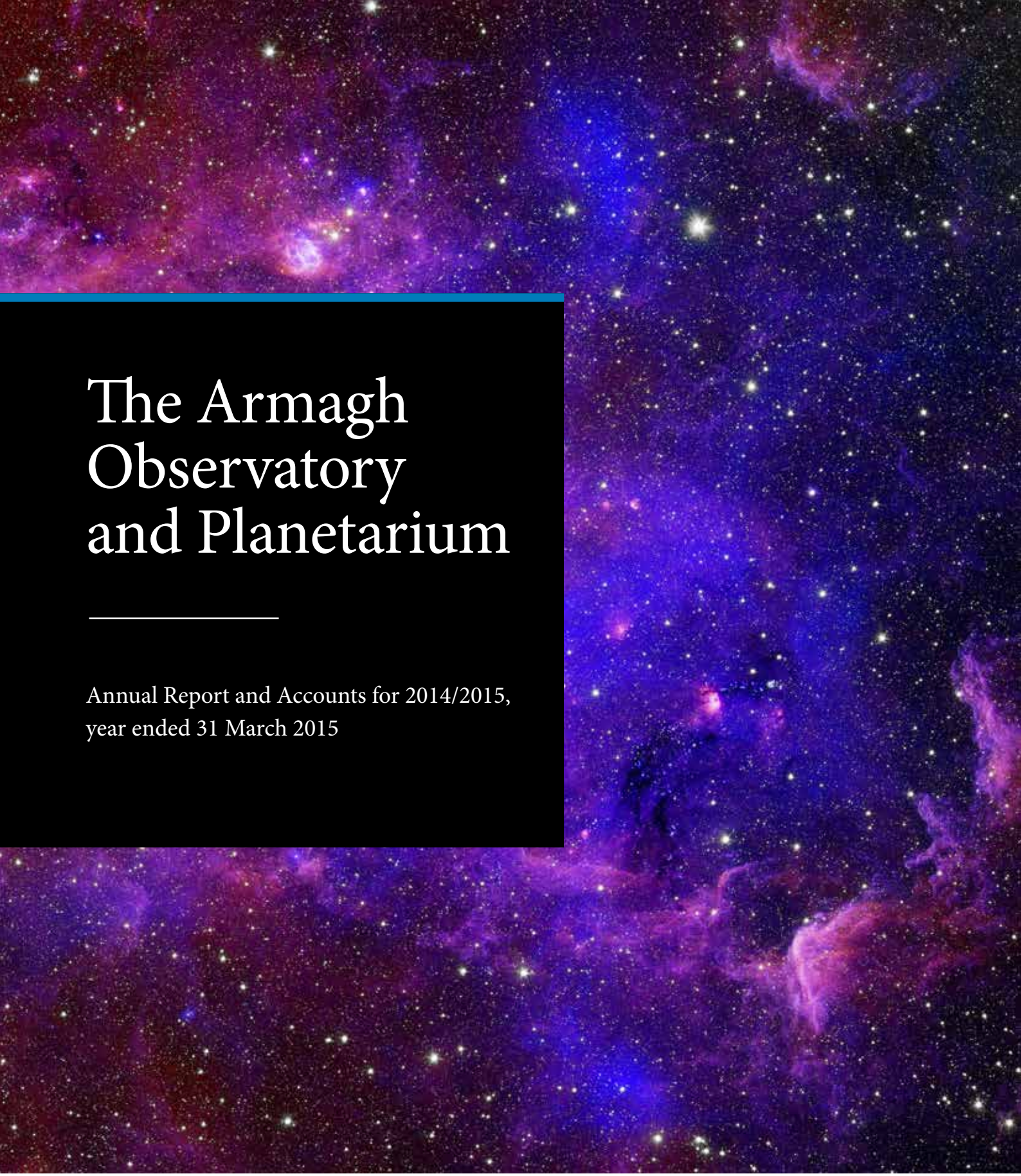
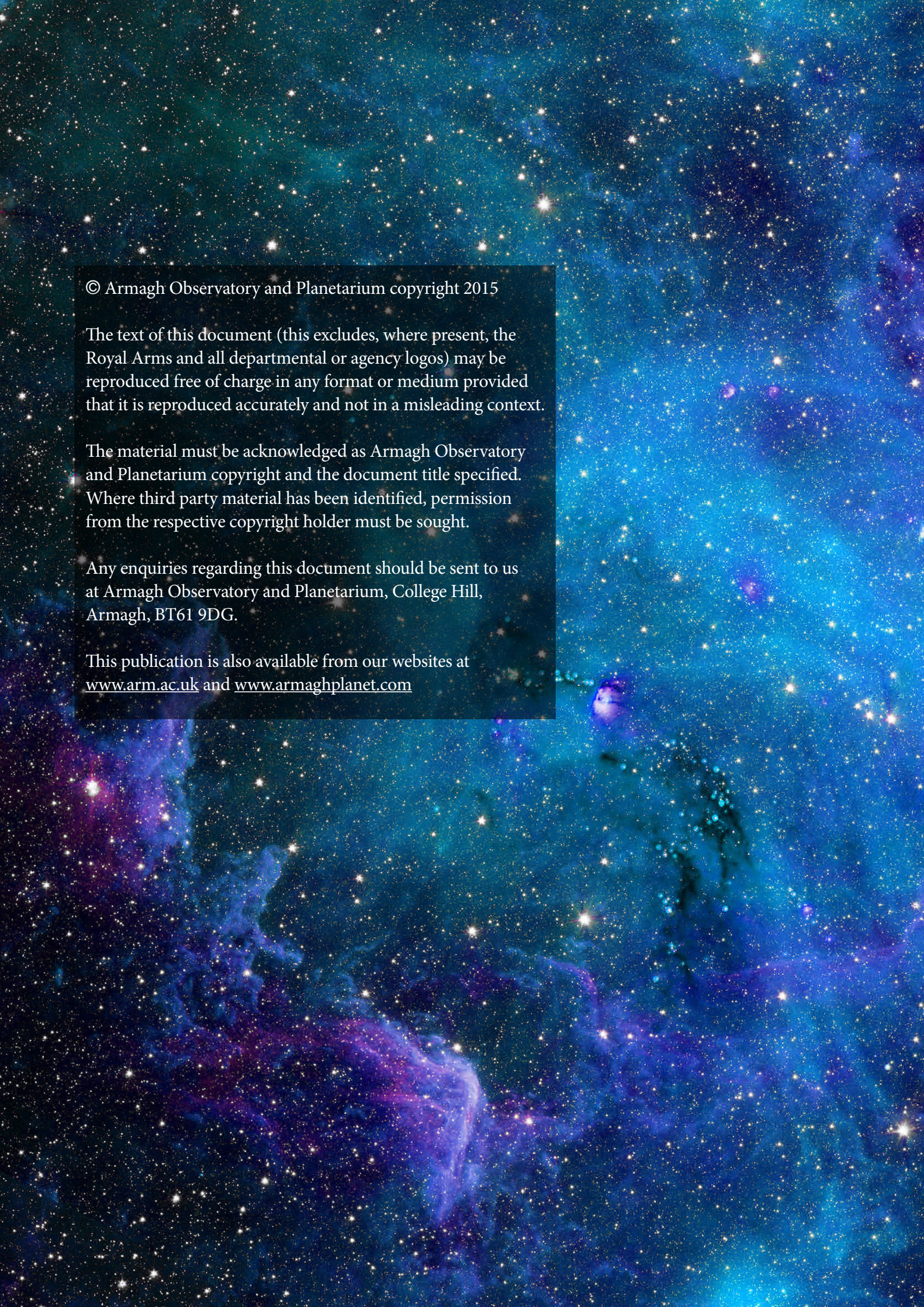


The Armagh Observatory and Planetarium

Annual Report and Accounts for 2014/2015, year ended 31 March 2015

Laid before the Northern Ireland Assembly by the Department for Communities 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, on 7 February 2018.

ARMAGH PLANETARIUM



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This publication is also available from our websites at www.arm.ac.uk and www.armaghplanet.com

The Armagh Observatory and Planetarium Annual Report and Accounts for 2014/2015, year ended 31 March 2015

Armagh Observatory

Armagh Planetarium

Management Commentary

The Vision of the Armagh Observatory is:

> *"To build on its position as a thriving astronomical research institute, and to continue to expand our understanding of the Universe and of humanity's place in it."*

The Mission is:

> *"To advance the knowledge and understanding of astronomy and related sciences through the execution, promotion and dissemination of astronomical research nationally and internationally in order to enrich the intellectual, economic, social and cultural life of the community."*

Introduction

The Armagh Observatory is the oldest scientific institution in Northern Ireland, the longest continuously operating astronomical research institute in the UK and Ireland. There is a fluctuating population of approximately 40 staff, which at the end of 2014 comprised a head count of 6 Research Astronomers and 19 other academic staff (including the director, two PDRAs and more than a dozen PhD students) as well as 11 external research associates and academic visitors, 2 core research and 5 core grounds and administrative support staff. The Observatory has an active visitors programme, each year hosting typically between 10 and 20 temporary academic visitors from abroad, people who visit Armagh for periods ranging from a day or two up to several weeks at a time, as well as PhD students that are co-supervised by Observatory staff but based elsewhere.

The group operates on the international stage and is underpinned by core funding from DCAL and the receipt of external grants from the UK Science and Technology Facilities Council (STFC), the Leverhulme Trust and other grant-awarding bodies. The total expenditure of the Observatory is approximately £1.5M per year, of which approximately three-quarters is directed towards research.

Core funding from the Department of Culture, Arts and Leisure (DCAL) for 2014/2015 was approximately £983.7k (Resource) plus £15k (Capital), together with additional non-cash resource funding to allow for depreciation and an AME figure, principally for pension costs, which can fluctuate significantly from year to year depending on the NILGOSC's fund's economic performance and actuarial revaluations. In recent years the Observatory has declared a surplus on its AME non-cash budget.

The Observatory is also able to bid for additional in-year funds to support various research, education and public outreach, technical equipment and infrastructure projects that cannot be progressed using core funding alone. In 2014/2015 such bids provided a further very significant contribution of additional DCAL funding (Resource plus Capital) totalling £188.5k.

The balance of income in recent years has been largely made up by a small number of high-value external grants. Over the past five years these sources of additional income to support the Observatory's programmes of research and education have together averaged in excess of £300k per year. Staff also occasionally gain other external grants from various sources and a variety of in-kind support (e.g. waiver of registration fees, assistance with T&S costs etc.) to support their research, for example to enable them to visit telescopes abroad or to attend conferences and workshops in support of the Observatory's broader programmes of research, education and learning.

It is noteworthy too that the use by Armagh Observatory staff of UK and international facilities located abroad or in space, which are paid for by the STFC from central UK government funds, corresponds to a further very significant element of external income 'in kind'. Over the last five years, for projects which had an Armagh Principal Investigator, such in-kind benefit has been valued at around £340k/year; and for those projects where there is an Armagh Co-Investigator the sum was around £1.2M/year. This additional 'in kind' support for the Observatory's research, totalling ~£1.5M per year, arises principally through staff winning research time in competitive bids for time on facilities such as those of the European Southern Observatory (ESO) and the European Space Agency (ESA), all of which are funded centrally through UK government subscriptions, or through collaborative arrangements between individual Armagh Observatory staff and other research groups worldwide.

Thus, by operating on the international stage, the Armagh Observatory provides a very high rate of return per pound on the DCAL's and the NI Executive's support for astronomy at Armagh.

Organizational Structure

The Armagh Observatory and the Armagh Planetarium are the two principal divisions of a single statutory public body and corporation 'The Governors of the Armagh Observatory and Planetarium', described in the Armagh Observatory and Planetarium (Northern Ireland) Order 1995. This NI 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'). The Northern Ireland Order 1995 has since been amended by the Audit and Accountability (Northern Ireland) Order 2003, the Insolvency (Disqualification from Office: General) Order (Northern Ireland) 2008 and a number of other amendments.

Following a review of the organization carried out by the NI Strategic Investment Board in 2014 the Corporation's Board of Governors and Management Committee, with the support of the DCAL, are in the process of implementing a change to the structure of the Corporation in which it is intended that the Observatory and Planetarium will ultimately be merged into a single government-funded Arms Length Body (ALB). During 2014/2015, however, the two sides of the corporation have continued to operate under two directors and two Accounting Officers, and have received joint core funding from the Northern Ireland Department of Culture, Arts and Leisure (DCAL). The Corporation as a whole has a total head-count of around 50 staff, research students and visitors, an average of approximately 40 in the Observatory and 10 in the Planetarium.

The Armagh Observatory is also a recognized charity, having been granted charitable status for tax purposes by Her Majesty's Revenue and Customs (HMRC) under Section 505 of the Income and Corporation Taxes Act 1988; the HMRC reference number is XN46022. The principal function of the 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 charity's aims and objectives are those encapsulated in the Observatory's Mission Statement, namely to advance the knowledge and understanding of astronomy and related sciences through the execution, promotion and dissemination of astronomical research nationally and internationally in order to enrich the intellectual, economic, social and cultural life of the community.

Thus, the principal function of the Armagh Observatory is to undertake original research of a world-class academic standard that broadens and expands our understanding of astronomy and related sciences. Important secondary functions include the organization's responsibilities to (i) promote, preserve and widen access to the heritage of astronomy at Armagh; (ii) maintain the continuity and precision of the unique more than 220-year long meteorological record at Armagh; and (iii) pursue a vibrant programme of Science in the Community in support of the Northern Ireland Executive's Science, Technology, Engineering and Mathematics (STEM) Strategy and the strategic goals of the DCAL's Learning Strategy. As part of the programme of Science in the Community, the Observatory undertakes a wide range of community service programmes in astronomy and related sciences and represents Northern Ireland on the national and international stage. Taken together, these activities feed into many areas of government policy, particularly those directed towards improving the economy, education and lifelong learning, and enhancing the attractiveness of Northern Ireland to national and international visitors.

Armagh Planetarium The Armagh Planetarium, which was founded by Dr Eric Mervyn Lindsay, the seventh director of the Armagh Observatory, was officially opened on 1st May 1968. The Planetarium's primary function is to disseminate knowledge of a wide range of science and to promote public understanding of astronomy and science through its programme of educational services for schools and the wider public. Its staff deliver interactive presentations using the latest projection and information technology to all age groups and abilities on a wide range of astronomical and scientific topics, including meteorite impacts, the planets, current astronomical phenomena and Earth sciences. Through the large number of visitors coming through its doors the Planetarium also plays a key role in promoting and enhancing tourism within Armagh City and District, now the wider council area known as Armagh City, Banbridge and Craigavon Borough Council.

Governance and Accountability The Observatory Director has periodic meetings with the DCAL and reports to a Management Committee which meets up to four times a year and to an annual meeting of the Board of Governors. The Management Committee (currently up to 15 members) and Board of Governors (up to 15 members) together comprise representatives and nominees from a wide range of partners, including the Church of Ireland, the Dublin Institute for Advanced Studies (DIAS), the Queen's University of Belfast (QUB), the UK astronomical community (e.g. members of UK universities), the UK Science and Technology Facilities Council (STFC), the DCAL and other bodies. Core funding is provided by grant-in-aid from the DCAL, while variable amounts of additional funding are obtained from other grant awarding organizations, charges for certain services, and donations from visitors and members of the public. Members of the Management Committee and the Board of Governors are listed elsewhere in this report.

Senior responsibility for the two divisions of the corporate entity (the Governors of the Armagh Observatory and the Armagh Planetarium) rests with the Management Committee and Board of Governors with the support of the DCAL. The two sides of the Corporation share the services of an Operations Manager and a Temporary Accountant, both of whom report to the Observatory Director and who together with other administrative and support staff have ensured the delivery of an efficient, effective, accountable and professional financial and operations management function in support of the discharge of the duties of both directors as Accounting Officers and Chief Executives of their respective sides of the Corporation during 2014/2015.

Principal Activities

Research The Observatory carries out front-line astronomical research in three key areas of astrophysics, namely: Solar-System Science, Solar Physics, and Stellar and Galactic Astrophysics. Solar-System research encompasses the dynamical structure, evolution and origin of objects in the inner and outer solar system and comparative planetology and meteor physics. Solar Physics research uses data from spacecraft (for example SoHO [Solar and Heliospheric Observatory], Hinode, Stereo and SDO [Solar Dynamics Observatory]) and ground-based facilities (for example the Dunn Solar Telescope at Sacramento Peak Observatory and the New Solar Telescope at Big Bear Solar Observatory) to study fundamental questions such as how the Sun's outer atmosphere is heated, what drives the solar wind and the Sun's variable magnetic activity and its resulting effect on the Earth's climate. The Observatory's Stellar and Galactic research includes a wide range of investigations into the formation and evolution of stars. This takes into account factors such as a star's mass and evolutionary stage (from birth to the end of a star's lifetime); the interactions between stars; stellar mass loss through stellar winds; stellar oscillations and what they tell us about a star's interior structure; stellar magnetic fields; extreme chemical abundances; the details of accretion physics; and wide-field surveys to discover a diverse range of astrophysically important short-period variable stars. Staff also carry out research on exoplanets and on objects called brown dwarfs, which are intermediate in mass between the largest planets and the smallest stars.

The breadth of these research themes illustrates the Observatory's primary long-term research function. The projects are often funded by external (i.e. non-DCAL) funding agencies with lead times of typically a year or two; they are normally led by an individual Research Astronomer and often require up to 3–5 years for completion.

Computer Facilities Computer facilities are used primarily for numerical analysis, computer modelling and data reduction. The computers and peripherals are largely funded by the DCAL, but occasionally by external research grants, for example those funded by the STFC, the Leverhulme Trust and various EU grants. Staff require access to high-end iMac and Linux workstations, and also have access to the Stokes supercomputer at the Irish Centre for High-End Computing (ICHEC), and through this facility to occasional advanced computer training programmes. In addition, the Observatory has four high-performance computer systems, namely: 'Polar', with 4 x 64-bit AMD Opteron processors each having 16 cores giving a total of 64 processing units and with

128GB RAM; 'Polar2', with 4 x 64-bit AMD Opteron processors each having 16 cores giving a total of 64 processing units and with 128GB RAM; 'Eddington', with 2 x 64-bit Intel Xeon processors each having 8 cores giving a total of 16 processing units and with 132GB RAM; and 'm15', with 2 x 64 bit Intel Xeon processors each having 8 cores giving a total of 16 processing units and with 48 GB RAM.

These computing resources are used mainly for computationally intensive research projects in observational and theoretical astrophysics (including data reduction and modelling) in areas such as solar physics, stellar atmospheres and polarimetry, stellar winds, radiation hydrodynamics, numerical magneto-hydrodynamics, and solar system dynamics. In addition, the Observatory has over 130TB of on-line storage capacity. The internal network is a 1 Gbps backbone ethernet linked with switched hubs and the external connection to the Internet is via a commercial ISP, Atlas, and operates at 100Mbps both upstream and downstream.

Meteorological Record As part of the Observatory's primary research role, staff take daily readings of a wide range of meteorological parameters at Armagh and maintain a unique 220-year long meteorological record and data-bank (http://climate.arm.ac.uk/). This is believed to be the longest daily climate series in the UK and Ireland from a single site and one of the longest in the world. The climate station has been continuously maintained since 1794 December, with readings currently taken every day at 09:00 (GMT).

Calibration of these data has enabled researchers and government agencies to use the Armagh series for reports and research into global warming, and data are released to the general public on a monthly basis through the Observatory's press releases and the Observatory's climate website (http://climate.arm.ac.uk), 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 Observatory'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.

International Standing The Armagh Observatory provides a strong, positive image of Northern Ireland on the international stage. Members of staff play a full role in the international astronomical community, for example serving on committees of bodies such as the Science and Technology Facilities Council (STFC), the Royal Astronomical Society, the Royal Irish Academy, and the International Astronomical Union (IAU); assessing grant and research proposals on behalf of external funding agencies; and reviewing scientific papers and editing international academic journals. In addition, Observatory staff have access to world-class international facilities provided through STFC and UK Government subscriptions and bilateral agreements and collaborations involving individual Armagh Observatory research staff. Observatory staff regularly obtain telescope time on national and international facilities such as the ESO Very Large Telescope (http://www.eso.org/outreach/ut1fl/) and various spacecraft missions (such as SoHO, SDO, Hinode, Stereo, Swift, XMM-Newton, and the Hubble Space Telescope). They obtain research grants from a wide range of grant awarding bodies (e.g. the STFC, the Royal Society, the Leverhulme Trust, British Council etc.), and through the Observatory's membership of the UK SALT Consortium (UKSC) have access to the 11-metre diameter Southern African Large Telescope (SALT; see http://star.arm.ac.uk/SALT/), located at the Sutherland Observatory, South Africa. Complementing these international facilities, restoration of the Observatory's historic telescopes has brought opportunities to reintroduce some visual observing from Armagh, while new computer and camera technology has enabled a variety of new automatic observational programmes to be introduced from Armagh, recording data autonomously whenever the sky is clear.

During 2014 staff at the Armagh Observatory also maintained an active programme of Science in the Community, for example by providing guided tours of the Observatory and Astropark, holding special public lectures and exhibitions, delivering an outreach programme to schools, and supervising school children and undergraduates on a variety of work-experience programmes and summer research projects. The Observatory's Grounds, Astropark and Human Orrery are developed and maintained as a unique facility to enrich the lives of visitors to Armagh and residents alike.

Library and Archives The Observatory'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 contain a unique collection of historic books and manuscripts, as well as a growing collection of 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 at Armagh. In recent years more than 25,000 records have been added to the on-line, publicly accessible archives and library database, with many linking to associated images or digitised documents. The library catalogue with over 3,000 entries is also on-line.

Heritage Policy The Observatory's heritage policy is to progressively restore the historic buildings, scientific instruments, and historic books and other archives in its possession, placing the restored material where possible on display or close to its original location in the main Georgian Grade A listed building. The objective is to maintain the integrity of the Library, Archives and Historic Scientific Instruments as a coherent collection for future generations in the City of Armagh and to preserve this historic material and improve the environmental conditions in which it is held. The Observatory seeks to widen access to this material where possible so that researchers, or visitors to the Observatory's web-sites and others who may use the Observatory's facilities, will be able to use the material for individual research projects and appreciate more clearly the context in which the historic material was first acquired and then transferred into the 'museum' collection. As part of widening access we have installed eleven 'Virtual Visits' (http://star.arm.ac.uk/virtualvisit/), which are available online to everyone through the Internet. The Observatory's Library and Archives is a rich scientific, educational and cultural resource, resonating with the Observatory's position as Northern Ireland's oldest scientific institution.

Science in the Community As already noted, in addition to its primary function to carry out an international level programme of scientific research in astronomy and related sciences and to extend the heritage of astronomy at Armagh, the Armagh Observatory also carries out a vibrant and multifaceted programme of Science in the Community aligned with the DCAL Learning Strategy and

aimed at widening public understanding of science — and of astronomy in particular — for all. There are many strands to this programme of education and community outreach, which includes education and learning for people of all ages as well as public lectures and guided tours of the Observatory and its Grounds, Astropark and Human Orrery. In addition, there are more formal education programmes associated with the Observatory's programmes of work experience, student and teacher training, and engagement with the local community, elements of which all draw on the professional knowledge and expertise of research astronomers at Armagh.

In the past, projects have included construction of the Human Orrery (the first such exhibit in the world to be laid out with precision) and the creation of the first International Phenology Garden in Northern Ireland (see http://star.arm.ac.uk/phenology/), which is closely linked to European and Cross-Border phenology projects and to the Observatory's own unique climate record (http://climate.arm.ac.uk/). The Observatory has also presented a biennial public 'Robinson Lecture' in honour of Archbishop Robinson, the Observatory's founder, and has worked with the Centre for Cross Border Studies to arrange a biennial Cross-Border Schools Science Conference using the facilities of the Observatory together with those of the Royal School Armagh and the Armagh Planetarium.

A highlight of the Observatory's outreach activities during calendar year 2014 was the completion of its UK European Universe Awareness (EU-UNAWE) programme, led by the Director and UK Project Manager Libby McKearney, and the work to complete the installation of a new outdoor exhibit for the Observatory Grounds and Astropark, namely 'aroundNorth', a sonic-art installation created by artist Robert Jarvis and supported in large measure by the PRS for Music Foundation (http: //www.prsformusicfoundation.com). The permanent exhibit in the Observatory Grounds was launched on 2015 March 19.

During 2014/2015 the Observatory has also worked closely with Libraries NI to display the 'From Earth To The Universe' (FETTU) posters in various libraries throughout Northern Ireland, with a focus on those in relatively economically or socially disadvantaged areas. During Autumn 2014, this exhibition reached approximately 11,850 library visitors, of which approximately 7,050 (c.60%) were Adults and 4,800 (c.40%) Children. In addition, a programme of special FETTU talks to primary and early second-level schoolchildren reached a further 88 children and 8 Teachers and Classroom Assistants during the same period (2014 September to December). Primary schools provide very fertile ground for a cross-cutting introduction to science, mathematics, engineering and technology using the vehicle of astronomy, especially as research indicates that the future career decisions of many young people are often determined by their experience of science at primary and early second-level.

Public Benefit

Disabled Access The Observatory has implemented reasonable adjustments necessary to widen access to its facilities by disabled people, whether visiting the Observatory or the Observatory Grounds and Astropark. These include (a) wheelchair access and the installation of additional seating in and around the Astropark; (b) the provision of ramps and other adjustments to the rear of the main building to facilitate wheelchair access; and (c) the installation of a disabled toilet in the Library. As part of widening access the Observatory maintains a rich website (http://star.arm.ac.uk and http://climate.arm.ac.uk), which contains a wealth of information regarding the organization and astronomy and related sciences more generally, and there are eleven 'Virtual Visits' (http://star.arm.ac.uk/virtualvisit/) that are available online to everyone through the Internet.

Developing the Social and Cultural Life of the Community The strands of the Observatory's innovative programme of Science in the Community highlight the contribution of the Observatory's astronomical heritage to Northern Ireland and to the City of Armagh. They help to explain to a wide audience the results of modern astronomy and the benefits of carrying out international-level astronomy, particularly for education, learning and training in the 'STEM' subjects (Science, Technology, Engineering and Mathematics) that are of such importance for our knowledge-based economy. The Observatory makes a major contribution to the international profile of Northern Ireland; helps to develop science and science-based skills in the community; and provides an active programme of public lectures, guided tours, and work-experience activities which together contribute to wider UK and Northern Ireland Government initiatives aimed at deepening scientific knowledge and improving scientific literacy across the whole community.

