The Armagh Observatory and Planetarium

Annual Report and Accounts
For the year ended 31 March 2018

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The Trustees' Annual Report for the year ended 31 March 2018

The Board of Governors, who are the Trustees for the Armagh Observatory and Planetarium (AOP) has pleasure in presenting its annual report and financial statements for this charity for the year ended 31 March 2018. These financial statements have been prepared in accordance with the accounting policies set out in note 1 to the accounts, with the guidance issued by the Department of Finance on the form and contents of the Annual Reports and Accounts of Executive Non-Departmental Public Bodies, *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995* and Accounting and Reporting by Charities: Statement of Recommended Practice (SORP) applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland published on 16 July 2014.

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

Background to Charitable Status

Historically the Armagh Observatory and the Armagh Planetarium were treated as being distinct institutions; being two component divisions of a single statutory corporation and arms-length body (ALB), 'The Governors of the Armagh Observatory and Planetarium' as described in *The Armagh Observatory and Planetarium (Northern Ireland) Order 1995*. This 1995 Order superseded the original 1791 Act of the Irish Parliament entitled '*An Act for Settling and Preserving a Public Observatory and Museum in the City of Armagh For Ever'*, and an Amendment of 1938 ('The University and Collegiate and Scientific Institutions Act [Northern Ireland], 1938').

The Armagh Observatory was a recognized charity (reference XN 46022). 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 Armagh Planetarium, which was also a recognized charity (reference XN 48022), was founded by Dr Eric Mervyn Lindsay, the seventh director of the Armagh Observatory, and was officially opened on 1 May 1968. The Planetarium's primary activity is to disseminate scientific and technical knowledge of a wide range of scientific and STEM subjects, and to promote public understanding of astronomy and science through its programme of educational services for schools and the wider public.

From 1 April 2016 the Charity Commission for Northern Ireland has registered *The Governors of the Armagh Observatory and Planetarium* as a single charity. The 'unified' charity's reference number is NIC 103948.

Objectives and Activities

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

Armagh Observatory, established in 1789, is the oldest scientific institution in Northern Ireland, and the longest continuously operating astronomical research institute in the UK and Ireland. Armagh Planetarium, which was officially opened in 1968 is also the oldest operating planetarium in the UK and Ireland.

The Vision statement of the newly unified organisation is:

'Armagh Observatory and Planetarium is renowned throughout the world as a unique Centre of Excellence for research, education, inspiration and outreach in space and science.'

Mission

The Mission of the Armagh Observatory and Planetarium is:

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

The principal charitable objective of the Armagh Observatory and Planetarium, which provides a significant public benefit, 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 (i) promoting, preserving and widening access to the heritage of astronomy at Armagh; (ii) maintaining the continuity and precision of the unique more than 220-year long meteorological record at Armagh; and (iii) pursuing 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 Department's learning strategy.

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.

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

It is noteworthy that the use by Armagh Observatory and Planetarium 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'. Thus, by operating on the international stage, the Armagh Observatory and Planetarium provides a very high rate of return per pound on the Department's and the NI Executive's support for astronomy at Armagh.

During 2017/18 there were an average of 18.8 employees, 8.3 temporary staff and 8 PhD students, which included the Director, 6 Research Astronomers, 2 PDRAs and 6 Education Support Officers, together with support and administration staff. There were also 7 external research associates and academic visitors. There is an active visitors programme, hosting typically between 10 and 20 temporary academic visitors from around the world each year, spending periods in Armagh ranging from a day to several weeks at a time.

Public Benefits

The Trustees of Armagh Observatory and Planetarium confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under section 4(b) of the Charities Act (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2018. This is demonstrated in the following summary of Principal Activities which provides detail on how the organisation has delivered against its objectives and the public benefit which has flowed from this.

Principal Activities

Research

The Armagh Observatory and Planetarium 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 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. 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; wide-field surveys to discover a diverse range of astrophysically important short-period variable stars, and studies of the molecular gas associated with the formation of 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 primary long-term research function. The projects are often funded by external (i.e. non-Department) funding agencies with lead times of typically one or two years; they are normally led by an individual Research Astronomer and often require 3–5 years for completion.

Science Highlights

Some research highlights are described below. A listing of scientific publications in 2017-18 is provided as an Appendix, together with a list of all seminars, public talks and associated activities delivered by members of the Armagh Observatory and Planetarium.

