;
- designing audit procedures to address specific laws and regulations which the engagement team considered to have a direct material effect on the financial statements in terms of misstatement and irregularity, including fraud. These audit procedures included, but were not limited to, reading board and committee minutes, and agreeing financial statement disclosures to underlying supporting documentation and approvals as appropriate; and
- addressing the risk of fraud as a result of management override of controls by:
 - performing analytical procedures to identify unusual or unexpected relationships or movements;
 - testing journal entries to identify potential anomalies, and inappropriate or unauthorised adjustments;
 - assessing whether judgements and other assumptions made in determining accounting estimates were indicative of potential bias; and
 - investigating significant or unusual transactions made outside of the normal course of business.

A further description of my responsibilities for the audit of the financial statements is located on the Financial Reporting Council's website www.frc.org.uk/auditorsresponsibilities. This description forms part of my certificate.

In addition, I am required to obtain evidence sufficient to give reasonable assurance that the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Report

I have no observations to make on these financial statements.



Dorinnia Carville
Comptroller and Auditor General
Northern Ireland Audit Office
106 University Street
BELFAST
BT7 1EU

11 October 2023

The Armagh Observatory and Planetarium

Northern Ireland - Charity number 103948

Annual return

THE ARMAGH OBSERVATORY AND PLANETARIUM

THE CERTIFICATE AND REPORT OF THE COMPTROLLER AND AUDITOR GENERAL TO THE NORTHERN IRELAND ASSEMBLY

Opinion on financial statements

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- have been properly prepared in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102); and
- have been properly prepared in accordance with the Armagh Observatory Planetarium (Northern Ireland) Order 1995 and Department for Communities directions issued thereunder.

Opinion on regularity

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Basis for opinion

I conducted my audit in accordance with International Standards on Auditing (ISAs) (UK), applicable law and Practice Note 10 'Audit of Financial Statements and Regularity of Public Sector Bodies in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of this certificate.

My staff and I are independent of Armagh Observatory Planetarium in accordance with the ethical requirements that are relevant to my audit of the financial statements in the UK, including the Financial Reporting Council's Ethical Standard, and have fulfilled our other ethical responsibilities in accordance with these requirements.

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I have nothing to report in this regard.

Opinion on other matters

In my opinion based on the work undertaken in the course of the audit:

- the parts of the Trustees' to be audited have been properly prepared in accordance with Department for Communities directions made under the Armagh Observatory Planetarium (Northern Ireland) Order 1995; and
- the information given in the Trustees' Annual Report the financial year for which the financial statements are prepared is consistent with the financial statements.

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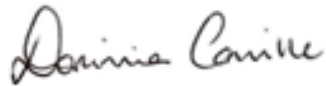
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Report

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Dorinnia Carville
Comptroller and Auditor General
Northern Ireland Audit Office
106 University Street
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BT7 1EU

11 October 2023