STEAM In recent years there has been growing recognition of the importance of cross-cutting links between science and the arts, and indeed in many areas of activity that embrace elements of human creativity other than science. This is now developing into a new strategy known as STEAM, which aims to place the Arts (broadly understood) at the centre of STEM. It is evident that the Observatory, together with many other DCAL Arms Length Bodies (ALBs), is well positioned to contribute to the new STEAM agenda, as indicated (for example) by the success of its FETTU programme and the new sonic-art installation 'aroundNorth' mentioned above. In addition, during 2014/2015, DCAL commissioned the Education and Training Inspectorate (ETI) to evaluate the learning offer by the Department and its Arms Length Bodies (ALBs), in order to assess what changes are necessary to ensure that they will be ready to contribute effectively to the anticipated STEAM agenda. The generally very positive ETI report was published on 2015 May 28 (see http://www.etini.gov.uk/index/inspection-reports/inspection-reports-department-of-culture-arts-and-leisure/inspection-reports-department-of-culture-arts-and-leisure-2015/an-evaluation-of-the-future-steam-agenda-and-its-strategic-link-to-the-dcal-learning-strategy.htm)

Summary The Observatory's vibrant programmes of frontline scientific research and science in the community highlight the strength of international astronomical expertise in Armagh and help to explain to a wider audience the very active research programmes in astronomy and related sciences that are and have been undertaken in Armagh. The Observatory is an international research institute that makes a major contribution to promoting the City of Armagh and Northern Ireland on the world stage. Its students come from many countries around the world, and research links and collaborations forged in Armagh often extend for years after students have left Northern Ireland. During calendar year 2014 the Observatory continued to attract a high level of media interest (approximately 330 identified mass-media citations to its work in 2014), and its web-sites attracted approximately 18 million hits and more than a million distinct e-visitors (DEVs) from around the world. Some 40,000 people visited the landscaped

Grounds and Astropark, a figure that highlights the importance of this inner-city parkland as a unique visitor attraction and resource that enriches the lives of residents and visitors to Armagh alike.

Equal Opportunities Policy

The corporation is an equal opportunities employer, committed to ensuring that the talents and resources of all members of the corporation are utilised to the full. The corporation does not discriminate directly or indirectly on the grounds of religious belief, political opinion, trade union membership, gender, marital status, sexual orientation, age, disability, race, colour or ethnic origin, against any member of staff, full-time or part-time, or job applicant, actual or potential, in any aspect of the corporation's activities, including matters of recruitment, training, promotion, appointment, nomination or selection for any position, job transfer or redundancy.

Policy on Payment of Suppliers

The corporation is committed to the payment of all invoices not in dispute within agreed contractual terms. The corporation also recognizes the importance of paying invoices received as soon as possible and does everything practically possible to meet the 10-day prompt payment target in the Accounting Officer guidance of DAO 12/08 issued by the Department of Finance and Personnel. In the year to 31 March 2015, 99% of the Observatory's invoices not in dispute were paid within 10 working days.

Auditors

Under the Audit and Accountability (Northern Ireland) Order 2003, responsibility for the audit of the accounts of the Armagh Observatory and Planetarium has been vested in the Comptroller and Auditor General for Northern Ireland.

Employee Information and Consultation

The corporation takes every opportunity to inform and consult with all members of the organisation on the corporation's activities and plans for the future through the dissemination of annual reports and operational plans, the provision of the latest information on research, educational and other activities through the web-sites, regular formal and informal briefing and discussion meetings, and consultations with staff representatives on employment-related and operational policies and procedures.

Further information on the Observatory is available at http://star.arm.ac.uk/ and http://climate.arm.ac.uk/, and on the Planetarium at http://www.armaghplanet.com.

The Armagh Observatory — Operating Review 2014/2015

The following research results, performance indicators for 2014/2015, and objectives for 2015/2016 are extracted from the Armagh Observatory Annual Report for Calendar Year 2014 (Financial Year 2014/2015), which contains an extensive summary of the whole of the Observatory's principal research and other activities during 2014. The full report is available at http://star.arm.ac.uk/annrep/ or by contacting the Armagh Observatory at College Hill, Armagh, BT61 9DG, Tel. +44-28-3752-2928; E-mail: info@arm.ac.uk.

Alignment with Northern Ireland Programme for Government Goals and Objectives The Northern Ireland Executive Programme for Government 2011–2015 contains 82 commitments divided into five interrelated priorities, namely: (1) Growing a Sustainable Economy and Investing in the Future; (2) Creating Opportunities, Tackling Disadvantage and Improving Health and Well-Being; (3) Protecting our People, the Environment and Creating Safer Communities; (4) Building a Strong and Shared Community; and (5) Delivering High Quality and Efficient Public Services.

The Observatory contributes to each of these cross-cutting government priorities, for example: (1) through the DCAL Learning Strategy and improved understanding of mathematics and numeracy (part of the Executive's STEM Strategy) at all levels including advanced training, and through its programme of Science in the Community; (2) by supervising therapeutic work-experience placements and reducing educational underachievement by providing primary-sector teachers with knowledge of astronomy and of Earth's place in space tied to the primary-sector school curriculum; (3) supporting national efforts to minimise light pollution and other forms of energy waste, and by encouraging wildlife and increased biodiversity in the Observatory Grounds and Astropark, and maintaining the continuity and precision of daily meteorological readings at Armagh in order to provide a better baseline for the risk of global climate change as it affects Northern Ireland; (4) using astronomy as a tool to inspire young people with the beauty and grandeur of the Universe and to introduce ideas of global citizenship essential to a confident, creative, community at peace with itself and others world-wide; and (5) by maintaining the excellence of the Observatory's research facilities and principal outputs in scientific research and public understanding of science, particularly its programme of Science in the Community aligned with the Department's top priority, namely that to Promote Equality and Tackle Poverty and Social Exclusion (PETPSE).

Performance

Staff at the Armagh Observatory have maintained a high level of research activity and other outputs during the year, producing 44 publications in refereed scientific journals during 2014 as well as many other scientific papers and attracting some 330 identified mass-media citations to the Armagh Observatory, its staff and their work. Electronic access to the Armagh Observatory has also remained at a very high level.

During 2014 there were approximately 1.2 million Distinct e-Visitors (DEVs) to the Observatory's principal web-sites (http://star.arm.ac.uk/, http://climate.arm.ac.uk/ and http://arpc65.arm.ac.uk/~spm/), 18.0 million 'hits', and 12.2 TB (1 TB = 1 million Megabytes) of data exported from the Armagh Observatory to users of astronomical information elsewhere.
During 2014, Armagh Observatory staff delivered more than 60 scientific papers, presentations and general talks at meetings both locally and abroad, and maintained an active programme of in-house training including 15 internal seminars and colloquia, most of which were delivered by external visiting speakers.

Total external grant receipts and other income received or receivable during 2014/2015 were approximately £266.3k (cf. £332.2k during 2013/2014), of which £256.5k is attributable to external grant receipts (cf. £322.6k for 2013/2014). This figure was slightly more than anticipated in the 2014/2015 Business Plan at the start of the year (£240k), highlighting the success with which Armagh Observatory staff are proactively obtaining externally funded, peer-reviewed research grants and other income in a difficult financial climate.

Trends of Historic Performance Indicators Key historic performance indicators introduced by the DCAL during 2006/2007 are defined as follows:

A: **"Rate of Return"**. This is the ratio of total external income as a percentage of total income per financial year following resource accounting rules. In recent years, the result (which takes no account of the value of the Observatory's significant use of external facilities) has averaged around 20%. In general, a high value is better, though it must be remembered that the Observatory is not a commercial organization.

B: **"Administrative Efficiency"**. This is the ratio of total governance and administration costs as a percentage of total expenditure per financial year. This provides a measure of the efficiency or 'value for money' of the Armagh Observatory in delivering a high-quality astronomical service at the lowest reasonable cost. A low percentage administrative cost is better.

C: **"Staff Absence"**. This is the average number of days absence per person per calendar year (days per person per year). A low value is better.

D: **"Refereed Publications"**: the number of scientific papers published per calendar year in refereed scientific journals. In general, a high value is better, though high-quality, influential work is more important and can also appear in other media such as books, conference publications and so on.

Calendar or Financial Year	Rate of Return Key PI 'A' Actual (%)	Rate of Return Key PI 'A' Target (%)	Admin. Efficiency Key PI 'B' Actual (%)	Admin. Efficiency Key PI 'B' Target (%)	Staff Absence Key PI 'C' Actual (d/p/yr)	Staff Absence Key PI 'C' Target (d/p/yr)	Refereed Publications Key PI 'D' Actual (per year)	Refereed Publications Key PI 'D' Target (per year)
2004 or 2004/2005	19.9	–	6.5	–	0.4	–	41	32
2005 or 2005/2006	18.1	–	7.2	–	0.4	–	47	35
2006 or 2006/2007	19.0	20.0	9.8	10.0	0.2	12.0	47	40
2007 or 2007/2008	20.7	20.0	7.4	8.8	0.5	11.0	57	45
2008 or 2008/2009	20.2	21.5	8.2	8.2	1.7	10.4	53	50
2009 or 2009/2010	24.2	21.5	8.0	8.2	3.0	9.6	41	50
2010 or 2010/2011	19.4	21.5	7.8	8.2	1.1	6.5	45	50
2011 or 2011/2012	24.0	21.5	8.2	8.2	3.6	6.5	49	50
2012 or 2012/2013	18.9	21.5	7.4	10.0	4.6	6.5	66	45
2013 or 2013/2014	19.6	21.5	9.1	10.0	11.2	6.5	44	45
2014 or 2014/2015	19.9	21.5	10.8	10.0	1.3	6.5	44	40
2015 or 2015/2016		**21.5**		**10.0**		**6.5**		**40**

Table 1: The trend of annual results for key performance indicators agreed with the DCAL during 2006. The first column denotes the calendar or financial year. The percentage Rate of Return (Key PI 'A') corresponds to the ratio of total external income to total income per financial year; Admin. Efficiency (Key PI 'B') represents the ratio of the total expenditure of the Observatory on governance and administration to total expenditure, again per financial year; Staff Absence (Key PI 'C') denotes the average number of days absence per person per calendar year (d/p/yr); and Refereed Publications (Key PI 'D') denotes the number of refereed journal papers produced by Observatory staff in each calendar year. Targets, which are aspirational, are expressed in round figures. Table last updated 2015 May 18.

Results for these key PIs for 2006/2007 et seq. as well as for the prior years for which we have data and targets for future years are shown in Table 1. Results for these and other PIs that are routinely collected to assess the Observatory's performance in different areas of activity are also shown in Table 2. In addition to these specific performance indicators, various other data are routinely recorded for statistical or internal management purposes, many of which are presented in tabular or narrative form in each year's Annual Report. For past reports, see http://star.arm.ac.uk/annrep/.

In summary, Tables 1 and 2 demonstrate the very high efficiency of the Observatory's corporate governance and administration systems (the latter costing typically around 10% of total income per year), the exceptionally strong commitment of Armagh Observatory staff to their work (illustrated by historically low staff-absence figures), and their high research productivity (illustrated by the number of refereed journal publications). In particular, there is an increasing trend in the number of high-quality scientific papers published in refereed scientific journals every year, a growth in the public profile enjoyed by the Observatory (e.g. as evidenced by the number of mass-media citations to the Observatory or its work) and a very significant number of people every year visiting both the Observatory's web-sites and the Observatory's Grounds and Astropark (Table 2).

Objectives for 2015/2016 The Armagh Observatory is a vibrant international research institute that plays a full role in international astronomy whilst developing and promoting the rich heritage of Northern Ireland astronomy and presenting an attractive and positive image of Northern Ireland on the international stage. Funded in large part by the Northern Ireland Government, it plays a full role in contributing to elements of the Northern Ireland Executive's Programme for Government (PfG), particularly the Executive's strategic priorities to (i) Grow a Sustainable Economy and Invest in the Future; (ii) Create Opportunities, Tackle Disadvantage and Improve Health and Wellbeing; (iii) Protect our People, the Environment and Create Safer Communities; (iv) Build a Strong and Shared Community; and (v) Deliver High-Quality and Efficient Public Services.

The Observatory's activities also align with particular PfG commitments, which have been taken into account in determining the focus of the Observatory's activities for 2015/2016, especially those to (a) increase uptake in economically relevant Science, Technology, Engineering and Mathematics (STEM) places, and (b) develop and implement a strategy to reduce economic inactivity by increasing skills, training and job creation. Furthermore, the Observatory's sponsoring body, the Department of Culture, Arts and Leisure, has developed a Vision to create *"a confident, creative, informed and vibrant community", and a Mission to promote equality and tackle poverty and social exclusion through systematically promoting a sustainable economic model and proactively targeting meaningful resources at sectors of greatest inequality, within areas of greatest objective need, in the wider context of effectively developing tangible opportunities and measurable outcomes for securing excellence and equality across culture, arts and leisure and a confident, creative, informed and healthy society in this part of Ireland."* Taking these requirements into account the Observatory's principal research, education and learning objectives for 2015/2016 are to:

- obtain external grants and funding to support new research projects;
- strengthen the Observatory's research capacity in Solar-System Science, Solar Physics, and Stellar and Galactic Astrophysics, by recruiting 3–4 PhD students and providing a high-quality research environment to facilitate their advanced training and that of other Observatory staff; and
- build on the Observatory's involvement in the DCAL Learning Strategy by developing new audiences and new initiatives in education and public outreach associated with the Observatory's programme of Science in the Community, aligned with the Northern Ireland Executive's STEM Strategy.

Performance Indicator	Prior Year (2013 or 2013/2014)	Current In-Year Result (2014 or 2014/2015)	Current-Year Target (2014 or 2014/2015)
A: 'Rate of Return'	19.6%	19.9% (12 months)	21.5%
B: 'Admin. Efficiency'	9.1%	10.8% (12 months)	10.0%
C: 'Staff Absence' (days/person/year)	11.2	1.3 (12 months)	6.5
D: 'Refereed Journal Publications'	44	44 (12 months)	40
External Grant Income Received In-Year (£000s)	322.6	256.5 (12 months)	250.0
Other External Income Received In-Year (£000s)	9.6	9.8 (12 months)	10.0
Distinct e-Visitors (millions)	1.06	1.21 (12 months)	0.80
Web-Site 'Hits' (millions)	24.56	18.02 (12 months)	18.0
Data Exported (TB)	9.94	12.20 (12 months)	9.00
Identified Media Citations	251	330 (12 months)	250
Astropark Visitors Numbers	-	40151 (12 months)	40000

Table 2: Annual in-year results for Armagh Observatory Performance Indicators. Data from the electronic counter for Astropark Visitor Numbers cannot be relied upon during 2013 (the estimated figure was 11000 for 6 months), as the instrument was not working reliably during that year and to some extent the previous year 2012 as well. It was replaced in early 2014 and began taking readings on 2014 February 8. The quoted 2014 figure has been extrapolated from the recorded figure of 35971 from 2014 February 8 to December 31. Table last updated 2015 May 18.

In addition to these programmes of frontline scientific research and public understanding of science, the Observatory will seek to progress plans for the design of a new Library, Archives and Historic Scientific Instruments building (a project that plays a central role in the Observatory's forward look), as it has an important function to promote, preserve and widen access to the library, archives and museum collection at Armagh, as well as the Observatory Grounds, which together represent another very significant component of Northern Ireland's scientific heritage.

The Observatory will also continue to maintain its unique climate archive, the longest daily climate series from a single site in the UK and Ireland and one of the longest in the world. Calibration of these data has enabled researchers and government agencies to use the Armagh series for reports and research into global warming. Meteorological readings are taken every day of the year at 09:00 GMT and results published on the Observatory's climate website (http://climate.arm.ac.uk). In addition during 2015/2016 it is intended to continue, as resources allow, a programme to improve the documentation, digitization and storage conditions of the historic library, archives and astronomical museum collection. The Observatory will also maintain a dialogue with the Department, begun in 2012/2013, aimed at improving its management and corporate governance structures, so as to respond better to the increasingly stringent demands of central government and to put in place a process for periodic assessment of the Observatory's programmes of research and public outreach.

Targeting Social Need (TSN) The principles underlying TSN, which align with many Government policies, are particularly relevant to the Observatory's programme of Science in the Community and its responsibilities as a recognized charity. The Observatory skews resources where possible towards those elements of the community that are most disadvantaged and which have fewer opportunities to participate in the excitement of modern scientific research and in the discoveries being made by scientists in astronomy and related sciences. Participation in this endeavour contributes to people's health and well-being, as well as to each individual's personal development, education, and future employment opportunities. The Observatory has been involved with TSN for many years, and has developed a vibrant programme of Science in the Community in order to respond to this need. In addition to disseminating the fruits of astronomical research to a wider audience, this work aligns directly with the DCAL's top priority and most important objective, namely that to Promote Equality and Tackle Poverty and Social Exclusion (PETPSE). The Observatory's TSN Action Plan can be viewed at: http://star.arm.ac.uk/TSN.html.

Principal Achievements During 2014 and 2014/2015

This section provides a summary of significant results and/or progress in astronomy as a result of Observatory activities during 2014 and 2014/2015.

1. **Applied Space Science**: Visiting astronomer Duncan Steel reports that since the aircraft was lost in 2014 March he has been using space science and applied physics to assist the search for the missing Malaysian Airliner MH370. For further details, see his website http://www.duncansteel.com/. Duncan Steel's work has featured in many mainstream media reports of the incident, and the website describing his research methods in connection with this event had been receiving approximately 10,000 hits per day.

2. **Meteor Outburst Related to Comet 209P/LINEAR**: David Asher reports that he and long-time colleague Robert H. McNaught made calculations on the expected Camelopardalid meteor outburst occurring during the night of 2014 May 23/24. They confirmed the predictions of other authors and highlighted the way in which the meteor activity can be associated with the Earth's passage through dense, narrow dust *trails*, representing material lost from the parent comet during successive perihelion passages, but principally the very close encounter of the Earth with material ejected by the comet 22 revolutions ago, around the time of its perihelion in 1903. In particular, they showed how the trail encounter

timings would vary slightly depending on the observer's location on the Earth's surface. They devised a webpage for the Observatory website (http://star.arm.ac.uk./~dja/209P), and distributed information to interested parties before the outburst.

Meteors from the comet were observed in Canada by Apostolos Christou and colleagues at the University of Western Ontario, London, Canada, from Elginfield approximately 40km north of London, while Asher & McNaught's work was disseminated by Christou as an internal seminar at the University. The relatively small number of observed meteors (~10 meteors per hour) compared with that predicted (an order of magnitude or more higher) can be used to place constraints on this low-activity comet's activity over the past century or more, prior to its discovery in 2004. It is intended to develop this work further in collaboration with Aswin Sekhar and Jérémie Vaubaillon (IMCCE, Paris).

3. **Search for and Recovery of Suspected Martian Trojans**: Apostolos Christou, David Asher and Ruxandra Toma report on their recent observations together with Ovidiu Vaduvescu and colleagues, which have recovered and improved the orbits of two Martian companions, namely 2011SL_{25} and 2011UB_{256}. These were suspected as being so-called Martian 'Trojan' asteroids, objects that move in orbits confined by solar and planetary gravity to revolve around the Sun in elliptical orbits either ahead of or behind the planet, librating respectively around the 3-body Lagrangian points ahead of (L_4) or trailing behind (L_5) the planet in its orbit.

Trojans are extremely long-lived companions of their controlling planet, with an origin either dating back to physico-dynamical processes associated with the origin of the planets and asteroids in the early solar system some 4.5 Gyr ago, or associated with rare dynamical processes and/or collisions that have subsequently scattered them into such long-term stable orbits, and which too may have occurred hundreds or thousands of millions of years ago. So far, Mars is the only terrestrial planet known to have Trojans, and the origin of its peculiar asteroid companions represents a challenge for current theories of the origin of the solar system as well as future opportunities for research.

A particular puzzle is why the majority of the seven known (or suspected) Martian Trojans at the end of 2013 are found to cluster in the trailing, L_5, Trojan family instead of being more evenly spread among the two groups. In previous work Christou (Icarus, 224, 144–153, 2013) has argued that this is because they have a common origin as fragments of a collision or a rotational break-up event that occurred long ago, in which case their study presents interesting opportunities to investigate the long-term consequences of various non-gravitational orbit and spin-state changing agents such as the Yarkovsky and YORP effects in a natural part of the solar system undisturbed by close encounters with terrestrial planets. In order to test these and other theories for the origin and evolution of the Martian Trojans, and to provide additional constraints on the early dynamical evolution of the terrestrial planets covering the period when the Trojans may first have been formed, it is essential to increase the inventory of confirmed Martian Trojans and to study not just their dynamics but their surface and other properties as well.

During 2013 Christou identified asteroids 2011 SL_{25} and 2011 UB_{256} as Martian Trojan candidates. As these objects had only been tracked briefly following their discovery in 2011, their orbits were too uncertain to know their status as Trojans or not. An observational window of opportunity to recover these asteroids occurred at the very end of 2013 through the early months of 2014. Christou and Asher noted that the uncertainty in the asteroids' sky positions, while very significant, was small enough to make a search for them feasible. In collaboration with EURONEAR project leader, Ovidiu Vaduvescu (Isaac Newton Group of Telescopes), who led this observational project, 2011 SL_{25} was found in 2014 January and 2011 UB_{256} in March, using the Wide-Field Camera of the 2.5 m Isaac Newton Telescope at the Observatorio del Roque de Los Muchachos on La Palma. Observers were Ovidiu Vaduvescu, Ruxandra Toma, Hristo Stoev and Vlad Tudor.

4. **Polarized Light Emission from Small Bodies in the Solar System**: Dr Gian Paolo Tozzi (Osservatorio Astrofisico di Arcetri, Florence) visited the Observatory for approximately three weeks during 2014 April/May for a period of intensive collaboration and advanced training under the European Union (EU) funded COST Action MP1104 'Polarization as a Tool to Study the Solar System and Beyond', on a Short-Term Scientific Mission (STSM). The STSMs, funded under various EU COST Actions, are intended to develop collaborations and international research capacity within Europe, and to advance specific research projects and the training of young astronomers. Tozzi worked with PhD student Aaron Stinson and Research Astronomer Stefano Bagnulo on the polarimetric behaviour and infrared spectra of two comets (74P/Smirnova-Chernykh and 152P/Helin-Lawrence), with the aim of obtaining further insight into the surface properties of the nuclei of these two short-period comets.

Aaron Stinson and Stefano Bagnulo were awarded a grant from COST Action MP1104 to attend the Asteroids, Comets, Meteors (ACM) conference in Helsinki, which took place from 2014 June 30 to July 4. This is one of the largest international conferences covering the subject of small bodies of the solar system. It is held every two years and attended by leading experts in the field from all countries. At this conference Stinson presented a talk on 'The Broadband FORS/VLT Polarimetry of Comet Nuclei: 9P/Tempel1, 19P/Borrelly, 67P/Churyumov-Gerasimenko, 74P/Smirnov-Chernykh, and 152P/Helin-Lawrence'. Stefano Bagnulo delivered a talk entitled: 'Spectropolarimetry: A New Diagnostic Tool for the Characterization of the Small Bodies of the Solar System', and was co-author of another three oral presentations and one poster presentation.

PhD students Aaron Stinson and student Will McLean, both supervised by Stefano Bagnulo and colleagues, were successful in their respective applications for grants from the COST Action MP1104 for a STSM in the first week of 2014 September to travel to the Delft Institute of Technology, The Netherlands, to work with Dr Daphne Stam, a world-leader in the modelling of planetary atmospheres. A particular objective of the visit was to use and understand Stam's theoretical code for modelling scattered light from planetary surfaces and atmospheres. The students are working on projects that require careful interpretation and modelling of the polarized light emission from the surfaces and atmospheres of small bodies in the solar system, such as planets, moons, comets and asteroids.

Will McLean also reports that he was accepted for the OPTICON Observing School and the associated Awareness Conference, which were held in the last two weeks of September respectively at the Bulgarian National Astronomical Observatory, Rozhen, and in Sofia, Bulgaria. The intensive training programme provides opportunities for young astronomers from across Europe to gain practical observing experience using state-of-the-art instrumentation under the

guidance of an experienced observer. The two-week summer school also provides an opportunity to carry out a time-bound research project involving all the usual steps of a longer-term standard observing programme. Introductory lectures were given by experts in the field, including Stefano Bagnulo. As with the COST Short Term Scientific Missions, funding to facilitate the Observatory's participation in this training school was obtained as a result of successful grant applications from Bagnulo's group, in this case through the EU-funded Network of European Observatories in the North (NEON) programme, which is part of OPTICON. The participation of the Observatory's students in this conference illustrates one of the benefits of the collaboration established during 2013/2014 between the Armagh Observatory and the Bulgarian National Astronomical Observatory on the subject of polarimetry of objects in our solar system.

5. **Exploring the *KEPLER* Archive**: Gavin Ramsay reports that he has recently analysed Kepler data referring to a suspected symbiotic star, StHA169, and found a month-long pulsation period from the red-giant star. The more compact star appears to be a late B star (Ramsay, Hakala & Howell, MNRAS, 442, 489–494). He has also been successful in placing various late M-dwarf stars on the target list for the successor mission to *Kepler*, K2. The goal is to detect the rotation period of M stars over the full spectral class and determine their flare characteristics. Together with Simon Jeffery he has also analysed and published (Jeffery & Ramsay, MNRAS, 442, L61–L65) the first engineering data from the K2 mission (the object was EQ PSc, a pulsating sdB star). Gavin Ramsay has also obtained time on LOFAR (MHz frequencies) through the international time process, to observe a binary system containing two M-dwarf stars.

6. **Precision Probes of Pulsating Photospheres**: Simon Jeffery studies how waves propagate through the outer layers of a star. Briefly, there are two ways in which a pulsation might manifest in a star, namely an oscillation (or standing wave) in which the entire star expands and contracts in phase, or a running wave in which periodic displacements in the deep interior travel outwards through the star over time. In a unique study of the pulsating helium star V652 Herculis using the Subaru telescope in Hawaii and the Swift satellite, Jeffery and colleagues set out to resolve the question of which of the two mechanisms is occurring in this star. They have shown how different absorption lines can be used to study the motion of different layers in the star's atmosphere. On average, this resolvable atmosphere represents some 2% of the star's radius. Over the course of the 150 min pulsation cycle the new observations show that the atmosphere (a) moves inward and outward through roughly 8% of the radius and (b) expands and contracts by a factor of two. These observations were especially designed to resolve the structure of the photosphere during the brief (15 min) phase around minimum radius when the star's surface accelerates by some 300 m s^{-2} (or 30g in terrestrial terms). As a result, the most significant discovery is that the phase of minimum radius moves outwards at a speed of between 140 and 240km s^{-1}; in other words, the pulsation is a running wave and not a standing wave. There is also evidence for a weak shock front as the wave passes through the atmosphere. A paper submitted to MNRAS in 2014 has recently been published (MNRAS, 447, 2836–2851).