Cool Stars

Activities of the cool star research group have focused on three aspects; extracting and analysing stellar flare observations obtained by the Kepler/K2 mission, extracting ultraviolet data of late type dwarfs observed with the Galex satellite and the Jansky Very Large Array (JVLA) radio telescope, and finally reducing and modelling data related to ultra-cool dwarfs observed with the JVLA. For some objects observed with the JVLA, radio data exhibited 100% right-hand circularly polarised bursts in the 2-8 GHz range which shows intense narrowband features with a fast-negative frequency drift. These were superimposed on a fainter broadband emission feature with a total duration of about 20 minutes, and a slow positive frequency drift. This makes it the first such event detected below 4 GHz and the first one exhibiting both positive and negative frequency drifts. We can reproduce the main characteristics of the burst using a model describing the magnetic field of the dwarf as a tilted dipole. We also analyse the origins of the quiescent radio emission and estimate the required parameters of the magnetic field and energetic electrons. Work on the Kepler/K2 and GALEX data continues.

Solar

Solar research this year again mainly focussed on small-jet features involving colleagues from India and our nearest neighbour, Queens University Belfast. Projects included: (i) the detection of impulsive plasma outflows due to magneto-acoustic shocks, (ii) analysing a micro-flaring region using inversion techniques on spectrophotometric observations taken from the Swedish Solar Telescope, (iii) applying a one-dimensional radiative transfer code in an attempt to reproduce the observed line profiles and simulate the atmospheric conditions of small chromospheric jets, (iv) in a multi-wavelength campaign, using ground and space-based observations in an effort to better understand the extent of these small chromospheric jets in the solar atmosphere. The highlight was a paper in Nature, based on our ground-based data from the Swedish Solar Telescope. In jet-like features called spicules, we detected the presence of high frequency (~12-42 mHz) torsional motions. Numerical model shows that these observations resemble a type of wave called "torsional Alfvén waves". We find that oscillating tubes (spicules) serve as substantial sources of Alfvén wave generation that provide sufficient energy not only to heat the corona but also to originate the supersonic solar wind.

Life Cycles of Stars

The spectrum of a star tells us about its surface and its history. A stellar spectrum includes dark bands or lines produced by specific atoms or ions and which carry unique information about temperature, density and chemistry. For example, when all the hydrogen in the core of stars like the Sun is used up, helium starts to burn. Normally, the chemistry of the surface remains almost unchanged, even in rare cases when the surface hydrogen has been stripped away to leave less than 1% of the original star. But a few stars are completely stripped, and the usual hydrogen features disappear form the spectrum. Such hydrogen-deficient stars represent a brief stage in the life cycle of a few rare stars. We have been surveying the sky for new example of such rare stars and, in 2017, discovered GALEX J184559.8-413827, the first extreme helium star to be found for nearly 40 years. Observations of another helium star HD144941 using NASA's planet-hunting Kepler spacecraft produced a different surprise. Previously believed to be non-variable, minute periodic changes in light showed the signature of a 'spotty' surface rotating every 14 days — possibly evidence for the first magnetic field to be found on an extreme helium star.

Polarimetry
Polarimetry is a technique that measures certain properties of the way light propagates. These polarimetric properties are determined by several physical phenomena, for instance the presence of a magnetic field, and the reflection from a surface. By measuring the polarisation of the light reflected by planets, comets, or asteroids, astronomers may determine various characteristics of the bodies of our solar system. Armagh astronomers are active in the use of polarimetric techniques, in particular they have participated in the successful commissioning of a new polarimeter in France and continue to participate in numerous studies of stellar magnetic fields and objects of our solar system, including our own planet.

The Moon as a giant mirror to study our planet
Astronomers come with various ideas on how to find if planets orbiting around stars other than the Sun share properties similar to our Earth, and in particular if they can host life. A convenient way to test new techniques is to observe the planet that we best know, and in which we are sure to find life: our Earth. To observe our planet, astronomers may point their telescopes to Earthshine, the light scattered by our planet to the Moon, and then reflected back to Earth. Basically, astronomers use the Moon as a giant mirror to see how Earth would appear if observed from space. Armagh Observatory and Planetarium is part of an international collaboration aimed at exploring how polarimetric techniques may be used to measure global atmospheric and surface properties of planet Earth (e.g., to monitor pollution and climate change), and then to check if these techniques may be applied to the studies of other planets.

Recently, new important observations have been obtained, while important progresses in showing how polarimetric measurements are highly sensitive to clouds and aerosols in the Earth's atmosphere have been achieved.