7. **A Candidate Young Star at Low Metallicity**: Jorick Vink reports that he and Venu Kalari and VFTS collaborators have discovered a B[e] star, designated VFTS 822, in the 30 Doradus star-forming region of the Large Magellanic Cloud. This has been classified by optical spectroscopy from the VLT-FLAMES Tarantula Survey (VFTS) and complementary infrared photometry. In a Letter in Astronomy & Astrophysics they evaluate the evolutionary status of this object and discuss its candidacy as a Herbig B[e] star. If the object is indeed in the pre-main sequence phase, it would provide an exciting opportunity spectroscopically to measure mass accretion rates at low metallicity in order to probe the effect of metallicity on accretion rates. This would provide constraints on the formation of the first stars in the Universe, at a time when the Universe was still metal free.

8. **Rotating Massive Stars with Flattened Winds**: Jorick Vink and Patrick Müller have published two-dimensional solutions for the velocity fields of rotating massive stars. Their line acceleration was obtained from Monte-Carlo multi-line radiative transfer calculations. They accounted for the effects of stellar distortion and gravity darkening, predicting a decrease of the mass-loss rate for rotating stars in comparison to the one-dimensional spherical case, in contradiction to the Maeder & Meynet formalism that is usually employed in stellar evolution calculations for rotating massive stars. Their results thus have major consequences for understanding the evolution of rotating massive stars and the origin of gamma-ray bursts.

9. **Luminous Blue Variables and Superluminous Supernovae from Binary Mergers**: In 2006 Kotak & Vink suggested that the direct progenitor stars of some supernovae are luminous blue variables (LBVs), which was totally unexpected at the time. In a recent Astrophysical Journal paper, a team involving Stephen Justham (Beijing), Philip Podsiadlovski (Oxford) and Jorick Vink proposed that LBV-supernovae and superluminous supernovae could be explained by binary mergers. The team examined evolutionary models in which massive stars gain mass soon after the end of core hydrogen burning. The post-merger stars then spend their core helium-burning phase as LBVs. The team also investigated whether such post-merger LBVs may explode successfully after core collapse. They showed that the detailed structures of these merged cores display qualitative differences to any single-star models that were calculated, making LBV merger explosions more likely.

10. **The VLT-FLAMES Tarantula Survey XVII. Physical and Wind Properties of Massive Stars at the Top of the Main Sequence**: The evolution and fate of very massive stars (VMS) are tightly connected to their mass-loss properties. Their initial and final masses differ significantly as a result of mass loss. VMS have strong stellar winds and extremely high ionising fluxes, which are thought to be critical sources of both mechanical and radiative feedback in giant ionized hydrogen regions. However, how VMS mass-loss properties change during stellar evolution is poorly understood.

    In the framework of the VLT-Flames Tarantula Survey (VFTS), Armagh astronomers Joachim Bestenlehner, Götz Gräfener, Jorick Vink and a team of European astronomers explored the mass-loss transition region (Vink & Gräfener 2012) from optically thin O to denser WNh star winds, thereby testing theoretical predictions. Joachim selected 62 VMS, an unprecedented sample of stars with the highest masses and luminosities known, and he performed a spectral analysis of optical VFTS as well as near-infrared data using a non-LTE radiative transfer code to obtain stellar and wind parameters. For

the first time, we observationally resolved the transition between optically thin O and optically thick WNh VMS winds. Our results suggest the existence of a kink between both mass-loss regimes, in agreement with recent Monte Carlo simulations. For the optically thick regime, we confirm the steep dependence on the Eddington factor from previous theoretical and observational studies. The transition occurs on the main-sequence near a million solar luminosities or a mass of 80–90$M_{\odot}$. Above this limit we find that, even when accounting for moderate wind clumping, wind mass-loss rates are enhanced with respect to standard prescriptions currently adopted in stellar evolution calculations. We also show that this results in substantial helium surface enrichment. Based on our spectroscopic analyses, we are able to provide the most accurate ionising fluxes for VMS known to date, confirming the pivotal role of VMS in ionising and shaping their environments.

11. **On the Hα Behaviour of Blue Supergiants: Rise and Fall over the Bi-stability Jump**: The evolutionary state of blue supergiants is still unknown. Stellar wind mass loss is one of the dominant processes determining the evolution of massive stars, and it may provide clues to the evolutionary properties of blue supergiants.

    As the Hα line is the most oft-used mass-loss tracer, Blagovest Petrov, Jorick Vink, and Götz Gräfener investigated Hα line formation. Blagovest found a maximum in the Hα strength at a temperature of exactly the location of the bi-stability jump. The Hα line profile behaviour is characterised by two temperature branches: (i) a hot branch where the line becomes stronger with lower temperature; and (ii) a cool branch where the line becomes weaker. The models show that this non-monotonic behaviour is related to the population of the second level of hydrogen, which becomes enhanced in comparison to the third level. This is expected to increase line absorption, leading to weaker flux for the cool branch. We also show that for late B supergiants the differences in the line between homogeneous and clumpy winds become insignificant. Moreover, we show that, at the bi-stability jump, Hα changes its character completely, from an optically thin to an optically thick line, implying that optically thick clumps should play an important role for cool stars. This would not only have consequences for the character of observed line profiles, but also for reported discrepancies between theoretical and empirical mass-loss rates.

12. **The Second Data Release of the INT Photometric Hα Survey of the Northern Galactic Plane**: Jorick Vink's former student Geert Barentsen and a group of European astronomers including Vink have published the second release of the INT/WFC Photometric Hα Survey of the Northern Galactic Plane (IPHAS). Barentsen derived the first quality-controlled and globally calibrated source catalogue derived from the survey, providing single-epoch photometry for 219 million unique sources. The observations were carried out between 2003 and 2012 to a mean depth of 21.2 (r), 20.0 (i), and 20.3 (Hα) in the Vega magnitude system.

13. **A 3D Extinction Map of the Northern Galactic Plane based on IPHAS Photometry**: Stuart Sale and a team including Jorick Vink presented a 3D map of extinction in the northern Galactic plane, derived using IPHAS photometry and using a method based on a hierarchical Bayesian model. In addition to mean extinction, differential extinction was also measured. This arises from the fractal nature of the interstellar medium. The method also provides photometric estimates of the distance, extinction, temperature, surface gravity, and stellar mass for 38 million stars. Both the extinction map and the catalogue of stellar parameters are made publicly available via http://www.iphas.org/extinction.

14. **The VST Photometric Hα Survey of the Southern Galactic Plane and Bulge (VPHAS+)**: A team of European astronomers led by Janet Drew (including Jorick Vink) have published the first VPHAS paper. VPHAS+ surveys the southern Milky Way in u, g, r, i and Hα at 1 arcsec angular resolution. Its footprint spans the Galactic latitude range from −5 to +5 degrees at all longitudes south of the celestial equator. Extensions around the Galactic Centre to Galactic latitudes of 10 degrees bring in much of the Galactic bulge. This European Southern Observatory (ESO) public survey began on 2011 December 28. It reaches down to 20th magnitude and will provide single-epoch digital optical photometry for 300 million stars.

15. **Temperaments of Young Stars**: Gráinne Costigan, Jorick Vink and collaborators from DIAS and ESO report observations of rapid variations in the rate at which young stars grow in mass. They presented a variability study of young stars over a wide range of time windows, ranging from minutes, to hours, to days, and years. In 2012 Costigan derived an *upper* limit to the timescale of these variations, finding that the intermediate (i.e. days) variability dominated over the longer time-scale (years) variability. Her new results, based on much higher cadence observations from the William Herschel Telescope now provide a *lower* limit to this variability on similar time-scales (i.e. days), thereby constraining the variability physics in a much more definitive way. She found that the extent of the variability was similar for objects ranging in mass from just 1/10th the mass of the Sun to several solar masses, suggesting that a single mode of star formation is at work over a wide range of stellar masses (MNRAS, 440, 3444–3461).

16. **Telescope Time**: Simon Jeffery reports that he has been allocated seven primary spacecraft orbits in Cycle 22 on the Hubble Space Telescope for the project 'Heavy-Metal, Extreme Chemistry and Puzzling Pulsation: Ultraviolet Clues to the Formation of Hot Subdwarfs'; the proposal was graded in the top quintile of all proposals presented to the telescope allocation panel. He has also been awarded 4 half-nights on the ESO VLT Ultraviolet and Visual Echelle Spectrograph (UVES) for the project 'High-Precision Time-Resolved Spectroscopy of the Pulstating Zirconium Subdwarf LS IV-15 116'.

    Stefano Bagnulo reports that he is PI on a proposal that was awarded four nights at the WHT to continue a spectro-polarimetric survey of asteroids. He has also been awarded a significant amount of time on the ESO VLT visual and near ultraviolet FOcal Reducer and low-dispersion Spectrograph (FORS), namely 31 hours for a spectropolarimetric survey of asteroids (PI Bagnulo) and 20 hours for a spectropolarimetric survey of white dwarfs (PI Landstreet). His PhD student, Alexander Martin, also obtained 4 nights as PI for the latter project on the Intermediate dispersion Spectrograph and Imaging System (ISIS), on the William Herschel Telescope (WHT) at the Roque de los Muchachos Observatory on the Canary Island of La Palma. Bagnulo notes that he has also been Co-I on a number of other successful proposals to use the VLT FORS

instrument with non-Armagh based PIs, the total amount of telescope time awarded involving his projects corresponding to an estimated in-kind external income of at least £0.5M.

Stefano Bagnulo also reports that PhD student Alexander Martin obtained 18 nights at the Mario Girolamo Fracastoro Mountain Station Observatory of the Catania Astrophysical Observatory (CAO) on the southern slopes of Mount Etna, Sicily, at Serra La Nave (1,735 metres above sea level). The project was to observe a number of chemically peculiar magnetic stars with the Catania Observatory's new spectropolarimeter. This has resulted in the establishment of a new collaboration with Professor Franco Leone, Head of Astrophysics in the Department of Physics and Astronomy, Catania University, and a former Research Astronomer at the CAO. Although weather conditions were not favourable, and Mount Etna erupted during the observation period (2014 June 12 to June 30), the data obtained will contribute to Martin's thesis and to ongoing tests of the efficiency of the new spectropolarimeter. Alexander Martin reports that this facility was ideal for training: although there are larger telescopes (e.g. the WHT on La Palma or ESO facilities in the southern hemisphere), the size of this telescope allowed for a unique hands-on experience. This made it possible to learn and participate in every activity associated with preparing and carrying out a night's observations, not simply controlling the camera and polarimetric optics.

Gavin Ramsay obtained 6 nights observing time on the 2.5m Isaac Newton Telescope (INT) on La Palma during 2014 October for a project examining the incidence of magnetic fields in M8–L2 dwarf stars. He also chaired the ESA XMM-Newton time allocation panel in London and Madrid in 2014 November.

New Grants Awarded

1. **EU COST Action MP 1104**: Following the application by Stefano Bagnulo and colleagues for EU funding to support a range of Short-Term Scientific Missions (STSMs) under the EU COST Action MP 1104 "Polarization as a Tool to Study the Solar System and Beyond" (see http://www. cost.eu/COST Actions/mpns/Actions/MP1104), the Observatory has accrued significant benefits in terms of scientific collaboration and advanced research, and also in PhD student training, through its involvement in this highly successful project. Principally as a result of Bagnulo's efforts, the Observatory has been accepted as the Grant Holder and administering institution for this project during the final year of this European Cooperation in Science and Technology (COST) Action, a position which involves administering the c.€140k EU project. Both the Temporary Accountant and Operations Manager were trained in the administration of this EU grant during 2014 November.

2. **Daniel K. Inouye Solar Telescope (DKIST)**: The Daniel K. Inouye Solar Telescope (DKIST), formerly the Advanced Technology Solar Telescope (ATST), was named after the late Senator Daniel K. Inouye for his long-standing support for fundamental research and discovery, particularly in astronomy. Senator Inouye (1924–2012) was the most senior U.S. senator at the time of his death, one of the longest serving senators in history, and was an enthusiastic and unwavering supporter of American science and innovation over more than five decades in his home state of Hawaii.

   Professor J. Gerry Doyle reports that, in large part through the efforts of Professor Mihalis Mathioudakis (QUB) and himself and other colleagues, and the receipt of end-year Capital funding from the DCAL in 2012/2013, astronomers in Great Britain and Northern Ireland will have a stake in the Daniel K. Inouye Solar Telescope (DKIST). The telescope will be the foremost ground-based facility for solar physics in the world for at least the next decade. A substantial fraction of the ~£2.4M funding awarded from the STFC for this project will be used for advanced detector development in partnership with Andor Technology (Belfast).

   The provision of initial funding for this project in 2013 March enabled the Observatory to make a key contribution to a consortium of institutions led by Queen's University Belfast, Armagh Observatory, University of Glasgow, Northumbria University, University of Sheffield, University of St Andrews, University of Warwick and Andor Technology plc (subcontractor). As a result, following submission of a project proposal, the award of approximately £2.44M can now be confirmed from the STFC.

   The majority of the requested funding was to support detector development work by Andor (ultimately of value to the company for the high-specification cameras required in various areas of medical imaging and diagnosis), and with the balance of funding going to the different university groups to support two key science work packages: (1) to extend techniques developed from the Interferometric Bidimensional Spectropolarimeter (IBIS) at the NSO/Dunn Solar Telescope in New Mexico (http://nsosp.nso.edu/dst/) and the Swedish Solar Telescope (SST) (http://www.solarphysics.kva.se/) for the DKIST, and (2) to develop forward modelling tools and observing proposals in support of UK involvement in the DKIST. Considering that Andor will contribute c.£1.1M towards detector development, with a further c.£1.0M coming from the different consortium members together with a further in-kind contribution from Mullard Space Sciences Laboratory (University College London), the total value of this important project is approximately £4.5M. Gerry Doyle also notes that following a meeting of UK Consortium members at the University of Warwick during 2014/2015, they have agreed a work schedule and work on the detector design has started. The aim is to deliver a prototype to DKIST towards late-summer 2016 and hand-over of the production camera approximately one year later.

   The Observatory's involvement with DKIST provides a very good example of how relatively small amounts of Northern Ireland government investment in research astronomy, in this case through QUB and Armagh (via DCAL), can lever substantial inward investment into Northern Ireland whilst supporting the fundamental research goals and international links that underpin the success of both the Observatory and QUB on the international stage.

3. **STFC Consolidated Grant ST/M000834/1**: The hard work of the Research Astronomers earlier this year (and particularly that of Gerry Doyle who led the proposal) in preparing the Armagh Observatory's STFC Consolidated Grant Application 2015–2018, was rewarded by a very successful outcome, namely two PDRA positions. The two funded PDRA projects are (1) 'The Exotic Star Zoo: Common-Envelope Evolution, White-Dwarf Mergers and Pulsating Helium Stars', led by Simon Jeffery; and (2) 'Trojan Asteroids: Chroniclers of the Solar System' led by Apostolos Christou. Three other PDRA proposals were recommended for support as Fundable, but were unfunded owing to lack of STFC funding in this highly competitive grant round. It is noteworthy that the general comments on the application made by the STFC panels included the following:

> The proposal brings together a range of projects concerning the near Universe that exploits the good track record and leadership areas of the applicants. A general strength of the proposal is a close connection between efforts in observation and theory. Armagh Observatory, while being a relatively small institute, maintains a high level of scientific productivity and attracts collaborators and visitors with excellent international profiles. The observatory has a long established and very strong track record in outreach and promoting public engagement in science.

In addition, the STFC's assessment of the Observatory's programme of Science in the Community (in STFC terms, 'Public Engagement') reads:

> The applicants have an excellent track record in Public Engagement and this is demonstrated by the wide range and scope of the activities both on and off site. Given that they will engage with all sectors of society, which also includes science/community partnerships. The proposal includes a wide plethora of activities bringing cutting edge science to the wider public/schools, promoting access to culture arts and leisure more broadly as well as a comprehensive social inclusion programme. Overall an excellent PE plan.

4. **EU SPACE AWARENESS (EUSPACE-AWE)**: The Director's success with Libby McKearney in delivering the UK component of the EU-UNAWE FP7 outreach programme has led to Armagh Observatory being accepted as a participating Dissemination Node in the Horizon 2020 programme 'EU Space Awareness (EUSPACE-AWE)'. This project began in March 2015. Key participants are the University of Leiden (The Netherlands), the Haus der Astronomie (Heidelberg, Germany), University College London and The Open University (UK), the IAU Office of Astronomy for Development (South Africa), and a number of other organizations located in Belgium, Greece and Portugal. EUSPACE-AWE is a 3-year project with key objectives overlapping those of the EU-UNAWE programme. Owing to the large number of participating institutions, and a similarly long list of participating Dissemination Nodes, the total amount of funding to each Dissemination Node is relatively small, in the Observatory's case equating to approximately one month's FTE activity or c.€10k.

5. **Leverhulme Artist in Residence Award**: The Director also reports that his application to the Leverhulme Trust, led by artist Dr Sally Walmsley, to support her work as Artist in Residence in the Observatory for a period of ten months during 2015 was successful. The value of the award is £14.8k, and the work began in February 2015.

6. **GAIA Travel Grant**: Apostolos Christou reports that he obtained a small grant (£0.5k) from the European Science Foundation's 'Gaia Research for European Astronomy Training' (GREAT) Research Networking Programme.

Visitors

Research Visitors During Calendar Year 2014 In addition to visitors coming to Armagh as part of the seminar programme or for specific workshops or conferences, a steady flow of research visitors come to Armagh every year to collaborate with staff at the Observatory on joint research projects. During 2014, more than 20 research visitors came to Armagh to participate in joint research projects.

Distinguished Visitors During Calendar Year 2014

1. **Ministerial Visit, 2014 February 20**: The Minister for Culture, Arts and Leisure, Ms Carál Ní Chuilín MLA, visited the Planetarium and the Observatory on the morning of 2014 February 20.

2. **Visit by Professor Patrick Prendergast, Provost, Trinity College Dublin, 2014 March 7**: The Provost of Trinity College Dublin visited the Observatory on the afternoon of 2014 March 7 as part of a wider visit to the City of Armagh hosted by Armagh City and District Council.

3. **Visit by Delegation from Tajikistan; the CCBS/GIZ Study Tour of Ireland/Northern Ireland, 2014 April 29**: Among the projects undertaken during 2014 April/May by the Armagh-based Centre for Cross Border Studies (CCBS; see http://www.crossborder.ie) was one to introduce a group of Tajikistani delegates to aspects of cross-border cooperation in Ireland that would be relevant to the work being done in the Tajikistan/Afghanistan border region. The group included Mr Saidrahmon Nazriev (Tajikistan Deputy Minister for Economic Development and Trade), senior public officials and experts in cross-border trade and economic development from across Europe and the Tajikistan/Afghanistan Border region, as well as CCBS staff members Anthony Soares (Research and Policy Manager) and Thomas Haverty (Research Intern). The Observatory's contribution to this visit to Armagh was to host on the evening of 2014 April 29 a tour of the Observatory.

4. **Visit by Former Members of Management Committee**: Emeritus Professor Derek McNally (University of Hertfordshire), a former General Secretary of the International Astronomical Union and former member of the Management Committee, and Dr Fred Byrne (Queen's University Belfast), the previous Deputy Chair of the Management Committee, made an informal visit to the Observatory on 2014 October 1.

5. **Visit by Michael D. Higgins, President of Ireland, 2014 July 28**: The President of Ireland, Professor Michael D. Higgins, visited the Observatory together with his wife Sabina on the afternoon of 2014 July 28 as part of a visit to Armagh that included the delivery of the opening address to the John Hewitt Summer School, a civic reception in The Palace, Armagh, hosted by the Lord Mayor, Councillor Mrs Cathy Rafferty, and tours of the Armagh Observatory and the Armagh Public Library.

Meteorological Readings at Armagh The Observatory's meteorological archive contains the longest continuous daily climate series from a single site in the UK and Ireland, and one of the longest in the world. Understanding the detailed processes that drive climate change, for example the variable Sun and other astronomical factors, the changing composition of the Earth's atmosphere and the varying circulation patterns of the Earth's oceans and atmosphere, and how they interact one with another to produce the observed monthly, seasonal and annual weather records of the UK and Ireland is a matter of strategic importance for Northern Ireland. This is especially the case when, as now, it appears that the Earth's climate system is entering a period of rapid climate change.

The Observatory's climate station has been continuously maintained since 1794 December with readings currently taken by the Grounds and Meteorological Officer and by other staff every day at 09:00 (GMT). Calibration of the Armagh data by former Research Astronomer John Butler and colleagues has enabled researchers and government agencies to use the Armagh series for reports and research into global warming and to assess how global climate change has affected Northern Ireland in the past.

Each month the Observatory's meteorological readings are uploaded to the 'climate' web-site (see http://climate.arm.ac.uk/calibrated.html), which provides a freely available record of the calibrated data for researchers, students and members of the public. The calibrated data include daily maximum and minimum temperatures; rainfall; wet-bulb and dry-bulb temperatures; humidity; sunshine hours; and soil temperatures at two depths. In addition, there is an important weather commentary, which although scanned and placed on the Observatory's climate web-site has not yet been coded in its entirety in a suitable machine-searchable format. For full details of the meteorological records, see http://climate.arm.ac.uk/.

The Armagh climate record is a most important part of Northern Ireland's scientific heritage. The data originate from a site which over the last two hundred years has been far less affected by urban pollution and local environmental change (e.g. the 'heat island' effect) than many other urban sites in Ireland, Great Britain and continental Europe for which similarly long records exist. Moreover, owing to Armagh's proximity to the Atlantic ocean, which generally moderates the temperature in Ireland and leads to a significant East-West gradient in climate parameters across the British Isles (and sometimes across Ireland as well), the record can be an indicator of changes in the North Atlantic. Insofar as it is the great oceans of the world which drive the main quasi-periodic changes of the Earth's weather system and provide the principal heat reservoirs on which climate stability depends, the Observatory's unique historic weather records, supplemented by continuing daily observations, are an important resource to aid greater understanding of the causes of climate change, and especially how climate change affects the UK and Ireland, and Northern Ireland in particular.

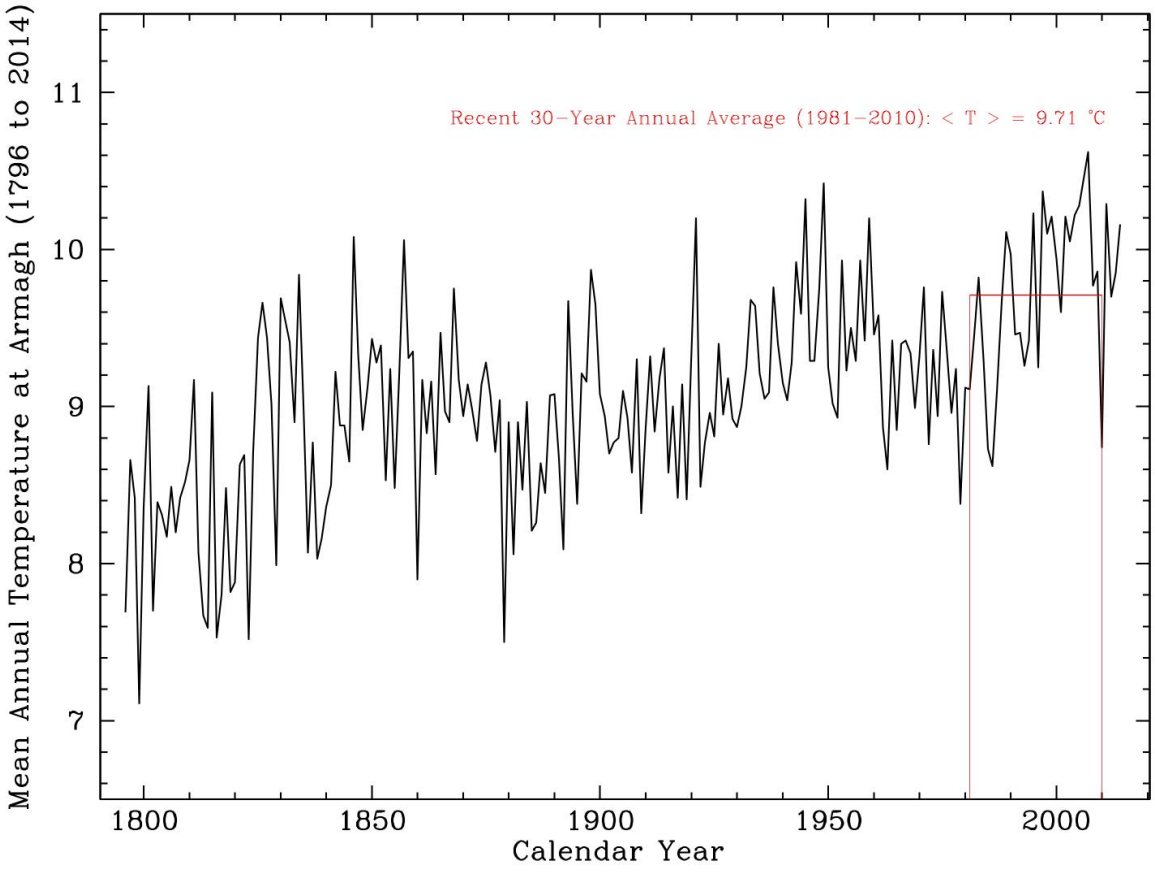


Figure 1: Mean annual temperature (Celsius) at Armagh, 1796–2014.