Magnetic fields in the latest stages of stellar evolution
Magnetic fields play a crucial role in all stages of stellar life, from the time when the interstellar medium collapses and the process of star formation begins, up to the latest stages of stellar evolution, when the star ends its life as a white dwarf or exploding as a supernova. Our Sun exhibits a very complex magnetic field, but astronomers are routinely detecting and studying the magnetic fields of many other kinds of star. Armagh astronomers are actively involved in the study of magnetic fields of white dwarfs. White dwarfs are stars in the final stage of stellar evolution, but the white dwarf stage itself may last very long. Armagh astronomers are interested in measuring how the magnetic field itself change with time during this stage of stellar evolution. Common theories predict that field strength and morphology should become smoother and simpler with time, but in fact we have discovered evidence of the contrary, i.e., that older white dwarfs may have remarkably stronger and more complex fields than younger white dwarfs. This finding must be followed up by further studies, but if confirmed, may represent an interesting challenge to our current understanding of how stellar magnetic fields are generated and evolve with time.

Interstellar medium
The space between stars is not empty but contains a very tiny amount of material consisting of a mixture of gas (99% of the total mass, mainly hydrogen and helium molecules) and dust grains (1%). Dust grains are typically less than 1-micron size, and are made of compounds of carbon, oxygen and silicon, sometimes surrounded by a mantel of water ice. Most of interstellar gas and dust originates from the death of stars, which return their material to the interstellar space. Astronomers are interested in the composition of the interstellar medium because it is a trace of the chemical evolution of the universe. Astronomers at Armagh Observatory and Planetarium have led a polarimetric study of the interstellar medium aimed at improving our knowledge of the size and composition of the dust grains in our Milky Way. Polarimetric observations of the interstellar medium may be used also to map the orientation of the galactic magnetic field, which in turns play an important but not fully understood role in the process of star formation.

The Milky Way
Armagh astronomers lead a new survey mapping the molecular gas along the southern Milky Way using the 22m diameter Mopra radio telescope in Australia. The programme is obtaining a new 3D map of the distribution of the molecular clouds where stars are born across the central regions of our Galaxy. The map provides an order of magnitude improvement in both the spatial and the spectral resolution over the previous generation map, i.e. 0.6 arcminute and 0.1 km/s, using the CO molecule as a tracer of the distribution of molecular hydrogen. The survey aims to cover over 200 square degrees of the Galactic plane, and at the end of the 2017 observing season was approximately 90% complete. The survey is also being used to support Armagh's involvement in the next generation gamma-ray telescope, the Cherenkov Telescope Array (CTA). This is because much of the gamma ray emission from our Galaxy is produced by the interaction of ultra-high energy cosmic rays with the nuclei of molecules found in star forming regions of the Galactic Plane – the so-called hadronic emission process for the production of gamma rays. A workshop on the CTA was held in Armagh in January 2017, and a second in Dublin in August, with the support of the Irish Research Council.

Gaia and the distances to stars
Determining the distances to stars has long been a difficult and sometimes controversial task. The European Space Agency (ESA) launched its Hipparchus satellite in 1989 and was able to measure the distances of 118,000

stars out to 300 light years. In 2013, ESA launched Gaia the successor to Hippocras and in April 2018 will release the distances and proper motions of a billion stars. In Sept 2016 ESA released a catalogue of the distances to relatively bright stars. This catalogue included 16 'Cataclysmic Variables' which contain a small but dense white dwarf and a low mass red star orbiting around one another on a timescale of an hour to half a dozen hours. One of these, SS Cyg, has been studied for more than a century and shows outbursts every month when it brightens by >10 magnitudes for a week. Using a distance determined using the *Hubble Space Telescope* the observations were at odds with the standard accretion disk model which astronomers use to predict the behaviour of outbursts in general. This was at odds with a distance made using the VLA radio telescope in New Mexico. Ramsay and colleagues in the UK and Chile were able to take the new distances derived by Gaia and show that SS Cyg now agrees with the standard accretion disk model. This put the accretion model on a sounder footing, but it will be rigorously tested once more distances are released in April 2018.

Gravitational-wave Optical Transient Observer
The announcement by the LIGO project in Feb 2016 of the direct detection of gravitational waves from two merging black holes was one of the great triumphs of mankind. LIGO's two detectors which are separated by several thousand of km both recorded the event. Since then a number of other gravitational wave events have been detected and three members of the LIGO team won the Nobel Prize for physics in 2017.

These detections are an amazing feat. It is equivalent to measuring the distance to the nearest star to the Sun to within a thickness of a human hair. However, the detectors are not able to pinpoint the location in the sky to great accuracy. Follow-up observations using other telescopes are needed to identify a new object in the region of sky where the event is most likely to be. This was spectacularly demonstrated in Sept 2017 when the optical counterpart of a merging neutron star binary was detected in the halo of the galaxy NGC 4993.