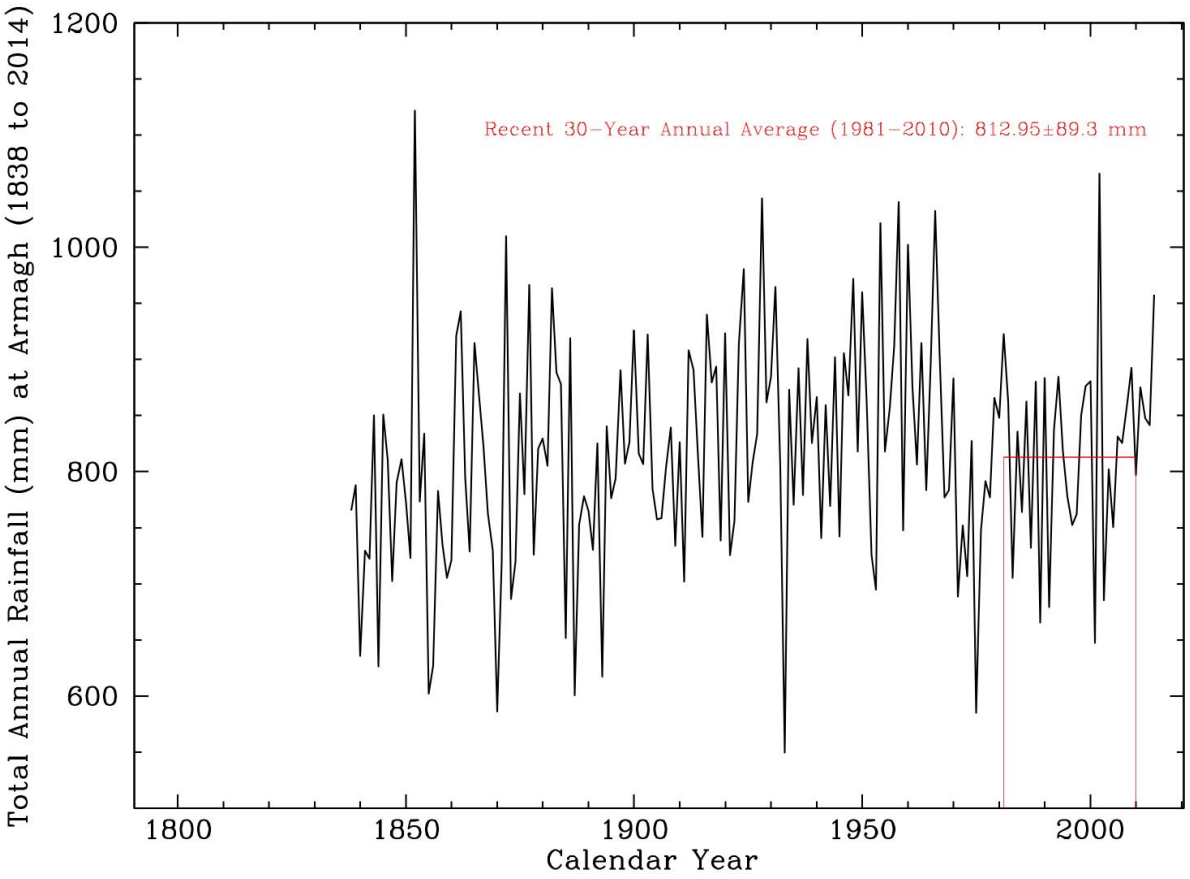


Figure 2: Total annual precipitation (mm) at Armagh, 1838–2014.

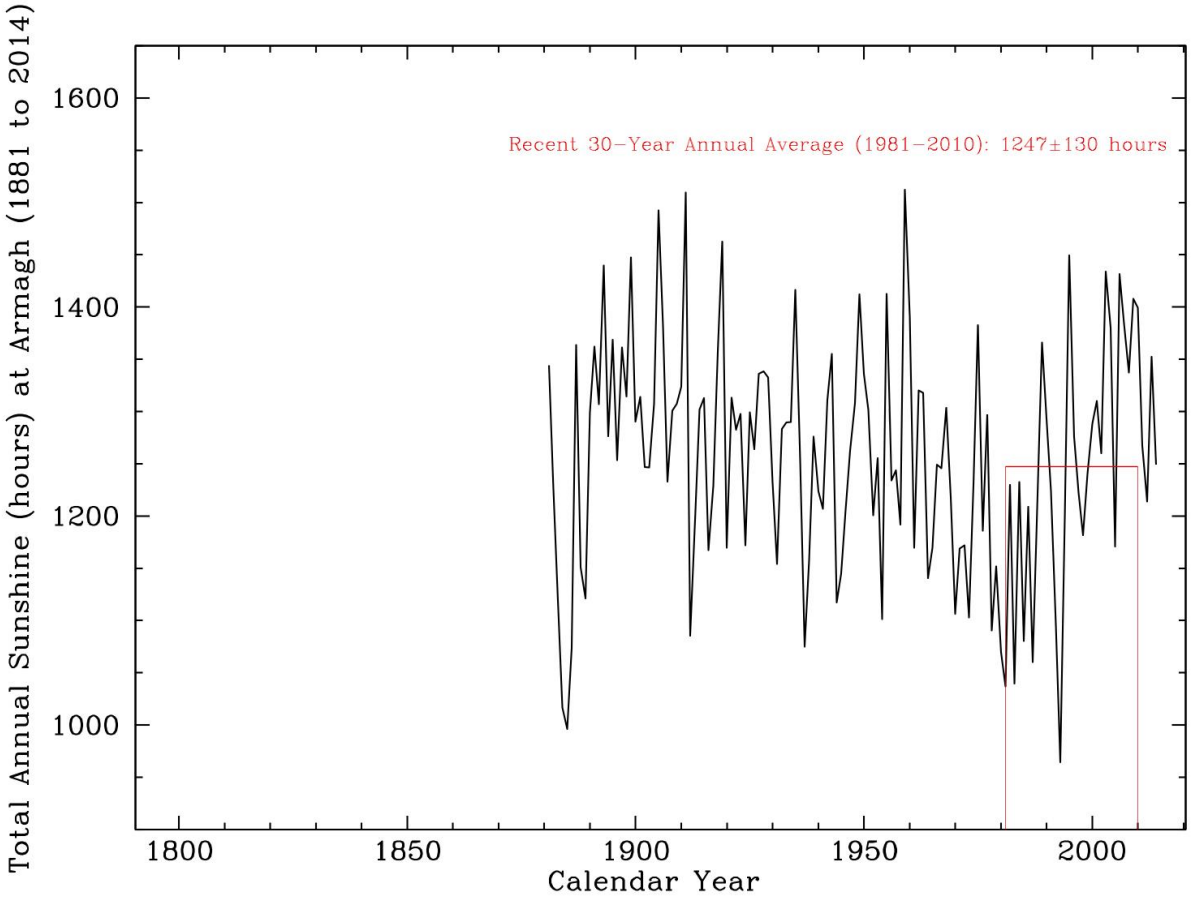


Figure 3: Total annual sunshine (hours) at Armagh, 1881–2013.

Figures 1, 2 and 3 (see pp. 14–15) provide graphs updated to end-2014 of the mean annual temperature at Armagh, the total annual rainfall and the total number of sunshine hours. Recent data referring to these parameters are shown in Table 3 (p.17). Such data provide objective information on the trends and variability of Northern Ireland's climate in response to global climate change over the past two hundred years and more. The Armagh Observatory's climate station thus provides 'ground truth' to inform programmes of education, learning and research in schools and universities, as well as invaluable data for meteorologists, environmental scientists and decision makers on the impact of climate change on Northern Ireland and the island of Ireland as a whole.

It is noteworthy that there is a very strong public interest in the causes and effects of climate change. Factors such as the variation of Northern Ireland's weather versus year and/or season, evidenced for example by year-on-year changes in average daily temperatures, precipitation, sunshine hours, storminess etc., and the impact of possibly more frequent extreme weather events on human activity in areas such as the environment, public health, the economy and the nation's built heritage, all attract attention and have important roles to play in helping to inform strategic policy decisions involving climate change.

As a result, the media too is very interested in all aspects of climate change, whether involving the past, present or future. For all these reasons the Armagh data are subject to increasingly close scrutiny and use by researchers in other institutions; and the Observatory's monthly weather reports are invariably published in one or another form in the mass media. The data, all of which are publicly available (see http//climate.arm.ac.uk/), contain valuable information on how Northern Ireland's weather patterns are changing as a result of climate change and provide a long historical baseline against which to judge the significance (or otherwise) of observed short-term variations in Northern Ireland's climate and how they compare with climate change observed world-wide.

Weather Notes for Calendar Year 2014 Taking the year as a whole, 2014 can be described as wetter and warmer than average with about average sunshine. This description, however, masks some rather large in-year variations, and with the monthly averages for each of the principal climate-change parameters varying markedly from one month to another month and in comparision with corresponding results for prior years.

For example, the Meteorological Winter (2013 December, 2014 January and 2014 February) was the wettest for 20 years and the sixth wettest Winter at Armagh since records of precipitation began in 1838. Winter 2013/2014 was, however, slightly sunnier than average, and much warmer than both the long-term (1796/1797–2010/2011) and the most recent 30-year (1981/1982–2010/2011) average Winter temperatures at Armagh.

Similarly, the Meteorological Spring (2014 March, April and May) was much warmer than average, the fifth warmest on record, but duller than average with the smallest number of hours of strong sunshine since 1998, and with about average total precipitation.

Summer 2014 (2014 June, July and August) was rather warmer than average, with slightly more than the most recent 30-year (1981–2010) average hours of strong sunshine and slightly more than the most recent 30-year (1981–2010) average precipitation.

Autumn 2014 (2014 September, October and November) was by contrast slightly duller than average, and both warmer and wetter despite an exceptionally dry September, the second driest September on record and the driest September at Armagh for 120 years.

With twelve months in a year, and so many potential weather records or extrema to be considered, there are always 'interesting' months and weather extremes to report. A question of great scientific interest is whether the climate is becoming more variable in recent years, as suggested by some climate-change models, or whether our increased focus on climate change and the steadily increasing size of the climate-change database (a statistical population effect) is producing only an apparent increase in climate variability. Figures 1, 2 and 3 also demonstrate a further complication that must be borne in mind, namely that each of these climate-change parameters (temperature, rainfall and sunshine) is subject to various long-term trends (which are relatively small in the case of recorded rainfall at Armagh) and short-term (i.e. multi-decadal) oscillations. This highlights the importance of maintaining the accuracy and precision of Armagh's unique climate series, which typically extend back in time 50 or 100 years longer than the corresponding instrumental records from other sites.

Among the interesting weather extrema recorded at Armagh during 2014 were: January (wettest since 2008); February (wettest since 2002, the sunniest since 2008); March (slightly warmer and slightly duller than average, with about average rainfall); April (exceptionally warm, the third warmest April at Armagh since daily temperature measurements at Armagh Observatory began in December 1794); May (warmest since 2008, and exceptionally dull, the dullest May for at least 129 years — that is since at least May 1885 — and either the dullest or the second dullest May recorded at Armagh since daily measurements of strong sunshine began in April 1880); June (driest since 2006, much warmer than average); July (drier and much warmer than average); August (coldest for 20 years, with the night of 23/24 August the coldest ever recorded at Armagh; and sunnier than average but much wetter, the wettest August since 2008); September (driest for 120 years, the second driest September on record at Armagh, warmer and slightly duller than average); October (wetter and warmer than average, the warmest Halloween day on record, that is since records of maximum and minimum daily temperatures began in 1843); November (much wetter than average, the fifth wettest November at Armagh since daily rainfall records began in 1838); and December (colder than average, with the night of 11/12 December the coldest night recorded at Armagh for 21 months, that is since 2013 March 12).

Isotopic Composition of Rainwater The Observatory has continued to collect rainwater samples during 2014 and remains a member of the international Global Network of Isotopes in Precipitation (GNIP) programme, a network of rainwater isotope-composition stations led by the Vienna-based International Atomic Energy Agency (IAEA). The Armagh Observatory's GNIP code is 0391301.

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (2014)	5.20	5.39	6.88	10.48	12.09	14.72	16.74	14.22	13.77	10.68	7.02	4.49	10.16
Temperature (2013)	5.01	4.35	3.33	7.42	10.60	14.08	18.23	16.16	13.77	11.70	6.49	6.65	9.85
Temperature (2012)	6.29	6.83	8.92	7.08	11.17	12.92	14.38	16.23	12.72	8.60	6.20	5.00	9.72
Temperature (2011)	3.47	6.86	6.76	11.75	11.66	12.84	14.90	14.53	14.15	11.51	9.40	5.56	10.29
Average Temperature (1981-2010)	4.71	4.92	6.67	8.50	11.16	13.86	15.74	15.38	13.25	10.12	7.02	4.93	9.71
Std Dev. (1981-2010)	±1.5	±1.5	±1.0	±1.1	±0.9	±1.0	±1.1	±1.2	±0.9	±1.4	±1.3	±1.6	±0.5
Average Temperature (1795-2010)	4.12	4.61	5.78	7.87	10.57	13.39	14.83	14.59	12.50	9.43	6.17	4.58	9.06
Sunshine (hours)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sunshine (2014)	41.3	87.3	86.9	168.9	104.2	155.3	148.7	151.7	101.8	90.8	58.9	53.2	1249.0
Sunshine (2013)	33.1	75.0	52.0	169.0	179.8	174.0	228.1	117.7	95.0	105.8	78.7	44.3	1352.5
Sunshine (2012)	45.3	31.0	120.6	142.7	185.9	87.2	107.7	154.6	123.8	90.6	67.6	56.7	1213.7
Sunshine (2011)	71.8	74.6	119.5	194.0	182.3	132.2	121.3	118.6	91.7	59.2	74.7	28.7	1268.6
Average Sunshine (1981-2010)	46.40	69.12	98.10	142.81	173.28	144.26	137.07	133.37	114.02	90.15	58.36	40.45	1247.4
Std Dev. (1981-2010)	±11.9	±18.2	±23.9	±29.2	±35.0	±35.5	±40.7	±34.0	±20.4	±14.9	±15.5	±12.0	±130.8
Average Sunshine (1881-2010)	49.76	70.40	110.07	156.80	189.56	173.88	146.70	143.49	121.66	94.19	64.10	40.85	1361.5
Precipitation (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation (2014)	107.05	107.05	66.90	46.20	60.90	36.60	48.65	129.70	3.55	103.10	149.20	98.95	957.85
Precipitation (2013)	86.15	68.20	90.45	54.60	76.00	52.45	54.70	39.10	49.95	129.25	38.25	102.40	841.50
Precipitation (2012)	68.00	31.75	16.90	46.65	50.55	146.85	105.80	88.80	86.70	87.40	47.00	71.30	847.70
Precipitation (2011)	32.15	100.85	51.10	19.65	68.90	74.35	33.00	46.40	91.15	182.75	91.40	83.15	875.15
Average Precipitation (1981-2010)	74.55	54.07	65.60	57.66	58.09	58.44	62.52	76.41	68.07	85.63	74.68	77.23	812.95
Std Dev. (1981-2010)	±31.4	±33.8	±24.3	±28.9	±31.6	±25.4	±31.8	±37.8	±35.9	±37.1	±37.4	±31.0	±89.3
Average Precipitation (1838-2010)	72.81	54.47	55.38	53.27	58.93	63.20	73.70	81.89	69.59	80.22	73.40	77.44	814.29

Table 3: Average weather conditions at Armagh, based on the Armagh Observatory's instrumental record commencing 1794 December. Shown are average temperature (Celsius), total sunshine (hours), and total precipitation (mm); each versus calendar month and year. Since the start of the maximum/minimum temperature series, in August 1843, the average daily temperature has been conventionally defined by the formula $T = (T_{max} + T_{mix})/2$. Sunshine hours for 2011 December are slightly under-reported owing to a technical difficulty with the instrument, but it was still a very dull month. Another under-reporting of sunshine hours affected the Observatory's data for 2010 December, owing to frost on the Campbell-Stokes sunshine recorder. Such examples illustrate the uncertainties underlying the raw scientific data on which depend a correct interpretation of long-term climate records, whether of trends from a single site such as Armagh, or from regional, country-wide or global averages.

Biodiversity and Sustainable Development The Grounds and Meteorological Officer, Shane Kelly, reports that the Observatory Grounds and Astropark comprise a mixture of habitats with an impressive variety of flora and fauna. Continual monitoring may be showing seasonal changes in biodiversity due to climate and events. One such event that has affected the diversity of the site is the almost complete eradication of the rabbit population by myxomatosis in summer 2014. This has proved to be both detrimental and beneficial to biodiversity.

Thus, species such as the fox and buzzard, which would be active around and over areas where rabbit activity was greatest, have not been spotted in a while. However cats, which are a pest species on the grounds, have all but disappeared because there are no young rabbits for them to worry. This has taken the pressure off other species on the ground, since cats have a proclivity to kill anything they can. The pygmy shrew population was under stress as a result of feline predation with many shrews discovered headless. Interestingly the summer of 2014 showed an increase in butterflies at the same time as the rabbits died off.

Bird populations appear to be the same as usual apart from buzzard sightings as explained above. A few notable points include groupings of up to half a dozen bullfinches, which are probably family groups, and large groupings of finches towards the end of the year with as many as sixty finches of different types flocking. Most notable of all was the sighting of a jay in the Yew tree at the bottom of the driveway. This bird is not often seen in Northern Ireland. A dog walker has also photographed a dead jay in the woods. Finally treecreepers have been spotted on the library wall. Trees on the grounds do not seem to be showing signs of disease. The ash trees have been monitored since the Chalara ash dieback and so far they appear unaffected.

Dog fouling on the grounds has become an issue with some individuals completely ignoring current signage. Temporary signage with a sterner request to clean up after your dog is being discussed.

Part of a future plan for the grounds is to install educational panels so that people are aware of what flora and fauna are on the grounds and to attain some sort of conservation status for the grounds as they now appear to be under threat of encroachment owing to a variety of external factors.

The Armagh Planetarium — Operating Review 2014/2015

Mission Statement

Armagh Planetarium's mission is "to advance and promote the knowledge and understanding of astronomy and related sciences to all members of the community". We aim to make our organisation the destination where every primary school child in Northern Ireland experiences the mysteries of cosmos. This accords with the strategic focus of the Department of Culture Arts and Leisure (DCAL) whose overall vision is for "a confident, creative, informed, and vibrant community." Blending these statements together has led to the Planetarium positioning itself as a place where impressionable young minds can be encouraged to tackle the challenges and rewards of careers in Science, Technology, Engineering and Mathematics (STEM). This STEM agenda is being embraced and promoted all over the world by those governments that are aware of the impelling need to enhance the competitiveness of their workforce in a technologically sophisticated business environment.

Armagh Planetarium brings the exciting world of astronomy to audiences of all ages from nursery to seniors. Since opening in 1968 the Planetarium has stayed in the forefront of science education by adapting to the needs of our audiences, offering content that is both up to date and stimulating. The Planetarium's educational programme not only covers curriculum material but also introduces a broader range of fascinating topics to promote a deeper understanding of basic astronomy. Interactive learning experiences of astronomy are encouraged for all members of the community, and especially visiting school groups. Resources are provided for teachers on our website (www.armaghplanet.com), including factsheets, videos and informed commentary on the latest astronomical news in our Astronotes blog.

Armagh Planetarium works with Queen's University Belfast to provide accredited courses in astronomy for teachers and adults. From inception, the Planetarium has responded to a steady stream of astronomical queries from the public and media. Armagh Planetarium is world-renowned as an innovative centre of excellence in promoting the public understanding of science.

Governance and Accountability, Key Performance Indicators 2014–2015

Governance

A Bi-annual Assurance Statement is provided to DCAL. The objective of this is to provide assurance to DCAL's Accounting Officer that a sound system of internal control and governance is in place. Performance, risks and policy issues are also discussed at quarterly Accountability meetings.

Alignment of Planetarium programme with government priorities

The Northern Ireland Executive, through the Programme for Government, has identified five key strategic, complementary priorities. Particular commitments included in the Programme which have been taken into account in planning work at the Planetarium include:

- To increase uptake in economically relevant Science, Technology, Engineering and Mathematics (STEM) places; and
- To develop and implement a Strategy to reduce economic inactivity through skills, training, incentives and job creation.

The major thrust of the Planetarium's work supports the Science, Technology, Engineering, Arts and Mathematics (STEAM) agenda as minds are developed and innovators of the future are trained.

The Planetarium's business plan has also been focused on promoting equality, tackling poverty and addressing social exclusion. Programmes are directed towards those from areas where there is greatest deprivation. Exciting and educationally stimulating experiences are provided both on and off site for pupils from deprived areas, in line with DCAL and government priorities.

Visitor Surveys and Key Performance Indicators

In August 2014 a survey was carried out to increase and improve the information available to the Planetarium about its visitors. The findings showed that a large proportion of customers visit on more than one occasion. The Planetarium has the reputation of being a good place for a family day out. Most customers were happy with their experience and rated the shows and workshops very highly.

It was clear that customers enjoyed the exhibition area but some felt that it needed to be refreshed and asked for more interactive exhibits. Views on the Coffee Dock were mixed – the majority thought it was good, but only for snacks. Many felt there was opportunity for more investment. It was clear that the Planetarium staff are one of its most valuable assets.

Area	Description	Target	Actual
Visitors	Total number of visitors by 31 March 2014	44,000	50,445
	Percentage of visitors from schools on the Extended Schools Register or with high Proportion of Free School Meals by 31 March 2015 (PETPSE)	20% of total	31% (pupils from schools on Extended Schools Register 47% (pupils from schools with Free School Meals entitlement > 20%)
	Number of hits to www.armaghplanet.com by 31 March 2015	1 million	1.6 million
	Number of participants in STEAM programmes by 31 March 2015	1,600	9,796
Outreach	Number of participants at outreach events by 31 March 2015	15,000	16,052
	Number of events targeted at areas of multiple deprivation by 31 March 2015 (PETPSE)	6	4
Resources	Self-generated income (through sales and admissions) as a percentage of total income by 31 March 2015	25%	28.6%
	Payments processed within 10 days	90%	97%

Table 1 – Key Performance Indicators 2014-2015

The targets set in the 2014–2015 Business Plan are the key performance indicators (KPIs) for the Planetarium; see Table 1. The target for visitors has been exceeded by 15%.

Schools report that the cost (in terms of time and transport) of trips is becoming very difficult to meet as their budgets are reduced. People in Northern Ireland typically have the lowest disposal incomes of any part of the UK[1]. This means they do not feel that they have the resources to allocate to external visits, no matter how worthwhile. As a result, the Planetarium is likely to be operating in a very challenging and competitive environment for the foreseeable future.

Theatre tickets provide the main source of income for the Planetarium. To help maintain visitor numbers, the price of tickets for the general public has remained the same for many years. The price of tickets for school bookings was increased in 2014. Special promotions have been used over the summer period to increase the number of tickets sold. This has proved to be successful. During 2014/15 the number of ticket sold increased by 4.9% and income from ticket sales increased by 13%. Prices of items for sale in the shop were also increased throughout the year by approximately 10%. This resulted in an increase in income from sales of 15.7%.

The target for the number of events held in areas of multiple deprivation in 2014/15 was not achieved. This was largely due to a reduction in number of staff available to go off site for events.

Activity Summary: Highlights of 2014–2015

Events

During 2014–2015 the Planetarium delivered a range of events on and off site. It is important for the Planetarium to retain its position as a centre of astronomical expertise and as a recognised place to learn about the exploration of the cosmos.

QUB Adult Education Programme

For the past eight years the Planetarium has offered adult education courses in astronomy at Queen's University Belfast. These courses (day and evening) have had been attended by a steady stream of interested adults. Very positive feedback has been provided by the attendees. This is an essential community service and the Planetarium will continue to deliver such courses for as long as there is demand for them.

[1] http://www.ons.gov.uk/ons/rel/regional-accounts/regional-household-income/spring-2014/sty-gdhi-2012.html

Staffing Matters

An Education Support Officer was appointed in June 2014, however the staff complement (9.5 staff) dropped to its lowest for several years. This makes it difficult to maintain an operation six days a week, (seven during the summer). The use of temporary staff has been essential. It is likely that staffing levels will be reviewed as part of the restructuring exercise being taken forward by the Board of Governors in 2015/16.

Several staff were trained in Child Protection and Recruitment and Selection during 2014/15.

Outreach

Outreach efforts are focused on groups situated in areas of high deprivation. However, due to staff shortages throughout the year, only four events were held rather than the six planned.

In the dark winter months the Planetarium runs free public telescope nights for interested amateurs to come and see the Planetarium's telescopes in action. Regrettably the weather occasionally makes observing very difficult, or impossible. When this happens, the theatre is used to project the artificial night sky on to the dome.

Technical Matters

Armagh Planetarium's Digistar 5 (D5) system is one of the most advanced planetarium projection systems available. It provides an excellent and very flexible software and hardware combination for creating shows in-house by the Planetarium's Creative Director. Armagh Planetarium's systems are at the leading edge of Planetarium development and operates one of only two Digistar 5 systems in the UK.

The Digistar 5 projection system has received continual software upgrades, more than any previous year. These upgrades facilitate improved system reliability, and quality of show production. All of these help to enhance the visitors' experience. Two additional sets of back up hard disc drives have also been acquired to reduce the risk of failure.

The newest projection systems allow even more detail to be projected on Planetarium theatres' domes. These are '8K' systems and we hope to move to such a system when the Planetarium's projectors are next upgraded.

Displays and Shows

The Planetarium's existing displays are nine years old, which makes them relatively aged given the new information arriving from space probes and telescopes. A good example is the discovery and announcement of new extra solar planets, which are being recorded on a monthly basis and the new Martian exploration robots. New shows are planned as usual for the summer visitor, and the popular in-house *ArmaghGeddon* rollercoaster show will be presented. *Little Yellow Star* remains very popular with very young visitors.

Promotion: Advertising and Marketing

The Planetarium faces difficulties with marketing as the budget is not large enough to sustain a planned marketing campaign. Marketing material was provided to Armagh City & District Council and the Northern Ireland Tourist Board. They use the Planetarium as an attraction for visitors and tourists to Armagh City. 'Groupon' promotions have been used to increase visitor numbers. The special rates attract visitors who would not normally travel to Armagh.

Online Presence

The Planetarium website is designed and managed in-house. It is used to advertise the Planetarium's many activities. The most successful element of the online presence is the *Astronotes* blog which is produced by the Planetarium's Science Education Director. Articles are written by the Education staff each month. This performs a double function - it maintains an up to date electronic presence and allows staff to refresh their knowledge and keep up to date as they research articles for publication. It is also a training method, helping staff keep abreast of the latest developments. It is a very powerful and economical way to communicate with a large international audience, as is our Twitter account, which has over 4,500 followers.

BBC Stargazing Live Programme

The March 2015 BBC astronomy programme *Stargazing Live* provided further evidence that the mainstream broadcasters continue to see the drawing power of astronomy based programmes for a public hungry for information. Ever since the launch of the Hubble Space Telescope, and the impressive images that it captured of deep space and Solar System objects, the public appetite for such spectacular images has grown exponentially. It is one thing to appreciate the symmetry and beauty of a mathematical expression that describes the motion of small moons orbiting Saturn; it is quite a different experience to see them, and their elliptical retrograde orbits, captured by the cameras on the Cassini spacecraft. Continuing the Planetarium's collaboration with the BBC and amateur colleagues, staff took part in events at the Planetarium and at Ballyhackamore Public Library.

Forward Look

The Planetarium faces significant budgetary pressures during 2015/16 as a result of centrally applied reductions to grant funding. Changes are also expected to the governance arrangements and senior management structures following the restructuring exercise initiated by the Board of Governors.

The Planetarium will, however, continue to deliver a high quality service to its visitors. Additional ways of promoting the activities available at the Planetarium, without incurring any great costs will be pursued. Special events have been planned throughout the year, including *Jedi Academy* and free open nights in the winter months. New shows have been purchased and will be launched before the busy summer period. The Planetarium will therefore continue to fulfil its mission "to advance and promote the knowledge and understanding of astronomy and related sciences to all members of the community".

Armagh Observatory and Planetarium — Financial Review for the Year Ended 31 March 2015

Pension Scheme Disclosures

The Armagh Observatory and Planetarium provide pension benefits to staff through the Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) pension scheme, which is a statutory defined benefit scheme where employees are promised a specific benefit in the future regardless of the current or future investment performance of the scheme. Under the accounting rules relating to defined benefit pension schemes, Financial Reporting Standard (FRS) 17, the Observatory and Planetarium are required to disclose in their accounts their respective share of the overall scheme surplus/(deficit) and the estimated costs of providing retirement benefits to employees in the accounting periods in which the benefits are earned by the employees, and the related finance costs and any other changes in value of pension assets and liabilities. Details of the disclosures for the Observatory are shown in pages 51 to 53, note 20 and for the Planetarium in pages 66 to 68, note 19.

FRS17 pension scheme deficits in the corporation's balance sheets decreased significantly over the year. At 31 March 2015 the Observatory deficit was £579,000 (2014: £482,000) and the Planetarium deficit was £681,000 (2014: £565,000). The main reasons for the change in deficits is likely to have been due to changes in the key assumptions used to calculate the present value of liabilities, and changes to the notional value of assets due to the returns achieved on the fund's assets over the accounting period.

The overall result on the Statement of Financial Activities for 2014/2015 after pension adjustments for the Observatory is a deficit of £97,944 (page 39) and for the Planetarium is a deficit of £116,581 (page 56). The operating result for the years 2012/2013, 2013/2014 and 2014/2015 can be computed as follows:

Reconciliation of net movement of funds after pension adjustment with the operating surpluses for 2012/2013, 2013/2014 and 2014/15

Armagh Observatory	**2014/2015**	**2013/2014**	**2012/2013**
	£	**£**	**£**
Net movement in funds for the year after pension adjustments	(97,944)	73,979	16,172
Reversal of pension scheme adjustments:			
Pension service cost	141,000	175,000	129,000
Employer's pension contributions	(114,048)	(123,135)	(111,665)
Pension scheme finance (income)/costs	(89,000)	(60,000)	-
Actuarial loss/(gain) on pension scheme	159,000	(66,000)	(36,000)
Operating (deficit)/surplus before pension scheme adjustments	(992)	(156)	(2,493)

Armagh Planetarium	**2014/2015**	**2013/2014**	**2012/2013**
	£	**£**	**£**
Net movement in funds for the year after pension adjustments	(116,581)	161,187	(118,654)
Reversal of pension scheme adjustments:			
Pension service cost	63,000	62,000	51,000
Employer's pension contributions	(54,198)	(54,789)	(52,821)
Pension scheme finance (income)/costs	(37,000)	(18,000)	14,000
Actuarial loss/(gain) on pension scheme	145,000	(157,000)	88,000
Operating surplus/(deficit) before pension scheme adjustments	221	(6,602)	(18,475)

Armagh Observatory

Operating result

After adjusting for pensions, the overall result for the year was a deficit of £992 (2013/2014: deficit £156), which was transferred to unrestricted funds leaving a balance of £79,044 (2013/2014: £80,036) in unrestricted funds before pension adjustments (page 48, note 13). Restricted funds of £7,293 remain unchanged from the previous year.

Income

Details of income received are on page 43, note 2.

The baseline recurrent funding from DCAL was £983,656. DCAL provided additional in-year funding of £53,500 for finance and accounts assistance, health and safety matters and miscellaneous technical equipment. DCAL also provided capital grant-in-aid of £15,000 (2013/2014: £25,000) for a boiler, and computer and miscellaneous equipment; and further in-year capital grant-in-aid of £135,000 (2013/14: £75,000) for collaborative research projects and a van.

Income from research and other grants decreased during the year to £256,502 (2013/2014: £322,591). The STFC Consolidated grant continued from April 2012 and the Observatory was successful in obtaining additional grant funding from Leverhulme Artist-in-Residence and DCAL creativity funds. The total contribution from research and other grants towards research supervisory salary costs and estate and indirect costs was £57,653 (2013/2014: £16,046).

Expenditure

Details of expenditure are on pages 43 to 45, notes 3 to 7. The main variances in expenditure were as follows:

(i) total salary costs of £820,002 (2013/2014: £893,294) decreased mainly due to the vacation of three posts during 2013/14 and which to date remain unfilled;

(ii) student maintenance grants of £139,149 (2013/2014: £150,838) decreased due to slightly lower average numbers of students during the year;

(iii) scholarship and training costs of £27,000 (2013/14: £35,638) decreased due to a number of the students being on thesis-only fees;

(iv) library and publication costs increased to £41,808 (2013/14: £36,014) due to the cost of updating the library with missing back-orders;

(v) archive materials and services increased to £21,450 (2013/14: £9,049) due to additional essential conservation treatment, digitisation of a number of 1835 ordnance survey maps, and packing materials;

(vi) Internet provision, £8,630 (2013/14: £16,330), decreased to reflect savings from the engagement of a new provider for a full year;

(vii) Public Understanding of Science expenses of £11,234 (2013/14: £15,551) reflects the strength of the Observatory's programmes of Science in the Community;

(viii) Observatory staff and students reduced their travel to undertake collaborative research projects, attend scientific meetings and conferences and to deliver talks and papers, to meet imposed efficiency savings. Associated costs for travel and subsistence decreased to £44,481 (2013/14: £62,035);

(ix) heat, light and power costs of £21,768 (2013/2014: £28,392) decreased as a result of relatively mild weather and reduced fuel prices;

(x) property and grounds maintenance costs of £43,311 (2013/2014: £36,263) increased due to the additional cost of a geological survey on the site of the proposed new library;

(xi) admin agency staff costs of £39,984 (2013/2014: £5,314) increased due to the temporary accountant being in post for a full year and a revised apportionment of her time;

(xii) office and miscellaneous equipment increased significantly to £40,949 (2013/14: £21,185) due to additional spend on minor technical equipment ;

(xiii) recruitment costs of £2,152 (2013/14: nil) relate to the recruitment of a new Systems Manager and a PDRA;

(xiv) management committee costs of £5,755 (2013/14: £2,128) increased as a result of the additional meetings relating to the Organisation and Management Review; and

(xv) professional fees (property) of £5,641 (2013/14: £3,287) increased owing to the receipt late invoices relating to prior years.

Debtors

Grant debtors (page 47, note 10) increased to £45,987 (2013/2014: £28,996) to reflect grant funding due but not received until after the year end.

Creditors and Accruals

Trade creditors (page 47, note 11) of £22,007 (2013/2014: £10,715) increased at the year end in line with additional expenditure late in the year which was settled early in April. Accruals (page 47, note 11) of £40,816 (2013/14: £104,354) decreased significantly due to a reduction in property maintenance costs outstanding. There was a new Grant Creditor of £60,182 relating to the EU Cost Action grant for which the Obervatory has become grantholder.

Deferred income

Deferred income (page 47, note 11) represents income from research and other grants, which has been deferred to be matched against expenditure on the grants in future years. The main reason for the decrease in the balance from £233,652 at 31 March 2014 to £116,713 at 31 March 2015 was the repayment of surplus funds.

Fixed Assets

Additions to fixed assets (page 46, note 9) of £141,856 comprise: (i) £6,856 for a boiler for the bungalow (ii) £15,000 for a general-purpose van, and (iii) £120,000 for contributions towards the capital costs of collaborative research projects.

Factors Influencing Future Financing Requirements

DCAL has announced recurrent funding of £925,700 for 2015/2016, which is less than the previous year and together with contributions from research and other grants, is unlikely to be sufficient to fund unrestricted costs for the year.

Unrestricted operating costs are funded primarily by DCAL grant-in-aid. The balance of such unrestricted operating costs are funded by contributions from external grants and miscellaneous income in an increasingly competitive financial environment. Observatory staff will continue to seek other funding streams to maintain this important source of funds.

Armagh Planetarium

Operating result

After adjusting for pensions, the overall result for the year was a surplus of £221 compared to a deficit in 2013/2014 of £6,602. The surplus was transferred to unrestricted funds resulting in an accumulated deficit of £10,492 (2013/2014, accumulated deficit: £10,713) in unrestricted funds before pension adjustments (page 64, note 13 to the accounts).

Income

The baseline recurrent funding from DCAL was £463,500. DCAL provided additional in-year recurrent funding of £29,500 for finance and accounts assistance, health and safety measures, and replacement theatre bulbs. DCAL also provided capital grant-in-aid of £30,000 for computer and security equipment, and a car.

The rise in admissions income to £129,538 (2013/14: £114,730) reflects the increase in visitor numbers for the year. The increase in visitors also contributed to an increase in shop gross profit to £37,969 (2013/2014: £28,910) which was due also in part to the in-year review of product prices. Details of income received are on page 60, note 2 to the accounts.

Expenditure

Details of expenditure are on pages 61 to 62, notes 3 to 6. The main variances in expenditure were as follows:

(i) salaries and wages costs increased to £416,085 (2013/14: £403,627) as a result of additional overtime costs to cover staff movements and additional open nights;
(ii) equipment maintenance and computer consumables of £23,927 (2013/2014: £36,543) decreased due to reduced expenditure on the theatre projector bulbs;
(iii) exhibitions and events costs of £26,909 (2013/2014: £46,727) decreased due to the running of fewer special events to the public during the year;
(iv) advertising costs of £5,783 (2013/2014: £9,188) decreased due to curtailment of planned expenditure to meet budget cuts;
(v) heat, light and power costs of £55,659 (2013/2014: £60,252) decreased as a result of relatively mild weather and reduced fuel prices;
(vi) general property repairs of £27,125 (2013/2014: £21,369) increased due to the additional cost of statutory fixed wire testing;
(vii) audit costs decreased to £10,452 (2013/14: £13,128) as there were no exceptional charges in the year;
(viii) printing and stationery costs of £4,500 (2013/2014: £6,318) decreased due to no special promotional booklets being printed;
(ix) management committee costs of £5,103 (2013/14: £2,138) increased as a result of the additional meetings relating to the Organisation and Management Review;
(x) production expenses decreased to £2,125 (2013/14: £11,233) as fewer shows were purchased; and
(xi) recruitment costs of £1,100 (2013/14: £625) reflect the additional costs of recruiting for the Educational Support Officer at the end of the year.

Debtors

Trade and grant debtors (page 63, note 10) of £3,820 (2013/2014: £6,578) were slightly lower than the previous year, reflecting ongoing efforts to efficiently manage cash flow.

Creditors

Trade creditors (page 64, note 11) of £36,413 (2013/2014: £13,421) increased at the year end in line with additional expenditure late in the year which was settled early in April. Accruals of £20,036 (2013/2014: £32,661) decreased to reflect the in-year settlement of the increased accruals at the end of the previous year.

Fixed Assets

Additions to fixed assets (page 63, note 8) of £30,000 (2013/2014: £26,485) comprised £15,824 for computer and security equipment and £14,176 for a motor car.

Factors Influencing Future Financing Requirements

DCAL has announced recurrent funding of £430,300 for 2015/2016, which is less than the previous year and together with shop profits, admissions income and sundry income, is unlikely to be sufficient to fund anticipated unrestricted costs for the year.

The Planetarium relies heavily on income from admissions, profit on shop sales, and other income to supplement the funding provided by DCAL for unrestricted costs. In 2015/16 the Planetarium will continue in its endeavours to build up visitor and outreach numbers and in so doing maximise the full potential of the Planetarium's science education services and provide additional sources of income for operational costs to supplement funding from DCAL.

Remuneration Report — Armagh Observatory

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

Remuneration

Single Total Figure of Remuneration						
Name	**Salary 2014/2015**	**Pension Benefits* 2014/2015**	**Total 2014/2015**	**Salary 2013/2014**	**Pension Benefits 2013/2014**	**Total 2013/2014**
	£'000	**£**	**£'000**	**£'000**	**£**	**£'000**
M.E. Bailey	60-65	9,077	70-75	60-65	6,402	70-75

*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 or any increase or decreases due to a transfer of pension rights.

Pension Entitlements

Name	**Accrued Pension at 31 March 2015**	**Real Increase in Accrued Pension**	**Accrued Lump Sum at 31 March 2015**	**Real Increase in Lump Sum**	**CETV at 31 March 2015**	**CETV at 31 March 2014**	**Real Increase in CETV**
	£'000	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**
M.E. Bailey	25-30	0-2.5	65-70	(0-2.5)	630	618	4

Signed:

Professor Michael Burton
Chief Executive

Date: 16 November 2017

Remuneration Report — Armagh Planetarium

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

Remuneration

Single Total Figure of Remuneration						
Name	**Salary 2014/2015**	**Pension Benefits* 2014/2015**	**Total 2014/2015**	**Salary 2013/2014**	**Pension Benefits 2013/2014**	**Total 2013/2014**
	£'000	**£**	**£'000**	**£'000**	**£**	**£'000**
T.R. Mason	60-65	16,144	80-85	60-65	11,319	70-75

*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 or any increase or decreases due to a transfer of pension rights.

Pension Entitlements

Name	Accrued Pension at 31 March 2015	Real Increase in Accrued Pension	Accrued Lump Sum at 31 March 2015	Real Increase in Lump Sum	CETV at 31 March 2015	CETV at 31 March 2014	Real Increase in CETV
	£'000	£'000	£'000	£'000	£'000	£'000	£'000
T.R. Mason	15-20	0-2.5	30-35	(0-2.5)	332	310	19

Signed: 

Professor Michael Burton
Chief Executive

Date: 16 November 2017

The CETVs above have been calculated in accordance with guidance used by the Northern Ireland Civil Service in Employer Pension Notice EPN21/2015.

1. The Directors of the Observatory and Planetarium are the persons in senior positions having authority and responsibility for directing and controlling the activities of their respective organisations.

2. The salary of each Director shown above is based on the Northern Ireland Civil Service Grade 6 pay scale. No bonus was paid in the year and neither of the Directors receives any benefits in kind.

3. The service contracts of the Directors are open-ended.

4. Pension benefits are provided through the Northern Ireland Local Government Officers' Superannuation Committee Pension Scheme (NILGOSC). In the period up to 31 March 2009 members paid contributions of 6% of pensionable earnings to the scheme up until retirement. From 1 April 2009 banded contribution rates were introduced and for the year 2014/2015 the Directors paid contributions of 7.2% on pensionable pay.

5. The main benefits payable on retirement for service up to 31 March 2009 are: (i) a retirement pension at a rate of 1/80th of final pensionable pay for each year of membership of the scheme; and (ii) a lump sum retirement grant at a rate of 3/80ths of pensionable pay for each year of membership of the scheme. On death after retirement, the surviving spouse will receive a pension payable for 3 months (6 months if there are dependent children) paid at the same rate as the monthly retirement pension at the date of death and thereafter a spouse's pension of half of the retirement pension for life. On death in service, the scheme pays a lump sum death grant of twice pensionable pay, normally to the surviving spouse or, if the member was not married, to next of kin. For service from 1 April 2009 retirement pension will be at a rate of $1/60^{th}$ of pensionable pay for membership built up after 31 March 2009 and further rights on pension augmentation, flexible retirement and family pension rights on death were introduced. Details of the changes can be obtained at http://www.nilgosc.org.uk.

6. The real increase in pension payable, lump sum and cash equivalent transfer value (CETV) shown above have been adjusted to take account of inflation and market investment factors. The CETV figures include the value of any pension benefit in another scheme that the individual has transferred to NILGOSC.

7. A 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 to secure pension benefits in another scheme when the member leaves a scheme and chooses to transfer the benefits accrued in their former scheme.

Statement of the Responsibilities of the Governors and Accounting Officers

Under the Audit and Accountability (Northern Ireland) Order 2003 the Governors are responsible for keeping proper accounts and proper records in relation to the accounts, and for preparing a statement of accounts in respect of each financial year in such form and containing such information as DCAL, with the approval of the Department of Finance and Personnel, shall direct. The Accounting Officer of DCAL has designated the respective Directors of the Armagh Observatory and Planetarium as the corporation's Accounting Officers. As Accounting Officers the Directors take personal responsibility for the propriety and regularity of the public finances for which they are answerable and for the keeping of proper accounts. They are required to sign the accounts thereby accepting personal responsibility for their proper presentation and to sign the Governance Statement. Their relevant responsibilities as Accounting Officers, including their responsibilities for the propriety and regularity of the public finances and for the keeping of proper records, are set out in Managing Public Money Northern Ireland.

The accounts are prepared on an accruals basis and give a true and fair view of the corporation's state of affairs at the end of the financial year and of its income and expenditure, total recognised gains and losses and cash flows for the financial year. The accounts have been prepared in accordance with the Statement of Recommended Practice "Accounting and Reporting by Charities" (SORP 2005). The financial statements comply with the guidance issued by the Department of Finance and Personnel on the form and contents of the Annual Reports and Accounts of Executive Non-Departmental Public Bodies and in particular:

- suitable accounting policies have been selected and applied consistently (subject to changes arising on the adoption of new accounting standards);
- reasonable and prudent judgements and estimates have been made;
- applicable accounting standards have been followed, subject to any material departures disclosed and explained in the financial statements;
- the financial statements have been prepared on the going concern basis, unless it is inappropriate to presume that the corporation will continue in business.

The Accounting Officers are also responsible for safeguarding the assets of the corporation and hence for taking reasonable steps for the prevention and detection of fraud and other irregularities.

Statement of Disclosure of Information to the Auditors

So far as the Accounting Officers of the Armagh Observatory and the Armagh Planetarium in office at the date of the approval of these financial statements are aware:

- there is no relevant audit information relating to their respective organizations of which the auditors are unaware; and
- they have taken all the steps that they ought to have taken as Accounting Officers in order to make themselves aware of any relevant audit information relating to their respective organizations and to establish that the auditors are aware of that information.

Armagh Observatory and Planetarium: Governance Statement

1. Scope of Responsibility

The Board of Governors, Management Committee and Directors of the Armagh Observatory and Planetarium are required to prepare a statement of accounts for each financial year to be laid before the Northern Ireland Assembly. The accounts are prepared to show a true and fair view of the Corporation's financial activities during the year and of the Observatory and Planetarium's respective financial positions at the end of the year. The Observatory and Planetarium prepare separate audited accounts and the Directors are the Accounting Officers for their respective sides of the organisation.

In preparing the Armagh Observatory's and Armagh Planetarium's accounts, the Board and Management Committee of the Armagh Observatory and Planetarium are required to:

- comply with the Government Financial Reporting Manual;
- observe the accounts direction issued by the government, including the relevant accounting and disclosure requirements, and apply suitable accounting policies on a consistent basis;
- make judgments and estimates that are reasonable and prudent;
- state whether applicable accounting standards and statements of recommended practice have been followed, and disclose and explain any material departures in the financial statements;
- prepare the financial statements on the going concern basis, unless it is inappropriate to presume that the Armagh Observatory and Planetarium will continue in operation.

The Permanent Secretary of the Department for Culture, Arts and Leisure (DCAL) has designated the Armagh Observatory and Planetarium Directors as Accounting Officers for the Armagh Observatory and Planetarium, respectively. Their relevant responsibilities as Accounting Officer, including their responsibility for the propriety and regularity of the public finances for which they are personally answerable and for the keeping of proper records, are set out in Managing Public Money Northern Ireland (MPMNI).

The responsibilities include the need to maintain a sound system of internal control which supports the achievement of the policies, aims and objectives of the Armagh Observatory and Planetarium respectively, whilst safeguarding public funds and the assets of the Armagh Observatory and Planetarium respectively, for which the Accounting Officer is personally responsible and which have been assigned to him by the Board of Governors of the Armagh Observatory and Planetarium.

2. Compliance with Corporate Governance Best Practice

In April 2013 the Department of Finance and Personnel issued Dear Accounting Officer (DFP) 06/13 regarding the revised Code of Good Practice on Corporate Governance in Central Government Departments.

While the 2013 Code has been written for central government departments, it concentrates throughout on key principles. As such, 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.

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

3. Governance Framework

Accounting Officer

The Permanent Secretary of the Department of Culture, Arts and Leisure has designated the Director of the Armagh Observatory and the Director of the Armagh Planetarium as Accounting Officer for their respective organisations.

The Directors of the Observatory and Planetarium, as Accounting Officers, are responsible for maintaining a sound system of internal control as outlined in section one.

Board of Governors

The Armagh Observatory and Planetarium 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 DCAL nominee;
- one Queen's University Belfast (QUB) nominee; and
- up to three additional members nominated by the Board of Governors.

During 2014/15 Archdeacon Hoey retired, he was replaced by Archdeacon T. Scott, who was already a member of the Board of Governors. Rev. Canon N. J. Hughes was appointed to the Chapter of the Church of Ireland Cathedral of Armagh on 16 November 2014 and hence the Board of Governors. Rev. Canon C.F. Moore retired from the Church of Ireland and the Board of Governors on 19 February 2015. This leaves one vacancy from within the members of the Chapter of the Church of Ireland Cathedral of Armagh and one vacancy from within the Board of Governors nominees.

BOARD OF GOVERNORS			
GOVERNOR	**APPOINTMENT**	**DATE OF EXPIRY**	**MEETINGS ATTENDED (max. 4)**
CHAIR Archbishop Richard Clarke	15 December 2012		4
The Dean: Very Rev G. Dunstan	4 December 2011		4
The Venerable Archdeacon R.G. Hoey	1992	30 September 2014	0
The Venerable Archdeacon T. Scott	9 November 2006		3
Rev Canon J.N.T. Campbell	23 February 2009		3
Rev Canon W.J.A. Dawson	1998		0
Rev Canon C.F. Moore	1997	19 February 2015	0
Rev Canon W.M. Adair	10 September 2008		1
Rev Canon R.J.N. Porteus	1998		0
Rev Canon N.J. Hughes	16 November 2014		4
Rev Canon S.R.T. Boyd	6 October 2013		1
Professor S. Smartt	23 March 2012		3
Professor R. Oudmaijer	1 November 2008	30 June 2015	3
Mr W.G. Berry	1 January 2011	31 December 2015	2
Professor A. Hibbert	28 March 2014		4

The Board of Governors meets once a year, though it can call special meetings to discuss important issues that may arise. The Board formally approves the annual budget and future financial business plan, and receives and approves major strategies and projects where appropriate. The Board has established a Management Committee to provide specialist advice and expertise relating to Scientific Research and Education, and to fulfil certain duties of governance oversight and challenge.

At the annual meeting the Board reviews, examines and approves all of the papers from the Management Committee meetings and the Audit and Risk Assurance Committee meetings.

During 2014/15 three special meetings of the Board of Governors were convened to discuss the Review of the Organisation and Management of the Armagh Observatory and Planetarium.

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

The Management Committee comprises:

- the Church of Ireland Archbishop of Armagh (Chair) or his nominee (appointed as Chair);
- three nominees from the Board of Governors;
- six nominees from DCAL;
- one nominee of the Queen's University, Belfast (vacant);
- 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.

During 2014/15 the Minister of Culture, Arts and Leisure made four appointments to the Management Committee. One of the Board of Governors' nominees retired on 30 September 2014, leaving two vacant nominee positions and two Board of Governors' co-opted positions vacant. The newly appointed members all attended a CIPFA 'Essential Skills for Board Members' training course in respect of their responsibilities for corporate governance and accountability of the organisation.

MANAGEMENT COMMITTEE			
MEMBER	**DATE OF APPOINTMENT**	**DATE OF EXPIRY**	**MEETINGS ATTENDED (max. 6)**
CHAIR Archbishop R. Clarke	15 December 2012		3
DEPUTY CHAIR Professor A. Hibbert	18 March 2005		6
The Venerable Archdeacon R.G. Hoey	1992	30 September 2014	0
Professor T. Ray	4 March 2009		6
Professor M. Merrifield	1 January 1999		4
Professor R. Oudmaijer	1 November 2008	30 June 2015	5
Mr B. Hannam	1 January 2011	31 December 2015	6
Dr M. McKay	1 January 2011	31 December 2015	6
Mrs P. Wilson	1 November 2014	31 October 2018	4
Professor L. Harra	1 November 2014	31 October 2018	3
Mr S. Brown	1 November 2014	31 October 2018	4
Mr P. McGurgan	1 November 2014	31 October 2018	4

During 2014/15 the Management Committee considered a wide range of business including updates on key performance indicators and developments relating to financial performance, scientific research, science education, outreach and engagement, staffing, health and safety, Bi-Annual Assurance Statements and Risk Registers as well as reports of the Audit and Risk Assurance Committee. Internal controls are in place to validate the accuracy and completeness of information presented to the Management Committee.

There were three special Management Committee meetings during 2014/15 to discuss the Review of the Organisation and Management of the Armagh Observatory and Planetarium.

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

Audit and Risk Assurance Committee

The Audit and Risk Assurance Committee has been established to advise the Board of Governors, the Management Committee and the respective Directors of the Observatory and Planetarium as Accounting Officers on issues facing the organisation in respect of organisational risks, internal control, governance and their associated assurances.

AUDIT & RISK ASSURANCE COMMITTEE	
	MEETINGS ATTENDED (max. 4)
CHAIR Mr B. Hannam	4
Professor A. Hibbert	4
Professor L. Harra[2]	0
Mr P. McGurgan[3]	1

During 2014/15 the Audit and Risk Assurance Committee has provided assurance that good governance exists in the organisation and where any improvements were necessary, action has been or is being taken to address specific issues.

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.

The Committee is also satisfied, from the evidence provided at meetings that work has been undertaken to implement the recommendations arising from the Internal Audit carried out in 2014/15.