One telescope aiming to detect these counterparts is the Gravitational-wave Optical Transient Observer (GOTO) which is located on La Palma in the Canaries. This is a collaboration between Warwick, Sheffield and Leicester Universities in the UK, Monash University in Australia and NARIT in Thailand, together with the Armagh Observatory and Planetarium. GOTO is currently undergoing commissioning tests but has already observed the optical counterpart of one gamma-ray burst showing that our strategy and instruments are up to the task. Our Phase I deployment consists of four 0.4m telescopes giving a field of view of ~20 square degrees. Plans are afoot to duplicate the existing set of telescopes on La Palma, doubling the area of sky which can be recorded in one step, and to site another system in Australia.

The most massive stars in the Universe
In the massive star research group, the lives and deaths of the most massive stars in the Universe are studied, both observationally and theoretically. Over the last couple of years, this group led the analysis of the most massive stars in a European wide Very Large Telescope (VLT) spectroscopic survey of the Tarantula nebula, and this year we published our VFTS survey results presenting the first direct evidence for an overabundance of massive stars. We now know that massive stars not only dominate the light in the Universe, but that despite the fact they are not as common as lower mass (solar-type) stars, massive stars also contain most of the stellar mass.

The group maintains a visible presence is a particularly large number of international consortia, including not only VFTS, but also IPHAS, GES, VPHAS, WEAVE, CYGOB2, Cobras, TMBM, amongst others.

This year a new STFC Consortium research grant was awarded to appoint a postdoctoral fellow to predict the mass loss of massive stars just prior to collapse as Wolf-Rayet stars and lower mass stripped helium stars. A pilot study was presented, challenging the notion that stripped helium stars may be discovered from emission line spectroscopy, as argued by a competing group in Amsterdam.

For this reason, we worked with Cormac Larkin, a former secondary school student from Cork, to use SALT to find these elusive stars from their continuum radiation instead. The reason it is so important to find the hypothetical population of stripped helium stars is that they may be the most common progenitors of stripped envelope supernovae.

Wolf-Rayet stars are also the direct progenitors of black holes, as recently revealed in the detection of gravitational waves by the LIGO consortium. The big surprise of those discoveries has been that these black holes were heavier than most astronomers considered possible. Already a decade ago Vink predicted the existence of "heavy" black holes when the host galaxy has a chemical fingerprint that was more characteristic of the Early Universe, but in 2017 with a colleague from Exeter showed that the most popular proposed evolutionary channel towards Black Holes, driven by very rapid stellar rotation, is not backed up by observations of the polarised light of Wolf-Rayet stars in the low metallicity Magellanic Clouds. It is therefore much more likely massive stars evolve in a classical way via a post-outbursting luminous blue variable (LBV) phase towards the black hole phase.

Two workshops on massive stars were held (in conjunction with the Dublin Institute of Advanced Studies and supported by the Irish Research Council). They aimed to bring together researchers from a number of starting new massive-star groups on the island of Ireland. The first, in May 2017, was in Dublin, and the second was held in Armagh during August.

Asteroids broken up by sunlight
An Armagh Observatory and Planetarium-led international team led by Christou has been investigating a group of small asteroids that move in sync with the planet Mars. The origin of this unique group has so far been a mystery. Groups such as these usually formed when a collision breaks up an asteroid into fragments that continue to move around the Sun in similar orbits. Yet the collision theory is difficult to invoke in the case of these objects. Simulations of their motion show that they have most likely been quite happily staying where they are now for billions of years, quite far from the Main Belt of asteroids lying between Mars and Jupiter, a region full of debris travelling at many kilometres per second and capable of smashing up a precursor asteroid into bits to form the group. However, now the Armagh team believe they have identified the culprit: sunlight absorbed and re-emitted by the asteroid's surface. This has the effect of spinning up an asteroid to the point where it begins to shed material, in effect creating new asteroids, all in more-or-less the same orbit. Furthermore, this process has likely been going on for about a billion years. The team's findings, which highlight how small asteroids near the Sun may evolve and may have implications for debris around stars other than the Sun, were presented at the annual Meeting of the Division of Planetary Sciences of the American Astronomical Society, in October 2017.