Employment Conditions and Remuneration Committee

The Employment Conditions and Remuneration Committee meets infrequently, for example when there are specific matters relating to employment and pay to be discussed. The business of the Committee is primarily conducted by email, for example, in

[2] From 29 January 2015
[3] From 29 January 2015

2014/15 to consider Special Bonus Payments for the Observatory. The Committee comprises the Deputy Chair of the Management Committee and three named members of the Management Committee.

EMPLOYMENT CONDITIONS & REMUNERATION COMMITTEE	
	MEETINGS ATTENDED (max. 0)
CHAIR Professor A. Hibbert	0
Dr M. McKay	0
Professsor T. Ray	0
Mrs P. Wilson	0

Conflicts of Interest

The organisation also 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 which may include that member not taking part in discussions or making decisions on certain matters or being excluded for part/all of that meeting.

Directors and Secretary

Professor M.E. Bailey MBE MRIA — Director, Armagh Observatory
Dr T.R. Mason MBE — Director, Armagh Planetarium
Operations Manager — acts as secretary to the Board of Governors, Management Committee and Audit and Risk Assurance Committee

4. Business Planning and Risk Management

Business Planning

The Mission of Armagh Observatory and Planetarium is:

"To advance the knowledge and understanding of astronomy and related sciences through the execution, promotion and dissemination of astronomical research nationally and internationally in order to enrich the intellectual, economic, social and cultural life of the community".

This aligns closely with the aims and objectives of the Observatory's sponsor - the Department of Culture, Arts and Leisure (DCAL) and also with the broader aims and objectives of the Northern Ireland Executive's Programme for Government. A Business Plan was approved by DCAL in April 2014.

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. Full details of all the Observatory's activities are provided in comprehensive Annual Reports which are available in hard copy on request or online at: http://star.arm.ac.uk/annrep/.

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. The Planetarium makes much of its own content which is designed and scripted in-house. 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 is focused on actively assisting children from disadvantaged backgrounds to experience a visit to the site.

It should be noted that no Ministerial direction has been given regarding the work of the Armagh Observatory and Planetarium.

Risk Management

Risk Management is an essential element of the Armagh Observatory and Planetarium's corporate governance framework and is closely linked to the system of internal control and business planning process. A robust risk management process assists the Armagh Observatory and Planetarium 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 Armagh Observatory and Planetarium's aims and objectives, the organisation encourages a proactive approach to innovation and well-managed risk taking where there is potential to realize 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 the Armagh Observatory and Planetarium. The Director and other staff are responsible for ensuring that treated 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.

Quarterly updates are provided to the Audit and Risk Assurance Committee on the development and implementation of the risk management process across the Armagh Observatory and Planetarium. The Audit and Risk Assurance Committee provides the Accounting Officers 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. No new risks were identified in 2014/15.

5. Fraud and Information Risk

The Directors of the Armagh Observatory and Planetarium have overall responsibility for managing the risk of fraud in their respective institutions 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 preliminary investigations are carried out if fraud occurs, is attempted or is suspected;
- 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; and
- ensuring that appropriate action is taken to minimise the risk of similar frauds occurring in future.

Risks to data and information held by the Observatory is owned and managed by individuals, responsible as information asset owners. The Operations Manager responds, in consultation with the Directors and the organisation's governance structure, to requests for information under the Data Protection and Freedom of Information Acts.

6. Governance and Accountability

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

The Chair has a particular leadership responsibility for securing the sustainability and vitality of the Corporation in the long term; giving advice and direction in formulating the Corporation'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 the Observatory and Planetarium, leadership is exercised by the respective Director, who is 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 (Observatory);

- promoting their respective organisation's 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 Directors in accord with their respective roles in the organisation. They also provide the Directors with guidance and advice on strategic and operational matters such as personnel issues, accountability, staff salary levels in relation to responsibilities and performance, and relationships with stakeholders.

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

The Management Committee completed an internal self-assessment of its effectiveness in 2014/15, using the National Audit Office template questionnaire. Concerns were expressed about 1) the lack of objectives for the Committee, 2) not regularly reviewing its performance, 3) no long term strategy being in place for the organisation and 4) oversight by the Department appearing to be increasing. It was agreed that these areas would be taken forward by the new Management Board which was proposed following the Review of the Organisation and Management of the Armagh Observatory and Planetarium.

It was agreed by the Board of Governors and the Management Committee that the proposed governance changes accepted, following the Review of the Organisation and Management removed the need for the current Board of Governors to complete an internal self-assessment of its effectiveness.

7. Sources of Independent Assurance

Internal Audit

The internal audit function is carried out by a contractor following a competitive tender process. The appointed firm operates to the standards defined in the Public Sector Internal Audit Standards. The Annual Audit Plan was approved by the Audit and Risk Assurance Committee in June 2014. The Audit and Risk Assurance Committee considered reports on the following areas:

Audit Assignment	Level of Assurance
IT Security and Business Continuity	Limited
Safeguarding	Substantial
Payroll	Satisfactory
Expenses	Satisfactory
Procurement	Substantial
Drawdown	Satisfactory
Follow up on previously accepted recommendations	Satisfactory

A **satisfactory** annual assurance rating was awarded on the adequacy, reliability and effectiveness of the Armagh Observatory and Planetarium's system of risk management, control and governance for the year ended 31 March 2015.

An audit of Governance within Armagh Observatory and Planetarium is currently ongoing. The purpose of the audit is to provide an independent professional opinion on the adequacy and effectiveness of management control over governance within Armagh Observatory and Planetarium.

External Audit

The organisation is also subject to independent scrutiny from the Northern Ireland Audit Office. The Audit Office is independent of Government and is tasked by the Assembly to hold the Northern Ireland Departments and their Agencies to account for their use of public money. The Comptroller and Auditor General works closely with the Assembly's Public Accounts Committee which can require Accounting Officers and senior officials to account for their actions in relation to the management of public funds.

A representative from the Northern Ireland Audit Office attends all Audit and Risk Assurance Committee meetings. The Audit Strategy was approved by the Audit and Risk Assurance Committee in March 2015.

8. Review of Effectiveness of the System of Internal Controls

The system of internal controls 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 control is based on an ongoing process designed to identify and prioritise risks to the achievement of the Armagh Observatory's and Planetarium's 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 controls

has been in place in the Armagh Observatory and Planetarium for the year ended 31 March 2015 and up to the date of approval of the annual accounts, and accords with Department of Finance and Personnel guidance.

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

- assessments of the Observatory's research outputs;
- regular reports by Observatory and Planetarium 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 Armagh Observatory and Planetarium Audit and Risk Assurance Committee;
- regular meetings with officials from the DCAL to consider operational and strategic issues and matters relating to the system of internal control;
- bi-annual Assurance Statements submitted to the DCAL on internal control;
- periodic review of the Armagh Observatory and Planetarium Risk Registers by the respective Director, the Armagh Observatory and Planetarium Audit and Risk Assurance Committee, and the DCAL;
- 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 external auditors to the Management Committee and the Board of Governors on the material issues relating to the annual accounts, which provide an opinion on whether the accounts give a true and fair view of the affairs of the organisation and of its incoming resources and application 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.

A number of the organisation's policies have been reviewed throughout 2014/15. Plans are underway to formalise the review process and determine ownership of individual policies. The work of the Audit and Risk Assurance Committee includes reviews of the controls in place for effective management of information risk.

DCAL reviewed the Armagh Observatory and Planetarium in 2014. Four recommendations were made which will help to improve the organisational effectiveness of the Armagh Observatory and Planetarium. They included:

- maximising outreach activity, focusing on promoting equality, tackling poverty and social exclusion on an all-island basis,
- establishing an independent means of benchmarking the Observatory's research work,
- examining the longer-term strategic business potential of the Armagh Observatory and Planetarium as a visitor destination and
- reviewing the governance and operational structures.

The Review of the Organisation and Management of the Armagh Observatory and Planetarium was carried out by the Strategic Investment Board in 2014. The Board of Governors agreed to implement some of the proposals and recommendations arising from this and an implementation plan is in place for stage 1. This includes the key governance and organisational changes and will be completed in 2015/16.

9. Internal Governance Divergences

Update on Prior Year:

1. Following the outcome of the Court Case (associated with the Northern Ireland Office and the Police Service of Northern Ireland) in March 2013 the Department of Culture, Arts and Leisure considered the Equal Pay issue to be closed. The NICS position is that the Equal Pay terms of settlement apply to those working in a NICS department at 1 February 2009. Staff in Non-Departmental Public Bodies were excluded from the settlement payments and assimilation terms. Staff have contacted their Trade Union to seek advice on the options available to them.

Identification of New Issues:

1. A number of weaknesses were identified through the Internal Audit carried out in 2014/15. Appropriate action will be taken during the next year to resolve them.

2. Special Bonus payments to Planetarium staff in 2013/14 exceeded the Department of Finance and Personnel limit of 0.2% of the pay bill. The overall cost of Special Bonus payments was 0.45% of the pay bill.

10. Conclusion

I am satisfied that the Armagh Observatory has an effective governance structure and is operating to a high standard of integrity and probity. In signing this report I have taken assurances from the Audit and Risk Assurance Committee and I will continue to monitor internal audit and Northern Ireland Audit Office recommendations to ensure that all issues are addressed.

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

Signed: 

Professor Michael Burton
Chief Executive
Date: 16 November 2017

I am satisfied that the Armagh 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 from the Audit and Risk Assurance Committee and I will continue to monitor internal audit and Northern Ireland Audit Office recommendations to ensure that all issues are addressed.

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

Signed: 

Professor Michael Burton
Chief Executive
Date: 16 November 2017

THE ARMAGH OBSERVATORY AND PLANETARIUM

THE CERTIFICATE OF THE COMPTROLLER AND AUDITOR GENERAL TO THE NORTHERN IRELAND ASSEMBLY

I certify that I have audited the financial statements of the Armagh Observatory and Planetarium for the year ended 31 March 2015 under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995. These comprise the Statements of Financial Activities, the Statements of Recognised Gains and Losses, the Balance Sheets and the Cash Flow Statements and the related notes. These financial statements have been prepared under the accounting policies set out within them. I have also audited the information in the Remuneration Report that is described in that report as having been audited.

Respective responsibilities of the Governors, Accounting Officers and auditor

As explained more fully in the Statement of the Responsibilities of the Governors' and Accounting Officers the Governors and Accounting Officers are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view. My responsibility is to audit, certify and report on the financial statements in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995. I conducted my audit in accordance with International Standards on Auditing (UK and Ireland). Those standards require me and my staff to comply with the Auditing Practices Board's Ethical Standards for Auditors.

Scope of the audit of the financial statements

An audit involves obtaining evidence about the amounts and disclosures in the financial statements sufficient to give reasonable assurance that the financial statements are free from material misstatement, whether caused by fraud or error. This includes an assessment of: whether the accounting policies are appropriate to the Armagh Observatory and Planetarium's circumstances and have been consistently applied and adequately disclosed; the reasonableness of significant accounting estimates made by the governors; and the overall presentation of the financial statements. In addition I read all the financial and non-financial information in the Annual Report to identify material inconsistencies with the audited financial statements and to identify any information that is apparently materially incorrect based on, or materially inconsistent with, the knowledge acquired by me in the course of performing the audit. If I become aware of any apparent material misstatements or inconsistencies I consider the implications for my certificate.

I am required to obtain evidence sufficient to give reasonable assurance that the incoming and resources expended 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.

Opinion on regularity

In my opinion, in all material respects the incoming resources and resources expended have been applied to the purposes intended by the Assembly and the financial transactions conform to the authorities which govern them.

Opinion on financial statements

In my opinion:

- the financial statements give a true and fair view of the state of the Armagh Observatory and Planetarium's affairs as at 31 March 2015 and of its incoming resources and resources expended and cash flows for the year then ended; and
- the financial statements have been properly prepared in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995 and Department for Communities, formally the Department of Culture Arts and Leisure directions issued thereunder.

Opinion on other matters

In my opinion:

- the part of the Remuneration Report to be audited has been properly prepared in accordance with Department for Communities, formally the Department of Culture Arts and Leisure directions made under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995; and
- the information given in the Management Commentary, Operating Reviews and Financial Reviews for the financial year for which the financial statements are prepared is consistent with the financial statements.

Matters on which I report by exception

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 part of the Remuneration Report to be audited are not in agreement with the accounting records; 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 Department of Finance's guidance.

Report

My detailed observations are included in the report I have attached to the financial statements on pages 71 to 77.

KJ Donnelly
Comptroller and Auditor General
Northern Ireland Audit Office
106 University Street
Belfast
BT7 1EU

19 December 2017

Statement of financial activities for the year ended 31 March 2015

	Notes	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Incoming resources					
DCAL grant-in-aid	2	1,037,156	150,000	1,187,156	1,192,500
Other grants and receipts	2	-	256,502	256,502	322,591
Interest receivable		318	-	318	293
Rents		5,665	-	5,665	5,445
Miscellaneous income		3,771	-	3,771	3,848
Transfer to deferred income	14	-	(27,727)	(27,727)	(98,372)
Transfer from deferred income	11,14	13,716	60,236	73,952	42,967
Transfer between funds		57,643	(57,643)	-	-
Total incoming resources		1,118,269	381,368	1,499,637	1,469,272
Resources expended					
Direct expenditure of the corporation	3	933,108	230,893	1,164,001	1,296,049
Fundraising and publicity	4	-	-	-	-
Management and administration of the corporation	6	213,105	8,619	221,724	154,033
Capital expenditure		-	141,856	141,856	71,211
Total resources expended		1,146,213	381,368	1,527,581	1,521,293
Net movement in funds before finance income		(27,944)	0	(27,944)	(52,021)
Finance income/(costs) - pension scheme		89,000	-	89,000	60,000
Net movement in funds after finance income		61,056	-	61,056	7,979
Actuarial (loss)/gain on pension scheme		(159,000)	-	(159,000)	66,000
Net movement in funds after actuarial (loss)/gain		(97,944)	0	(97,944)	73,979
Balances brought forward at 1 April		(395,276)	7,293	(387,983)	(461,962)
Balances carried forward at 31 March	13, 14	(493,220)	7,293	(485,927)	(387,983)

All amounts above relate to continuing operations of the corporation.

The income and expenditure summary is included at Note 8.

Statement of recognised gains and losses

	2015 £	2014 £
Net movement in funds for the year after other finance income	61,056	7,979
Net movement on government grant reserve	47,867	(22,109)
Net movement on donated assets reserve	(19,535)	(19,535)
Actuarial (loss)/gain on pension scheme	(159,000)	66,000
Recognised (losses)/gains for the year	(69,612)	32,335

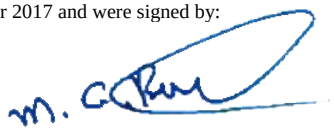
Armagh Observatory

Balance sheet at 31 March 2015

	Notes	2015 £	2014 £
Tangible assets	9	2,888,459	2,860,127
Current assets			
Debtors	10	107,081	87,143
Cash at bank and in hand	18, 19	209,990	339,875
		317,071	427,018
Creditors: amounts falling due within one year	11	(239,718)	(348,721)
Net current assets		77,353	78,297
Net assets excluding pension liability		2,965,812	2,938,424
Long-term liabilities - pension scheme	20	(579,000)	(482,000)
		(579,000)	(482,000)
Net assets		2,386,812	2,456,424
Funds			
Unrestricted funds	13	(493,220)	(395,276)
Restricted funds	14	7,293	7,293
Government grant reserve	12	737,727	689,860
Designated funds	16	2,135,012	2,154,547
		2,386,812	2,456,424

The financial statements on pages 39 to 55 were approved on 16 November 2017 and were signed by:

Archbishop Richard Clarke
Chair of the Board of Trustees



Professor Michael Burton
Chief Executive

Armagh Observatory

Cash flow statement for the year ended 31 March 2015

	Notes	2015 £	2014 £
Net cashflow from operating activities		(130,203)	116,102
Returns on investments and servicing of finance			
Interest received		318	293
Interest paid and similar charges		-	(10)
		318	283
Capital expenditure			
Purchase of tangible assets		(141,856)	(71,211)
Capital grants received		141,856	71,211
		-	-
Net cash (outflow)/inflow before financing and management of liquid resources		(129,885)	116,385
Management of liquid resources			
Movement in Danske Bank deposit account		65,822	(105,413)
Net cash outflow/(inflow) from management of liquid resources		65,822	(105,413)
(Decrease)/increase in cash in the year	18, 19	(64,063)	10,972

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Reconciliation of operating result to net cash flow from operating activities

	2015 £	2014 £
Net incoming resources per statement of financial activities	(27,944)	(52,021)
Interest received	(318)	(293)
Interest paid and similar charges	-	10
Depreciation	111,587	112,855
Pension service costs	27,000	48,000
Release of deferred credit - Government grant reserve	(92,052)	(93,320)
Release of deferred credit - donated asset reserve	(19,535)	(19,535)
(Increase)/decrease in debtors	(19,938)	(8,450)
(Decrease)/increase in creditors	(109,003)	128,856
Net cash (outflow)/inflow from operating activities	(130,203)	116,102

Notes to the financial statements for the year ended 31 March 2015

1 Accounting policies

Basis of accounting

The financial statements have been prepared under direction issued by DCAL, in particular the requirement to recognise grant in aid received from them on a cash basis in order to present a true and fair view of Government funding. With the exception of this departure from the SORP, in all other aspects the financial statements comply with the Statement of Recommended Practice for Charities (SORP 2005).

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:

	%
Furniture and fittings	2 - 15
Office equipment	10 - 20
Scientific equipment and other equipment	10 - 25
Buildings	2
Astropark	2 - 5
Exhibits and grounds	6 - 10
Motor Vehicles	25

Land and buildings are included in the balance sheet at depreciated replacement cost, estimated value in use or market value.

Incoming Resources

Grant income from DCAL is shown in the Statement of Financial Activities in the year in which it is received.
Grants that relate to specific capital expenditure are treated as deferred income which is then credited to the Statement of Financial Activities over the related asset's useful life. Grants that relate to specific research projects are treated as deferred income and credited to the Statement of Financial Activities over the lifetime of the related project. Other grants are credited to the Statement of Financial Activities when received.

Pension scheme

The corporation provides pension benefits to its employees by participating in the Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) Pension Scheme, which is a defined benefit scheme. Annual contributions to the NILGOSC scheme are based on actuarial advice. The operating costs of providing retirement benefits to the corporation'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.

Fund accounting

The corporation 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

Funds which are expendable at the discretion of the Governors in furtherance of the objectives of the corporation. In addition to expenditure on the provision of services, such funds may be held in order to finance capital investment and working capital.

Reserves policy

The Armagh Observatory 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. They have a need to retain a sufficient level of unrestricted cash reserves to meet the risks associated with financial contingencies, uncertainties and demands.

The Observatory considers that funds of between £50,000 and £100,000, approximately 5% of total annual expenditure, are sufficient to meet financial risks. The level of unrestricted funds (after reversal of pension adjustments) at 31 March 2015 is £79,044. The policy is reviewed by the Director on an annual basis at the end of the financial year.

The reserves are held in a short-term interest-bearing bank deposit account within the NICS banking arrangements, with any interest earned being used to fund operating costs.

2 Incoming Resources

The accounts reflect the receipt of the following grants:

Grant-in-aid from the Department of Culture, Arts and Leisure (DCAL)

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Recurrent grant-in-aid	983,656	-	983,656	1,043,000
In-year recurrent grant-in-aid	53,500	-	53,500	49,500
Capital grant-in-aid	-	15,000	15,000	25,000
In-year capital grant-in-aid	-	135,000	135,000	75,000
	1,037,156	150,000	1,187,156	1,192,500

Other grants and receipts

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
STFC Research, Visitor and Travel grants	-	160,702	160,702	185,801
Leverhulme Artist-in-Residence	-	13,329	13,329	-
DCAL Creativity Month	-	6,000	6,000	-
Leverhulme Trust	-	75,266	75,266	80,838
ARTI	-	-	-	2,587
Around North Project	-	-	-	4,500
Project with the Armagh Public Library	-	-	-	5,396
European Commission FP7 EuroPlaNet Project	-	1,205	1,205	-
EUNAWE	-	-	-	42,621
Other grants and receipts	-	-	-	848
	-	256,502	256,502	322,591

3 Direct expenditure of the corporation

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Salaries and wages	697,410	122,592	820,002	893,294
Student maintenance grants	70,141	69,008	139,149	150,838
Scholarship and training	13,152	13,848	27,000	35,638
Travelling and subsistence	30,460	14,021	44,481	62,035
Around North Project	-	-	-	6,750
Computer consumables	16,830	3,467	20,297	23,853
Library and publications	41,808	-	41,808	36,014
Archive materials and services	21,450	-	21,450	9,049
Internet provision	8,630	-	8,630	16,330
Contribution to UKSC and SALT operating costs	18,250	-	18,250	17,250
Meetings and conferences	17	-	17	2,183
Visitor programme	3,726	-	3,726	2,732
Public Understanding of Science expenses	11,234	-	11,234	15,551
EUNAWE	-	-	-	24,532
Leverhulme Artist in Residence	-	1,957	1,957	-
DCAL Creativity Month	-	6,000	6,000	-
	933,108	230,893	1,164,001	1,296,049

4 Fundraising and publicity

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
	-	-	-	-

5 Travel and subsistence

Restricted travel and subsistence is funded in the main from external grant aid from the Science and Technology Facilities Council (STFC).

6 Management and administration of the corporation

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Insurance	10,463	-	10,463	9,852
Heat, light and power	21,768	-	21,768	28,392
Property and grounds maintenance	43,311	-	43,311	36,263
Admin agency staff costs	39,984	-	39,984	5,314
Cleaning consumables	2,743	-	2,743	1,062
Cleaning agency staff costs	11,637	-	11,637	11,721
Postage and telephone	4,497	-	4,497	4,313
Recruitment costs	2,152	-	2,152	-
General expenses	9,647	475	10,122	7,549
Management Committee	5,755	-	5,755	2,128
Office and miscellaneous equipment	32,805	8,144	40,949	21,185
Bank charges	-	-	-	10
Audit	8,497	-	8,497	10,954
Professional fees - property	5,641	-	5,641	3,287
Other professional fees	11,058	-	11,058	9,808
Stationery, printing and advertising	3,147	-	3,147	2,195
Depreciation	-	111,587	111,587	112,855
Release from grants reserve	-	(92,052)	(92,052)	(93,320)
Release from donated asset reserve	-	(19,535)	(19,535)	(19,535)
	213,105	8,619	221,724	154,033

7 Average staff numbers and related costs

Average staff numbers

	2015 Number	2014 Number
Permanent staff	12.0	13.5
Fixed-term contract staff	2.5	2.9
Agency staff	1.2	0.6
	15.7	17.0

Included within the numbers above are the corporation's Operations Manager (whose salary is shared equally between the Observatory and Planetarium) and the Temporary Accountant (whose salary is apportioned between the Observatory and Planetarium in the ratio 3:1).

Costs

	2015 £	2014 £
Permanent staff		
Wages and salaries	514,780	546,954
Social security costs	44,007	47,213
Employer's pension contributions	98,119	104,226
Pension service cost (note 20)	26,952	51,864
	683,858	750,257
Fixed-term contract staff costs		
Wages and salaries	109,447	113,050
Social security costs	10,768	11,078
Employer's pension contributions	15,929	18,909
	136,144	143,037
Total permanent and fixed-term contract staff		
Wages and salaries	624,227	660,004
Social security costs	54,775	58,291
Employer's pension contributions	114,048	123,135
Pension service cost (note 20)	26,952	51,864
	820,002	893,294
Agency staff costs	51,621	17,035
Total staff costs	871,623	910,329

Staff costs above include 50% of the salary costs of the corporation's Operations Manager and and 75% of the costs of the Temporary Accountant.
The pension service cost of £26,952 is the actuarial present value of pension benefits earned by staff during the year.

Average student numbers and related costs

	2015 Number	2014 Number
PhD students	10.0	10.8

	2015 £	2014 £
Student maintenance grants	139,149	150,838

8 Income and expenditure summary

	2015 £	2014 £
Gross income	1,357,781	1,398,061
Expenditure		
Direct expenditure of the corporation (note 3)	1,164,001	1,296,049
Fundraising and publicity (note 4)	-	-
Management and administration of the corporation (note 6)	221,724	154,033
	1,385,725	1,450,082
Other finance income	89,000	60,000
Surplus/(deficit) for the year	61,056	7,979

9 Tangible fixed assets

	Freehold Land & buildings £	Exhibits and grounds £	Astropark £	Furniture Fittings £	Office Eqpt. £	Equipment & Historic telescopes £	Motor Van £	Total £
Cost or valuation								
At 1 April 2014	2,569,994	23,593	367,490	139,548	34,717	766,333	-	3,901,675
Asset revaluation	-	-	-	-	-	-	-	-
Additions	-	-	-	6,856	-	120,000	15,000	141,856
Disposals	-	-	-	(1,953)	-	(28,210)	-	(30,163)
At 31 March 2015	2,569,994	23,593	367,490	144,451	34,717	858,123	15,000	4,013,368
Depreciation								
At 1 April 2014	66,438	16,542	316,047	68,433	34,717	539,371	-	1,041,548
Adjustment for asset revaluation	-	-	-	-	-	-	-	-
Charge for year	33,218	1,871	7,350	8,204	-	60,944	-	111,587
Disposals	-	-	-	(16)	-	(28,210)	-	(28,226)
At 31 March 2015	99,656	18,413	323,397	76,621	34,717	572,105	-	1,124,909
Net book value								
At 31 March 2015	2,470,338	5,180	44,093	67,830	-	286,018	15,000	2,888,459
Net book value								
At 31 March 2014	2,503,556	7,051	51,443	71,115	-	226,962	-	2,860,127

Tangible fixed asset additions of £141,856 as shown above were funded as follows:

		£
DCAL	Capital grant-in-aid	6,856
DCAL	In-year capital grant-in-aid	135,000
		141,856

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

	2015 £	2014 £
Cost	715,334	715,334
Aggregate depreciation	(255,287)	(239,318)
Net book value based on historic cost	460,047	476,016

Depreciation on fixed assets for the year was £111,587 (2014: £112,855).

Land and buildings include grounds and buildings with a net book value of £1,785,175 at 31 March 2015 which were donated to the corporation in 1790 by Archbishop Richard Robinson, the founder of the corporation (31 March 2014: £1,803,817).

The Obsevatory includes in fixed assets any expenditure over £3,600 (on an item or group of related items) which is expected to be used for more than a year.

10 Debtors

	2015	2014
	£	£
Grant debtors	45,987	28,996
Prepayments	54,358	51,459
Pension scheme	6,736	6,688
	107,081	87,143

11 Creditors: amounts falling due within one year

	2015	2014
	£	£
Trade creditors	22,007	10,715
Grant creditor	60,182	-
Accruals	40,816	104,354
Deferred income	116,713	233,652
	239,718	348,721

Analysis of deferred income

	2015	2014
	£	£
Balance at 1 April 2014	233,652	194,975
Transfer to statement of financial activities (restricted funds)	(60,236)	(42,967)
Transfer from statement of financial activities (restricted funds)	27,727	98,372
Transfer to statement of financial activities (unrestricted funds)	(13,716)	-
Grants repaid	(70,714)	(16,728)
Balance at 31 March 2015	116,713	233,652

12 Government grants reserve

	Land and buildings	Exhibits and grounds	Astropark	Furniture Fittings	Office Eqpt.	Equipment & Historic telescopes	Motor Van	Total
	£	£	£	£	£	£	£	£
Balance at 1 April 2014	340,429	-	51,443	71,114	2	226,872	-	689,860
Additions	-	-	-	6,856	-	120,000	15,000	141,856
Disposals	-	-	-	(1,937)	-	-	-	(1,937)
Transfer balances	(7,140)	7,051	-	1	(2)	90	-	-
Amortised	(13,683)	(1,871)	(7,350)	(8,204)	-	(60,944)	-	(92,052)
Balance at 31 March 2015	319,606	5,180	44,093	67,830	-	286,018	15,000	737,727

13 Unrestricted funds

	2015 £
Balance at 1 April 2014	(395,276)
Incoming resources	1,118,269
Resources expended	(1,146,213)
Other finance income	89,000
Adjustment to the statement of recognised gains and losses	(159,000)
Balance at 31 March 2015	(493,220)

The unrestricted funds include a deficit of £579,000 (2014: £482,000) in respect of pension scheme liabilities of the pension fund.

It is the policy of the Armagh Observatory to retain a reasonable level of unrestricted cash funds for future cash needs to fund salary and other costs of research grants, which are normally paid in arrears, and to provide a contingency fund for development opportunities and possible exceptional expenditure.

The Observatory considers that funds of between £50,000 and £100,000, approximately 5% of total annual expenditure are sufficient to meet financial risks. The level of unrestricted funds at 31 March 2015 of £79,044 is currently sufficient to meet foreseeable contingencies. This policy will be reviewed by the Director on an annual basis at the end of the financial year.

Unrestricted funds after reversal of the pension adjustments are as follows:

	£
Unrestricted funds at 31 March 2015	
Balance on unrestricted funds at 31 March 2015	(493,220)
Reversal of pension scheme debtor at 31 March 2015	(6,736)
Reversal of pension scheme liability at 31 March 2015	579,000
Unrestricted funds at 31 March 2015 after reversal of pension adjustments	79,044

14 Restricted funds

	Balance 01/04/2014	Incoming resources	Resources expended	Transfer between funds	Transfer from defrd. income	Transfer to defrd. income	Balance 31/03/2015
	£	£	£	£	£	£	£
DCAL grant-in-aid							
SALT	5,031	-	-	-	-	-	5,031
Capital grant-in-aid		15,000	(15,000)	-	-	-	-
In-year capital grant-in-aid	-	135,000	(135,000)	-	-	-	-
	5,031	150,000	(150,000)	-	-	-	5,031
Other grants							
STFC grants	-	160,702	(147,886)	(56,438)	59,977	(16,355)	-
Leverhulme Trust	-	75,266	(75,525)	-	259	-	-
Lindsay Scholarship Fund	2,037	-	-	-	-	-	2,037
Creativity Month	-	6,000	(6,000)	-	-	-	-
Leverhulme Artist in Residence	-	13,329	(1,957)	-	-	(11,372)	-
Europlanet	-	1,205	-	(1,205)	-	-	-
	2,037	256,502	(231,368)	(57,643)	60,236	(27,727)	2,037
Donations	225	-	-	-	-	-	225
	7,293	406,502	(381,368)	(57,643)	60,236	(27,727)	7,293

DCAL Grant-In-Aid

The Observatory received a capital grant of £15,000 and further in-year capital grants of £135,000 from DCAL during the year to fund expenditure on a new boiler for the bungalow, computer equipment, collaborative research projects and a van.

Other Grants and Receipts

The Observatory received funding from the STFC to fund a number of research projects during the year.

Funding was received from the Leverhulme Trust for a research project: Ultracool Dwarfs: A New Class of Stellar Lighthouse.

An Artist in Residence Grant was received from the Leverhulme Trust to fund the 'Beyond Limits' project.

These grants fund salary, travel and other direct costs of the research projects and provide a contribution towards the principal investigator's salary costs and indirect and estate costs.

15 Analysis of transfer between funds

The transfer from restricted to unrestricted funds represents funds received from the STFC and other grants towards grant supervisory salary costs and other general running costs of the Observatory.

16 Designated funds

	2015 £	2014 £
Revaluation of land and buildings		
Balance at 1 April 2014	348,051	348,051
Transfer to donated assets reserve	-	-
Revaluation of land and buildings	-	-
Balance at 31 March 2015	348,051	348,051
Donated assets reserve		
Balance at 1 April 2014	1,806,496	1,826,031
Transfer from revaluation of land and buildings	-	-
Revaluation of donated land and buildings	-	-
Amortised	(19,535)	(19,535)
Balance at 31 March 2015	1,786,961	1,806,496
Total designated funds at 31 March 2015	2,135,012	2,154,547

Buildings and grounds with a net book value at 31 March 2015 of £1,785,175 (2014: £1,803,817) were donated to the corporation in 1790 by Archbishop Richard Robinson, the founder of the corporation.

The corporation's land and buildings were revalued at 31 March 2012 by Land and Property Services, an agency within the Department of Finance and Personnel, on the following bases:

Land and buildings	**Basis of valuation**
Operational land and buildings which are unique due to their specialised nature and design	depreciated replacement cost
Operational non-specialised land and buildings	existing use value
Other land and buildings	market value

17 Analysis of net assets between funds

	Designated Funds £	Unrestricted Funds £	Restricted Funds £	Total Funds £
Tangible assets	2,872,739	8,427	7,293	2,888,459
Current assets	-	125,177	191,894	317,071
Current liabilities	-	(47,824)	(191,894)	(239,718)
Pension liability	-	(579,000)	-	(579,000)
Net assets/(liabilities)	2,872,739	(493,220)	7,293	2,386,812

18 Analysis of net funds

	1 April 2014 £	Cash Flow £	31 March 2015 £
Cash at bank and in hand	12,332	(64,063)	(51,731)
Liquid resources	327,543	(65,822)	261,721
Net funds	339,875	(129,885)	209,990

Liquid resources comprise short term deposits held at the bank.

19 Reconciliation of net cash flow to movement in net funds

	2015 £	2014 £
(Decrease)/increase in cash in financial year	(64,063)	10,972
(Decrease)/increase in deposits	(65,822)	105,413
(Decrease)/increase in net funds in the year	(129,885)	116,385
Net funds at 1 April	339,875	223,490
Net funds at 31 March	209,990	339,875

20 Pension scheme

An actuarial valuation of the NILGOSC scheme was carried out at 31 March 2013. The funding level (ratio of assets to past service liabilities) at 31 March 2013 was 91% compared to 82% at 31 March 2010 corresponding to a funding deficit of £467million (£783m at 31 March 2010). It has been agreed that the employers' contribution rate for 2014/2015 of 20% will remain for the next 2 years, with an increase anticipated from 1 April 2017 to remove the shortfall.

The NILGOSC actuary, Aon Hewitt Ltd, has provided the following details for the purposes of accounting for the Observatory's share of the scheme deficit in accordance with FRS 17 at 31 March 2015.

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Financial assumptions

	31/3/2015 %	31/3/2014 %	31/3/2013 %
Rate of increase in salaries	3.3	3.9	5.2
Inflation/pension increase	1.8	2.4	2.8
Discount rate	3.2	4.3	4.5

Mortality assumptions

	2015 Years	2014 Years
Longevity at age 65 for current pensioners:		
- Men	22.2	22.1
- Women	24.7	24.6
Longevity at age 65 for future pensioners:		
- Men	24.4	24.3
- Women	27.0	26.9

The fair value of assets in the scheme

	Value at 31/3/2015 £k	Value at 31/3/2014 £k	Value at 31/3/2013 £k
Equities	3,604	3,226	2,789
Government Bonds	281	256	402
Corporate Bonds	321	265	18
Property	622	487	284
Cash	99	113	173
Other	10	-	22
	4,937	4,347	3,688

Asset values at 31 March 2015 are at bid values as required under FRS 17.

Armagh Observatory

Scheme balance sheet

	31/3/2015 £k	31/3/2014 £k
Fair value of assets	4,937	4,347
Present value of scheme liabilities:	-	-
Present value of unfunded liabilities	-	-
Present value of funded liabilities	(5,516)	(4,829)
Total value of scheme liabilities	(5,516)	(4,829)
Deficit in the scheme	(579)	(482)

Analysis of amount charged to operating profit in respect of the scheme

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k
Current service cost	141	175	129
Past service cost	-	-	-
	141	175	129

Analysis of amount charged to other finance expenses

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k
Expected return on scheme assets	298	253	181
Interest on scheme liabilities	(209)	(193)	(181)
Net return	89	60	-

Recognition in the statement of financial activities

	Year to 31/3/2015 £k	Year to 31/3/2015 %	Year to 31/3/2014 £k	Year to 31/3/2014 %
Current service costs	141	24.7	175	27.5
Past service costs/(gains)	-	-	-	-
Interest costs	209	36.7	193	30.3
Expected return on assets	(298)	(52.3)	(253)	(39.7)
Total	52	9.1	115	18.0
Actual return on assets	569		617	

Reconciliation of defined benefit obligation

	Year to 31/3/2015 £k	Year to 31/3/2014 £k
Opening defined benefit obligation	4,829	4,249
Current service cost	141	175
Interest cost	209	193
Contributions by members	40	44
Actuarial losses/(gains)	430	298
Past service costs/(gains)	-	-
Benefits paid	(133)	(130)
Closing defined benefit obligation	5,516	4,829

Reconciliation of fair value of assets

	Year to 31/3/2015 £k	Year to 31/3/2014 £k
Opening fair value of assets	4,347	3,689
Expected return on assets	298	253
Contributions by members	40	44
Contributions by the corporation	114	127
Actuarial gains/(losses)	271	364
Benefits paid	(133)	(130)
Closing fair value of assets	4,937	4,347

Amount for current and previous accounting years

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k	Year to 31/3/2012 £k	Year to 31/3/2011 £k
Fair value of assets	4,937	4,347	3,689	3,210	3,246
Present value of defined benefit obligation	(5,516)	(4,829)	(4,249)	(3,791)	(3,610)
(Deficit)/Surplus	(579)	(482)	(560)	(581)	(364)
Experience gains/(losses) on assets	271	364	370	(199)	204
Experience (losses)/gains on liabilities	(15)	(578)	3	(25)	206

Amount recognised in the statement of recognised gains and losses (SRGL)

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k	Year to 31/3/2012 £k	Year to 31/3/2011 £k
Actuarial (losses)/gains	(159)	66	36	(210)	736
Increase/(decrease) in irrecoverable surplus from membership fall and other factors	-	-	-	-	-
Actuarial (losses)/gains recognised in the SRGL	(159)	66	36	(210)	736
Cumulative actuarial (losses)/gains	(625)	(466)	(532)	(568)	(358)

21 Commitments

There were no outstanding capital commitments at 31 March 2015 (2014: £nil).

22 Investment in Southern African Large Telescope Project

	2015 £	2014 £
Total investment at 31 March	185,096	185,096
Provision for impairment at 31 March	(185,096)	(185,096)
Net book value at 31 March	-	-

The Southern African Large Telescope (SALT) project involved the construction of a 10-metre class telescope with related buildings at the Sutherland Outstation of the South African Astronomical Observatory in Northern Cape Province. The main objective is to advance science and education in South Africa through the promotion of deep-sky astronomy, and by participating in the project the Armagh Observatory has attained rights to use the telescope.

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 during the year. The Armagh Observatory has had various material transactions with a number of Government Departments, Executive Agencies and Non-Departmental Public Bodies in Northern Ireland and the UK. Most of these transactions have been with DCAL, the Central Procurement Directorate (CPD), the Science and Technology Facilities Council (STFC) and the Southern Education and Library Board (SELB). DCAL provides recurrent and capital grant-in-aid (page 43, note 2), the STFC provides grants for research projects (page 43, note 2) and CPD and SELB are the Centres of Procurement Expertise for the corporation.

24 Financial Instruments

As the cash requirements of the Observatory are met through grants from DCAL 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 is therefore exposed to little credit, liquidity or market risk.

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

Statement of Financial Activities prepared under FReM

	2015	2014
	£	£
Incoming resources		
Incoming resources from research and other non-DCAL grants	289,011	267,186
Other incoming resources	9,754	9,586
Total incoming resources	298,765	276,772
Resources expended		
Direct expenditure of the corporation	1,164,001	1,296,049
Fundraising and publicity	-	-
Management and administration of the corporation	221,724	154,033
Capital expenditure	141,856	71,211
Total Resources expended	1,527,581	1,521,293
Net deficit for the year	(1,228,816)	(1,244,521)
Finance income/(costs) - pension scheme	89,000	60,000
Actuarial (loss)/gain - pension scheme	(159,000)	66,000
Amount transferred to funds	(1,298,816)	(1,118,521)

Analysis of funds prepared under the FReM

	2015	2014
	£	£
Balance at 1 April 2014	2,456,424	2,424,089
Adjustment to opening funds	13,716	-
Movement in government grant reserve	47,867	(22,109)
Movement in designated funds	(19,535)	(19,535)
Grant-in-aid received in the year	1,187,156	1,192,500
Net operating costs for the year	(1,298,816)	(1,118,521)
Balance at 31 March 2015	2,386,812	2,456,424

26 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 19 December 2017.

Armagh Planetarium

Statement of financial activities for the year ended 31 March 2015

	Notes	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Incoming resources					
DCAL grant-in-aid	2	493,000	30,000	523,000	571,500
Other grants and receipts	2	2,500	-	2,500	3,000
Admissions		129,538	-	129,538	114,730
Rents		6,230	-	6,230	5,331
Interest receivable		-	-	-	-
Disposal of fixed assets		-	-	-	-
Miscellaneous income		2,741	-	2,741	3,030
Outreach income		-	-	-	-
Shop gross profit	22	37,969	-	37,969	28,910
Transfer to deferred income		-	-	-	-
Transfer from deferred income		-	-	-	-
Transfer between funds		-	-	-	-
Total incoming resources		671,978	30,000	701,978	726,501
Resources expended					
Direct expenditure of the corporation	3	517,217	-	517,217	547,877
Fundraising and publicity	4	5,804	-	5,804	9,629
Management and administration of the corporation	5	157,538	-	157,538	156,323
Capital expenditure		-	30,000	30,000	26,485
Total resources expended		680,559	30,000	710,559	740,314
Net movement in funds before finance income		(8,581)	-	(8,581)	(13,813)
Finance income/(costs) - pension scheme		37,000	-	37,000	18,000
Net movement in funds after finance income		28,419	-	28,419	4,187
Actuarial (loss)/gain on pension scheme		(145,000)	-	(145,000)	157,000
Net movement in funds after actuarial (loss)/gain		(116,581)	-	(116,581)	161,187
Balances brought forward at 1 April		(556,562)	-	(556,562)	(717,749)
Balances carried forward at 31 March	13, 14	(673,143)	-	(673,143)	(556,562)

All amounts above relate to continuing operations of the corporation.

The income and expenditure summary is included at Note 7.

Statement of recognised gains and losses

	2015 £	2014 £
Net movement in funds for the year	28,419	4,187
Deficit arising from the revaluation of land and buildings	-	-
Net movement on government grant reserve	(119,109)	(156,048)
Actuarial (loss)/gain on pension scheme	(145,000)	157,000
Recognised (losses)/gains for the year	(235,690)	5,139

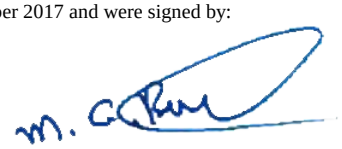
Armagh Planetarium

Balance sheet at 31 March 2015

	Notes	2015 £	2014 £
Tangible assets	8	4,381,986	4,501,095
Current assets			
Stock	9	14,732	11,600
Debtors and prepayments	10	35,384	41,656
Cash at bank and in hand	17, 18	14,190	1,264
		64,306	54,520
Creditors: amounts falling due within one year	11	(56,449)	(46,082)
Net current assets		7,857	8,438
Net assets excluding pension liability		4,389,843	4,509,533
Long-term liabilities - pension scheme	19	(681,000)	(565,000)
		(681,000)	(565,000)
Net assets		3,708,843	3,944,533
Funds			
Unrestricted funds	13	(673,143)	(556,562)
Government grant reserve	12	468,517	587,626
Designated funds	15	3,913,469	3,913,469
		3,708,843	3,944,533

The financial statements on pages 56 to 70 were approved on 16 November 2017 and were signed by:

Archbishop Richard Clarke
Chair of the Board of Trustees



Professor Michael Burton
Chief Executive

Armagh Planetarium

Cash flow statement for the year ended 31 March 2015

	Notes	2015 £	2014 £
Net cashflow from operating activities		15,661	98
Returns on investments and servicing of finance			
Interest received		-	-
Profit in sale of assets		-	-
Bank and credit card processing charges		(2,735)	(2,426)
		(2,735)	(2,426)
Capital expenditure			
Purchase of tangible assets		(30,000)	(26,485)
Capital grants received		30,000	26,485
		-	-
Net cash inflow/(outflow) before financing		12,926	(2,328)
Financing			
Repayment of principal under hire purchase agreements		-	-
Increase/(decrease) in cash	17, 18	12,926	(2,328)

Reconciliation of operating result to net cash flow from operating activities

	2015 £	2014 £
Net incoming resources per statement of financial activities	(8,581)	(13,813)
Interest received	-	-
Profit on sale of assets	-	-
Interest paid and similar charges	2,735	2,426
Depreciation	149,109	182,533
Deferred credit release	(149,109)	(182,533)
Pension service costs	8,000	10,000
(Increase)/decrease in stock	(3,132)	1,075
Decrease/(increase) in debtors	6,272	(12,582)
Increase/(decrease) in creditors	10,367	12,992
Net cash inflow/(outflow) from operating activities	15,661	98

Notes to the financial statements for the year ended 31 March 2015

1 Accounting policies

Basis of accounting

The financial statements have been prepared under direction issued by DCAL, in particular the requirement to recognise grant in aid received from them on a cash basis in order to present a true and fair view of Government funding. With the exception of this departure from the SORP , in all other aspects the financial statements comply with the Statement of Recommended Practice for Charities (SORP 2005).

Tangible fixed assets

The cost of tangible fixed assets is their replacement or valuation together with any incidental costs of acquisition. Deprec iation 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 rates used are as follows:

	%
Digistar	10
Furniture and fittings	10 - 15
Office equipment	15 - 25
Equipment	10 - 25
Buildings	2
Exhibits	10 - 25
Vehicles	25

Land and buildings are included in the balance sheet at depreciated replacement cost, estimated value in use or market value.

Incoming Resources

Grant income from DCAL is shown in the Statement of Financial Activities in the year in which it is received.
Grants that relate to specific capital expenditure are treated as deferred income which is then credited to the Statement of Financial Activities over the related asset's useful life. Other grants are credited to the Statement of Financial Activities when received .

Pension scheme

The corporation provides pension benefits to its employees by participating in the Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) Pension Scheme, which is a defined benefit scheme. Annual contributions to the NILGOSC scheme are based on actuarial advice. The operating costs of providing retirement benefits to the corporation'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.

Fund accounting

The corporation 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

Funds which are expendable at the discretion of the Governors in furtherance of the objects of the corporation. In addition to expenditure on the provision of services, such funds may be held in order to finance capital investment and working capital.

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.

2 Incoming Resources

The accounts reflect the receipt of the following grants:

Grant-in-aid from the Department of Culture, Arts and Leisure (DCAL)

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Recurrent grant-in-aid	463,500	-	463,500	484,000
In year recurrent grant-in-aid	29,500	-	29,500	62,500
Capital grant-in-aid	-	15,000	15,000	25,000
In-year capital grant	-	15,000	15,000	-
	493,000	30,000	523,000	571,500

Other grants and receipts

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
ESA Earth Rider Grant	2,500	-	2,500	-
ESERO UK Grant	-	-	-	3,000
	2,500	-	2,500	3,000

3 Direct expenditure of the corporation

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Salaries and wages	416,085	-	416,085	403,627
Agency staff	36,519	-	36,519	36,046
Travelling and subsistence	5,399	-	5,399	4,873
Equipment maintenance and consumables	23,927	-	23,927	36,543
Library and subscriptions	2,102	-	2,102	3,837
Production expenses	2,125	-	2,125	11,233
Exhibitions and events	26,909	-	26,909	46,727
Training	1,735	-	1,735	1,896
Vehicle expenses	2,416	-	2,416	3,095
	517,217	-	517,217	547,877

4 Fundraising and publicity

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Advertising and brochures	5,783	-	5,783	9,188
Hospitality	21	-	21	441
	5,804	-	5,804	9,629

5 Management and administration of the corporation

	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds 2015 £	Total funds 2014 £
Insurance	14,862	-	14,862	15,422
Heat, light and power	55,659	-	55,659	60,252
General property repairs	27,125	-	27,125	21,369
Cleaning services and consumables	22,034	-	22,034	21,477
Office and café furnishings	430	-	430	1,655
Postage and telephone	7,057	-	7,057	6,212
General expenses	1,267	-	1,267	1,043
Bank and credit card processing charges	2,735	-	2,735	2,426
Audit	10,452	-	10,452	13,128
Professional fees and licences	4,978	-	4,978	4,018
Management Committee and meetings	5,103	-	5,103	2,138
Rates	236	-	236	240
Printing and stationery	4,500	-	4,500	6,318
Recruitment	1,100	-	1,100	625
Depreciation	-	149,109	149,109	182,533
Release from grants reserve	-	(149,109)	(149,109)	(182,533)
	157,538	-	157,538	156,323

6 Average staff numbers and related costs

Average staff numbers

	2015	2014
	Number	Number
Permanent staff	9.3	9.4
Fixed-term contract staff	0.5	0.3
Agency staff	3.0	2.6
	12.8	12.3

Included within the numbers above are the corporation's Operations Manager (whose salary is shared equally between the Planetarium and Observatory) and the Temporary Accountant (whose salary is apportioned between the Planetarium and Observatory in the ratio 1:3).

Costs

	2015	2014
	£	£
Permanent staff		
Wages and salaries	303,212	304,059
Social security costs	25,581	24,598
Employer's pension costs	54,198	54,789
Pension service cost (note 19)	8,802	7,211
	391,793	390,657
Fixed-term contract staff costs		
Wages and salaries	24,292	12,970
Social security costs	-	-
Employer's pension costs	-	-
Pension service cost (note 19)	-	-
	24,292	12,970
Total permanent and fixed-term staff		
Wages and salaries	327,504	317,029
Social security costs	25,581	24,598
Employer's pension costs	54,198	54,789
Pension service cost (note 19)	8,802	7,211
	416,085	403,627
Agency staff costs	36,519	36,046
Total staff costs	452,604	439,673

Staff costs above include 50% of the salary costs of the corporation's Operations Manager and 25% of the salary costs of the Temporary Accountant.

The pension service cost of £8,802 is the actuarial present value of pension benefits earned by staff during the year.

7 Income and expenditure summary

	2015	2014
	£	£
Gross income	671,978	700,016
Expenditure		
Direct expenditure of the corporation	517,217	547,877
Fund raising and publicity	5,804	9,629
Management and administration of the corporation	157,538	156,323
	680,559	713,829
Other finance income	37,000	18,000
Surplus/(deficit) for the year	28,419	4,187

8 Tangible fixed assets

	Digistar	Freehold Land and buildings	Equipment	Exhibits	Vehicles	Total
	£	£	£	£	£	£
Cost or valuation						
At 1 April 2014	1,200,332	4,306,860	368,284	153,256	8,702	6,037,434
Asset revaluation	-	-	-	-	-	-
Additions	-	-	15,824	-	14,176	30,000
Disposals	-	-	-	-	-	-
At 31 March 2015	1,200,332	4,306,860	384,108	153,256	22,878	6,067,434
Depreciation						
At 1 April 2014	980,978	145,344	265,709	135,606	8,702	1,536,339
Adjustment on asset revaluation	-	-	-	-	-	-
Charge for year	35,610	72,672	37,376	3,451	-	149,109
Disposals	-	-	-	-	-	-
At 31 March 2015	1,016,588	218,016	303,085	139,057	8,702	1,685,448
Net book value						
At 31 March 2015	183,744	4,088,844	81,023	14,199	14,176	4,381,986
Net book value						
At 31 March 2014	219,354	4,161,516	102,575	17,650	-	4,501,095

Tangible fixed asset additions of £30,000 as shown above were funded as follows:

	£
DCAL Capital grant-in-aid	15,000
DCAL In-year capital grant-in-aid	15,000
	30,000

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

	2015	2014
	£	£
Cost	1,351,239	1,351,239
Aggregate depreciation	(494,975)	(469,890)
Net book value based on historic cost	856,264	881,349

9 Stocks

	2015	2014
	£	£
Finished goods and goods for resale	14,732	11,600

10 Debtors

	2015	2014
	£	£
Trade and grant debtors	3,820	6,578
Prepayments	6,780	9,408
VAT	6,435	6,519
Pension scheme	18,349	19,151
	35,384	41,656

11 Creditors: amounts falling due within one year

	2015	2014
	£	£
Trade creditors	36,413	13,421
Accruals	20,036	32,661
	56,449	46,082

Analysis of deferred income

	2015	2014
	£	£
Balance at 1 April	-	-
Transfer to miscellaneous income	-	-
Transfer to statement of financial activities	-	-
Transfer from statement of financial activities	-	-
Balance at 31 March	-	-

12 Government grants reserve

	Digistar	Buildings and grounds	Equipment	Exhibits	Vehicles	Total
	£	£	£	£	£	£
Balance at 1 April 2014	219,354	248,047	102,575	17,650	-	587,626
Additions	-	-	15,824	-	14,176	30,000
Disposals	-	-	-	-	-	-
Amortised	(35,610)	(72,672)	(37,376)	(3,451)	-	(149,109)
Balance at 31 March 2015	183,744	175,375	81,023	14,199	14,176	468,517

13 Unrestricted funds

	2015
	£
Balance at 1 April 2014	(556,562)
Incoming resources	671,978
Resources expended	(680,559)
Other finance income	37,000
Adjustment to the statement of recognised gains and losses	(145,000)
Balance at 31 March 2015	(673,143)

The unrestricted funds reserve includes a deficit of £681,000 (2014: £565,000) in respect of pension scheme liabilities of the pension fund.

Unrestricted funds after reversal of the pension adjustments are as follows:

	£
Unrestricted funds at 31 March 2015	
Balance on unrestricted funds at 31 March 2015	(673,143)
Reversal of pension scheme debtor	(18,349)
Reversal of pension scheme liability	681,000
Unrestricted funds at 31 March 2015 after reversal of pension adjustments	(10,492)

14 Restricted funds

	Balance 01/04/2014	Incoming resources	Resources expended	Transfer between funds	Transfer from defrd. income	Transfer to defrd. income	Balance 31/03/2015
	£	£	£	£	£	£	£
DCAL grant-in-aid							
Capital-in-aid	-	30,000	(30,000)	-	-	-	-
Total DCAL grant-in-aid	-	30,000	(30,000)	-	-	-	-
Total other grants and receipts	-	-	-	-	-	-	-
	-	30,000	(30,000)	-	-	-	-

DCAL Grant-In-Aid

DCAL provided funding of £30,000 for the purchase of equipment and a motor car.

15 Designated funds

	2015	2014
	£	£
Revaluation of land and buildings		
Balance at 1 April 2014	3,913,469	3,913,469
Revaluation of land and buildings	-	-
Balance at 31 March 2015	3,913,469	3,913,469

The corporation's land and buildings were revalued at 31 March 2012 by Land and Property Services, an Agency within the Department of Finance and Personnel on the following bases:

Land and buildings	**Basis**
Operational land and buildings which are unique due their specialised nature and design	depreciated replacement cost
Operational non-specialised land and buildings	existing use value
Other land and buildings	market value

16 Analysis of net assets between funds

	Designated funds 2015 £	Unrestricted funds 2015 £	Restricted funds 2015 £	Total funds £
Tangible fixed assets	4,381,986	-	-	4,381,986
Current assets	-	64,306	-	64,306
Creditors: amounts falling due within one year	-	(56,449)	-	(56,449)
Pension	-	(681,000)	-	(681,000)
Net current liabilities	-	(673,143)	-	(673,143)
Creditors: amounts falling due after more than one year	-	-	-	-
Net assets/(liabilities)	4,381,986	(673,143)	-	3,708,843

17 Analysis of net cash funds

	1 April 2014 £	Cashflow £	Non cash movement £	31 March 2015 £
Cash at bank and in hand	1,264	12,926	-	14,190
Net funds	1,264	12,926	-	14,190

18 Reconciliation of net cashflow to movement in net cash funds

	2015 £	2014 £
Increase/(decrease) in cash in financial year	12,926	(2,328)
Net funds at 1 April	1,264	3,592
Net funds at 31 March	14,190	1,264

19 Pension scheme

An actuarial valuation of the NILGOSC scheme was carried out at 31 March 2013. The funding level (ratio of assets to past service liabilities) at 31 March 2013 was 91% compared to 82% at 31 March 2010 corresponding to a funding deficit of £467m (£783 million at 31 March 2010). It has been agreed that the employers' contribution rate for 2014/2015 of 20% will remain for the next 2 years, with an increase anticipated from 1 April 2017 to remove the shortfall.

The NILGOSC actuary, Aon Hewitt Ltd, has provided the following details for the purposes of accounting for the Planetarium's share of the scheme deficit in accordance with FRS 17 at 31 March 2015.

Financial assumptions used by the actuary were:

	31/3/2015 %	31/3/2014 %	31/3/2013 %
Rate of increase in salaries	3.3	3.9	5.2
Inflation/pension increase	1.8	2.4	2.8
Discount rate	3.2	4.3	4.5

Mortality assumptions

	2015 Years	2014 Years
Longevity at age 65 for current pensioners:		
- Men	22.2	22.1
- Women	24.7	24.6
Longevity at age 65 for future pensioners:		
- Men	24.4	24.3
- Women	27.0	26.9

Armagh Planetarium

The fair value of assets in the scheme

	Value at 31/3/2015 £k	Value at 31/3/2014 £k	Value at 31/3/2013 £k
Equities	2,002	1,783	1,630
Government Bonds	156	142	235
Corporate Bonds	178	147	11
Property	345	269	166
Cash	55	62	101
Other	6	-	13
	2,742	2,403	2,156

Asset values at 31 March 2015 are at bid values as required under FRS 17.

Scheme balance sheet

	31/3/2015 £k	31/3/2014 £k	31/3/2013 £k
Fair value of assets	2,742	2,156	-
Present value of scheme liabilities:			
Present value of unfunded scheme liabilities	(3)	(3)	(4)
Present value of funded liabilities	(3,420)	(2,965)	(2,882)
Total value of scheme liabilities	(3,423)	(2,968)	(2,886)
Deficit in the scheme	(681)	(812)	(2,886)

Analysis of amount charged to operating profit in respect of the scheme

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k
Current service cost	63	62	51
Past service cost	-	-	-
	63	62	51

Analysis of amount charged to other finance expenses

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k
Expected return on scheme assets	165	148	104
Interest on scheme liabilities	(128)	(130)	(118)
Net return	37	18	(14)

Recognition in the statement of financial activities

	Year to 31/3/2015 £k	Year to 31/3/2015 %	Year to 31/3/2014 £k	Year to 31/3/2014 %
Current service costs	63	24.5	62	24.1
Past service cost	-	-	-	-
Interest costs	128	47.6	130	50.6
Expected return on assets	(165)	(61.3)	(148)	(57.6)
Total	26	10.7	44	17.1
Actual return on assets	316		225	

Armagh Planetarium

Reconciliation of defined benefit obligation

	Year to 31/3/2015 £k	Year to 31/3/2014 £k
Opening defined benefit obligation	2,968	2,886
Current service cost	63	62
Past service costs/(gains)	-	-
Interest cost	128	130
Contributions by members	17	17
Actuarial losses/(gains)	296	(80)
Estimated unfunded benefits paid	(1)	(1)
Benefits paid	(48)	(46)
Closing defined benefit obligation	3,423	2,968

Reconciliation of fair value of assets

	Year to 31/3/2015 £k	Year to 31/3/2014 £k
Opening fair value of assets	2,403	2,156
Expected return on assets	165	148
Contributions by members	17	17
Contributions by the corporation	54	51
Contributions in respect of unfunded benefits	1	1
Actuarial gains/(losses)	151	77
Unfunded benefits paid	(1)	(1)
Benefits paid	(48)	(46)
Closing fair value of assets	2,742	2,403

Amount for current and previous accounting years

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k	Year to 31/3/2012 £k	Year to 31/3/2011 £k
Fair value of assets	2,742	2,403	2,156	1,820	1,798
Present value of defined benefit obligation	(3,423)	(2,968)	(2,886)	(2,447)	(2,167)
(Deficit)/surplus	(681)	(565)	(730)	(627)	(369)
Experience gains/(losses) on assets	151	77	212	(110)	105
Experience gains/(losses) on liabilities	21	(110)	4	(37)	186

Amount recognised in the statement of recognised gains and losses (SRGL)

	Year to 31/3/2015 £k	Year to 31/3/2014 £k	Year to 31/3/2013 £k	Year to 31/3/2012 £k	Year to 31/3/2011 £k
Actuarial (losses)/gains	(145)	157	(88)	(255)	462
Increase/(decrease) in irrecoverable surplus from membership fall and other factors	-	-	-	-	-
Actuarial (losses)/gains recognised in the SRGL	(145)	157	(88)	(255)	462
Cumulative actuarial (losses)/gains	(871)	(726)	(883)	(795)	(540)

20 Commitments

There were no capital commitments at the 31 March 2015 (2014: £nil).

21 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 Planetarium during the year. The Armagh Planetarium has had various material transactions with a number of Government Departments, Executive Agencies and Non-Departmental Public Bodies in Northern Ireland and the UK. Most of these transactions have been with DCAL, the Southern Education and Library Board (SELB) and the Central Procurement Directorate (CPD). DCAL provide recurrent and capital grant-in-aid (page 60, note 2) and the SELB and the CPD are the Centres of Procurement Expertise for the corporation.

22 Shop trading account

	2015 £	2014 £
Sales	68,512	59,216
Less: cost of sales		
Opening stock at 1 April 2014	11,600	12,675
Add: Purchases	33,675	29,231
	45,275	41,906
Less: closing stock at 31 March 2015	(14,732)	(11,600)
	30,543	30,306
Gross profit	37,969	28,910
Gross profit %	55	49

Note: Other costs relating to the Shop operations are included with other Planetarium costs under resources expended.

23 Financial Instruments

As the cash requirements of the Planetarium are met through grants from DCAL 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 Planetarium's expected purchase and usage requirements and the Planetarium is therefore exposed to little credit, liquidity or market risk.

24 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 then to income and expenditure reserve. In addition the FReM requires grant-in-aid to be accounted for on a cash basis.

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

Statement of Financial Activities prepared under FReM

	2015	2014
	£	£
Incoming resources		
Incoming resources from other non-DCAL grants	2,500	3,000
Admissions	129,538	114,730
Outreach	-	-
Shop and mail order gross profit	37,969	28,910
Other incoming resources	8,971	8,361
Total incoming resources	178,978	155,001
Resources expended		
Direct expenditure of the corporation	517,217	547,877
Fundraising and publicity	5,804	9,629
Management and administration of the corporation	157,538	156,323
Capital expenditure	30,000	26,485
Total Resources expended	710,559	740,314
Net deficit for the year	(531,581)	(585,313)
Finance income/(costs) - pension scheme	37,000	18,000
Actuarial (loss)/gain - pension scheme	(145,000)	157,000
Amount transferred to funds	(639,581)	(410,313)

Analysis of funds prepared under the FReM

	2015	2014
	£	£
Balance at 1 April	3,944,533	3,939,394
Adjustment to opening funds	-	-
Movement in government grant reserve	(119,109)	(156,048)
Movement in designated funds	-	-
Grant-in-aid received in the year	523,000	571,500
Net operating costs for the year	(639,581)	(410,313)
Balance at 31 March	3,708,843	3,944,533

25 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 19 December 2017

The Armagh Observatory and Planetarium Annual Report and Accounts 2014-15

The Report of the Comptroller and Auditor General

Introduction

1. Until March 2016, the Armagh Observatory and the Armagh Planetarium were two distinct institutions within a single statutory corporation. Each operated under a Director and prepared separate annual accounts which were subject to audit.

2. The Director of the Armagh Observatory and the Director of the Armagh Planetarium were designated as Accounting Officers by the Department of Culture, Arts and Leisure (the Department). As such they had personal responsibility for the propriety and regularity of the public finances for which they were answerable and for keeping proper accounts. The Accounting Officers were also responsible for safeguarding the assets of the corporation and for taking reasonable steps for the prevention and detection of fraud and other irregularities.

3. Dr Tom Mason was appointed Director of the Armagh Planetarium on 1 August 1996 and was the Accounting Officer from 1 July 1997 until his retirement on 30 April 2015.

4. In April 2016, the Armagh Observatory and the Armagh Planetarium became one organisation. In May 2016, responsibility for this organisation transferred from the Department of Culture, Arts and Leisure to the Department for Communities. The current Chief Executive of the Armagh Observatory and Planetarium was appointed as the sole Accounting Officer in September 2016.

Investigations

5. In June 2015, the Armagh Observatory and Planetarium (AOP) Audit and Risk Committee was advised that a number of Single Tender Actions, in relation to Planetarium activities, had been made without appropriate approvals in place. Concerns were also raised in relation to entries in the Planetarium's hospitality register.

6. An initial examination of the supporting documentation found that the contracts were signed by Dr Mason and confirmed that appropriate procedures had not been followed. The AOP's internal auditors were asked to investigate further. Internal Audit began a comprehensive review and forensic audit of all transactions initiated by Dr Mason, in the period October 2013 to May 2015, to identify any non-compliance with AOP procedures for:

    - procurement;
    - and the use of the Planetarium's credit cards.

7. AOP and the Department were alerted to potential financial irregularities in relation to the purchase of high-value IT assets, some of which could not be located, and the potential misuse of the Planetarium's credit cards. In October 2015 the Department referred the matter to the Department of Finance's Group Fraud Investigation Service (GFIS) for further investigation.

8. The Internal Audit review was completed in March 2016, while GFIS reported their findings to the Department in October 2016.

Issues identified

9. My review of the investigation reports identified four main issues:

- purchases made outside of AOP's procedures;
- the misuse of the Planetarium credit cards;
- the purchase of high value IT equipment; and
- the receipt and recording of hospitality.

Purchases made outside of AOP's procedures

10. The investigations focused on three specific contracts[1]:

Supplier[2]	Contract Details	Value
A	Support of the Planetarium's projector and related technology	£15,030 per annum for three years
B	Purchase of two theatre shows	£14,342
C	Refurbishment of 93 seats	£20,597

11. With regards to Supplier A and Supplier B contracts:

- The Planetarium's Financial Controls and Procedures require that a business case is prepared for all non-routine purchases above £1,500 (excluding VAT). However, business cases had not been prepared for these purchases;
- The AOP Management Statement and Financial Memorandum (MSFM) issued by the Department in May 2009 advises that proposals for Single Tender Actions shall be subject to advice being taken from the Department of Finance's Central Procurement Directorate (CPD). However, no such advice had been sought from CPD in relation to these purchases; and
- Business cases for contracts exceeding the Accounting Officer's delegated limit of £10,000 should have been submitted to the Department for approval. This did not occur.

12. Dr Mason advised me that the Planetarium had been receiving *ad hoc* support from Supplier A for a number of years. He added that the Planetarium had tried to work with other suppliers but they were not competent to do the work required. Dr Mason considered that the arrangement with Supplier A needed to be formalised in order to future-proof the Planetarium theatre operation after he retired. His intention was "to provide a cushion for the Planetarium to weather the major changes in AOP's structure that were looming". He provided a similar explanation for the purchase of the two theatre shows.

13. On 5 January 2015 the Department approved the business case and Single Tender Action to Supplier C for £20,000 to purchase 33 new seats at the Planetarium in 2014-15. CPD advice had been sought for the purchase of the 33 new seats. However, the 33 new seats were not purchased in the 2014-15 financial year and the Planetarium's 2014-15 capital budget was reduced. Dr Mason subsequently committed the Planetarium to the expenditure required to refurbish all 93 seats at the Planetarium in 2015-16 at a cost of £20,597 without having sufficient budget cover in 2015-16 or valid approval.

[1] Although the investigations refer to contracts with the three suppliers, there is only a contract with Supplier A which was signed by Dr Mason on 6 April 2015. Invoices from Suppliers B and C were authorised by Dr Mason on 28 April 2015 and 10 April 2015 respectively. For the purpose of this report, reference to contracts has been retained.

[2] This report should not be seen as implying any criticism of these suppliers.

14. Dr Mason told me that his assessment was that new seating would be essential, and if it was not forthcoming the Planetarium would have to close. He considered that there would be money in the Planetarium's 2015-16 budget from his salary as he was only going to be in post until the end of April 2015. AOP advised me that Dr Mason did not discuss the budget with the Management Committee.

15. Dr Mason advised me that in his time as Director of the Planetarium, he fought to restore the AOP to its place as a world-renowned centre for astronomy education and his intention was to save the Planetarium as much money as possible. Regardless of his intentions, Dr Mason's actions in relation to these three contracts were a breach of the Planetarium's procedures and his Accounting Officer responsibilities as set out in the MSFM and Managing Public Money Northern Ireland. These resulted in irregular expenditure of £49,969 in 2015-16 and irregular spend of £15,582 in 2016-17. In addition, any expenditure incurred in 2017-18 in relation to the contract with Supplier A for support of the Planetarium's projector and related technology will be irregular spend.

The misuse of the Planetarium credit cards

16. Although the Planetarium's procedures (March 2013) refer to one credit card, the Planetarium actually had two cards.

17. As Internal Audit had noted that Dr Mason had used a Planetarium credit card to pay for his retirement functions in April 2015, and identified other issues of non-compliance with the Planetarium's credit card procedures, GFIS's investigation reviewed credit card expenditure from April 2011 to May 2015. This sought to identify any other credit card items which seemed unusual or outside of what would be considered normal business purchases. GFIS's report states that "this was not an easy task due to the poor nature of the records, lack of supporting documentation and the hand written annotations on some of the monthly bills (which we believe were made by Dr Mason)." Although Dr Mason responded to GFIS's initial invitation to meet and discuss certain issues, advising that he could be contacted again upon his return from holiday, he did not reply to GFIS's subsequent correspondence.

18. The issues identified in GFIS's analysis included:

- some items were sent directly to Dr Mason's home address;
- over £1,000 worth of gift cards had been purchased as staff bonuses;
- the purchase of a games console, four computer games and flowers;
- purchases at supermarkets and on-line stores without any explanation of what had been purchased; and
- the purchase of a drone.

19. GFIS advised that "Without the opportunity to speak to Dr Mason it is difficult to ascertain whether or not these items could be related to a business need within AOP, or indeed in the case of the drone, was it really value for money to purchase this item for one small shot of film."

20. It is disappointing that Dr Mason did not engage with GFIS during their investigation and afford them the opportunity to consider his responses. This would have enabled Dr Mason to explain his actions to AOP and facilitated AOP's review of his explanations.

21. Dr Mason did however, provide me with detailed responses to the issues identified in GFIS's analysis at paragraph 18 above. For example, he advised that he had purchased gift cards for the Planetarium staff to provide them with some small token of appreciation for their hard work and loyalty to the organisation. Dr Mason recalled that this was discussed with members of the Management Committee. AOP advised me the Management Committee members have no recollection of being informed of this expenditure. In addition, they advised that the correct

procedure would have been to raise the issue via the Employment Conditions and Remuneration Committee. However, there is no record in the Committee minutes or the hospitality and gift register to support the expenditure.

22. I asked AOP how they satisfied themselves that there were no irregularities in periods prior to those examined by Internal Audit and GFIS. AOP advised me that they are not aware of any suggestion of irregularities in prior periods and it should be recognised that current management are newly in post and have no detailed knowledge of prior years. Almost all the permanent staff in place in prior years have left and the current temporary staff do not have detailed knowledge of those years. They consider that it is unlikely that the initiation of a detailed review of prior years, not focused on specific times or transactions would pass the value for money test.

Reimbursement of Credit Card Expenditure

23. Dr Mason reimbursed AOP £422 in respect of his retirement functions which he had paid for using the Planetarium credit card. GFIS recommended that AOP consider recovery of money from Dr Mason for credit card purchases totalling £5,502 where GFIS concluded there can be no justification of business need and deemed to be inappropriate expenditure. AOP advised me that a letter had been sent to Dr Mason on 31 January 2017 seeking reimbursement of the £5,502, as recommended by GFIS. Dr Mason replied on 1 March 2017 stating that if AOP takes this matter to court he could explain fully all the expenditure. He suggested a mediation meeting. Dr Mason's letter was discussed at the Audit and Risk Assurance Committee meeting on 29 March 2017, noting that GFIS had stated that there were no issues of criminality. The Committee concluded that it was not appropriate to hold a mediation meeting as there was nothing to mediate. The Committee agreed that Dr Mason's duty was to explain expenditure on request without the need for a meeting.

24. Dr Mason advised me that he considered that all of the expenditure was directly related to the efficient running of the Planetarium and that most of the expenses and the circumstances were explained at the time to the Management Committee and specifically to the Vice Chairman. As noted at paragraph 20 it was in Dr Mason and AOP's interest that he engaged with GFIS on matters raised with his use of the Planetarium's credit cards. AOP advised me Dr Mason did not explain his actions at the time and that although he had an obligation to follow due process, he did not do so. AOP added that a conversation in passing about possible options should not be construed as Management Committee approval.

The purchase of high value IT equipment

25. The reviews of credit card expenditure identified the purchase of a number of IT items.

26. Physical verification of these purchases and other IT equipment was difficult as the Planetarium did not have a comprehensive asset register showing locations and tag numbers of all capitalised assets and other records were poor. A number of items could not be located and AOP believed they were in Dr Mason's possession.

27. In January 2016, almost ten months after his retirement, Dr Mason returned equipment which AOP advised had an estimated purchase cost of £9,500. Amongst the items returned were two laptops, a desktop computer, a drone, two action cameras and a projector.

28. GFIS concluded that "There can be no valid explanation why Dr Mason felt the necessity to have so much IT equipment at what was presumably his home address, and why it took the best part of 10 months after his retirement for him to return it."

29. Dr Mason advised me that he was responsible for IT at the Planetarium and that a lot of the equipment had been used and trialled at his home office. The Vice Chair of Management Committee and the Finance Officer knew that he had the IT equipment, and he had asked them both to let him know when the IT equipment needed to be returned. As none of the equipment was needed for day to day running of the Planetarium, he did not urgently attend to its return. He further stated that, when he was asked to return the equipment, he did so.

30. AOP advised me that it did not believe there was a need for so much expensive equipment to be taken away from the Planetarium. The Management Committee was not informed of Dr Mason's practice and is concerned that Dr Mason stated that he purchased equipment that was not needed for the day to day running of the Planetarium. AOP expected all equipment to be returned immediately on retirement without the need for it to issue a specific request.

31. When a member of staff leaves a public sector organisation any items belonging to the organisation, and held by the individual, should be returned immediately. Consequently AOP should have requested return of all the IT equipment held by Dr Mason as soon as he retired.

32. I asked AOP whether all missing items had been returned. AOP advised me that Dr Mason had signed a declaration that "all items owned by the Armagh Planetarium and Observatory which were in my possession at the time of my retirement have now been returned to the organisation." AOP are not aware of any items which have not been returned.

33. I asked AOP whether, in light of the issues raised in both investigations, it compiled a complete asset register and whether procedures had been put in place to ensure that it is updated on an on-going basis. AOP advised me that the asset register is reconciled to the accounting records and there is an on-going process to physically verify and tag:

- all older assets above a specified net book value; and
- all new additions.

The receipt and recording of hospitality

34. The MSFM advises that a public servant should not receive any benefits of any kind from a third party which might reasonably be seen to compromise their personal judgement or integrity. It also advises that regardless of whether a gift or hospitality is accepted or declined, the Gifts and Hospitality Acceptance form must be completed by the recipient and that failure to declare in the Gifts and Hospitality Register may result in disciplinary action. Where the propriety of accepting a particular gift or offer of hospitality is in doubt, the advice of the sponsor Department should be sought.

35. The MSFM also indicates that where hospitality offered is an overseas visit, prior approval is required from the Accounting Officer or Chair of the Board.

36. In March 2015 Dr Mason undertook a five night trip to Utah which was fully funded by a supplier (Supplier A). I note that Dr Mason did not:

- seek prior approval for the trip from the Chair of the Board;
- seek advice from the Department given the unusual nature of the trip; and
- record the trip in the Planetarium's Gifts and Hospitality Register.

37. In April 2015, Dr Mason awarded a contract to the same supplier for three years' support of the Planetarium's projector and related technology. As noted at paragraph 11 above, a business case

was not prepared for this expenditure. Neither had Dr Mason sought advice from CPD nor the Department's approval for the Single Tender Action, which exceeded his delegated authority.

38. When interviewed by Internal Audit, Dr Mason stated that his Utah trip did not influence the award of any contracts or the purchase of any items. Dr Mason advised Internal Audit that the trip was to facilitate the carriage of a meteorite along with an item from a university and to discuss/work on a film on which he had previously provided input. Dr Mason considered that the trip would benefit the Planetarium as it would have a copy of the final product free of charge and would be included in the credits. AOP advised me that although Dr Mason received a credit at the end of the film as a contributor, AOP had to pay £8,552 for the film.

39. Dr Mason told me that there was no need to seek prior approval of the Board for the Utah trip as he reported all business trips after the event as had been agreed with the Board. This practice is contrary to the MSFM.

Conclusions

40. The Department for Communities' Accounting Officer has advised me that the issues which led to the AOP Accounts being qualified are a concern to him. In response to the investigations, the Department had written letters to the Chair of the AOP, the Accounting Officer and Chair of the Audit and Risk Assurance Committee to seek assurance that management are working closely with auditors to establish an action plan and implement all recommendations to minimise the risk of similar irregular activities happening again. The Department advised me that they had received an action plan from AOP in February 2017 and that AOP had assured them that the plan is being implemented.

41. GFIS recommended that no further action was taken against Dr Mason in terms of potential criminality.

42. Dr Mason advised me that throughout his tenure his financial transactions were approved by the Board and regularly audited by the internal and external auditors. However, as Accounting Officer, Dr Mason had a personal responsibility to check compliance with prescribed procedures and this responsibility remained, regardless of the extent to which non-compliance issues were identified and brought to his attention.

43. Dr Mason engaged with the Internal Audit review of the three Single Tender Actions and use of the Planetarium credit cards but did not engage with the subsequent GFIS review. Even as a former public servant it remained Dr Mason's responsibility to seek every opportunity to respond to questions on his conduct, while in public service, with the fullest possible responses. It is clear from his responses to me that he had detailed information which would have assisted the GFIS review.

44. High standards of conduct in public life are essential to maintain fairness and transparency in public services and to help ensure that public expenditure achieves value for money. Extensive guidance on best practice is in place to ensure the effective corporate governance of all public sector bodies and to help protect public servants. All senior public servants, including those in small organisations such as AOP, have a responsibility not only to follow guidance but to act as role models for others regarding matters of propriety. Senior staff should lead by example, especially in matters of conduct.

45. I have examined the Internal Audit and GFIS reports and Dr Mason's responses to me on the issues raised. I have referred to these in my report. Dr Mason told me that what he did was to benefit the Planetarium and its standing in the international community. I am concerned that, regardless of

what he viewed as laudable objectives, as the Planetarium's Accounting Officer Dr Mason failed to follow guidance and best practice in relation to Single Tender Actions and in his use of the Planetarium's credit card. It is also disappointing that Dr Mason failed to consider whether a conflict of interest arose in relation to accepting hospitality from a supplier of one of these Single Tender Actions.

46. The role of Accounting Officer carries with it personal responsibilities in relation to regularity and propriety and the conduct of Accounting Officers should be beyond reproach. In my view, Dr Mason's actions were not up to this high standard, in his conduct as an Accounting Officer and specifically in his response to a GFIS review of his conduct.

47. I have also reported these matters in the Armagh Observatory and Planetarium's 2015-16 financial statements.

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