Planetary moons as tracers of the solar system's early evolution
Armagh Observatory and Planetarium PhD student Daohai Li has used a group of small moons orbiting Jupiter to time a series of cataclysmic events thought to have occurred during our planetary system's early days. Right after the planets formed, a shift of their orbits caused a violent re-arrangement of the different bodies and produced much of the solar system we see today. For instance, there would have been a "short" period of time – only a few tens of millions of years long – when giant planets such as Jupiter could cohabit with objects as large as the dwarf planets Pluto and Ceres and even have short, but quite close, encounters with each other. But it is not clear if the giant planets had already acquired their present retinue of moons by that time, something that can be used to test models of moon formation. We examined the effects on a group of distant moons of Jupiter. By running a series of numerical simulations, we found that they could reproduce the moons' orbits only if Jupiter had had several encounters with one of the outer giant planets such as Neptune. This means that the moons would have already been in place around Jupiter by that time, so they must have either formed or been captured earlier. Our findings lend support to the notion of a short but quite dramatic period of upheaval in our cosmic neighbourhood that is long past and can now be studied only through subtle peculiarities in the observed arrangement of planets, moons, asteroid and comets.

International Standing
The Armagh Observatory and Planetarium 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, staff have access to world-class international facilities provided through STFC and UK Government subscriptions and bilateral agreements and collaborations involving individual researchers. Staff regularly obtain telescope time on international (e.g. the Dunn Solar Telescope at Sacramento Peak Observatory, the New Solar Telescope at Big Bear Solar Observatory and the Mopra radio telescope in Australia) and international facilities, such as the ESO Very Large Telescope, and various spacecraft missions (such as SoHO, SDO, Hinode, Stereo, Swift, XMM-Newton and the Hubble Space Telescope).

Academic staff 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 organisation's membership of the UK SALT Consortium (UKSC) have access to the 11-metre diameter Southern African Large Telescope (SALT) located at the Sutherland Observatory, South Africa. Armagh is also a member of the international consortia involved with the GOTO (Gravitational-wave Optical Transient Observer) optical, LOFAR (LOw FRequency Array) radio and the CTA (Cherenkov Telescope Array) gamma-ray telescopes. 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.

Education and Community Outreach

Planetarium
The Planetarium's primary activity is to disseminate scientific and technical knowledge of a wide range of scientific and STEM subjects, and to promote public understanding of astronomy and science through its programme of educational services for schools and the wider public.

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 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, including factsheets, videos and informed commentary on the latest astronomical news in our Astronotes blog. From inception, we have responded to a steady stream of astronomical queries from the public and the media. Armagh Planetarium is world-renowned as an innovative centre of excellence in promoting the public understanding of science.

The unique selling point of the Planetarium is the full dome digital theatre – offering visitors the opportunity to journey through the cosmos to the furthest reaches of our Universe – all from the comfort of a seat in Armagh. The current digital projection system (Digistar 5) was installed in 2006/07 and as such is approaching the end of its economic life. During 2017/18, Armagh Observatory and Planetarium embarked on a process to strengthen maintenance provision through the equipment manufacturer's, Evans & Sutherland. The new maintenance contract – a Direct Award Contract – was approved by the Department and comes into effect on 01 April 2018.

Staff deliver interactive presentations in the Planetarium 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 the Armagh City, Banbridge and Craigavon Borough Council ("ABC" council) area.

Armagh Observatory and Planetarium aims to make our organisation the destination where every primary school level child in Northern Ireland experiences the mysteries of cosmos through our Digital Theatre shows, exhibitions and lectures. This accords with the strategic focus of the Department whose overall vision is for 'a confident, creative, informed, and vibrant community.' Bringing these aspirations 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.

Programme of Events
During 2017/18, the Planetarium continued to grow its visitor numbers, with more than 51,000 visitors attending during the year. This represents a 6% increase on visitor numbers for 2016/17 and is a trajectory that Armagh Observatory and Planetarium hopes to sustain in future years. Many of these visitors come for the immersive digital theatre experience offered by the full dome of the Planetarium. However, an equally important element of the 'jigsaw' is the annual programme of events, particularly during the summer period.

Approximately 28% of visitor numbers are primary and post-primary pupils attending during school hours (10am–3pm). School engagement is split roughly equally across the three school terms. 278 schools visited the Planetarium during 2017/18. Due to staff shortages during the latter half the period, however, Armagh Observatory and Planetarium was obliged to limit the number of school bookings per day. In February 2018, we successfully concluded a recruitment process to backfill two vacant Educational Support Officers posts. The new post holders commenced duties in March 2018.

Approximately 72% (38,000) of all visitors are paying members of the public. More than half attend during the summer holidays – July and August – while January and September continue to represent the quietest months in terms of visitor throughput. During the year several new public engagement partnerships were developed with the aim of increasing visitor numbers. These included late night and occasional Sunday openings in conjunction with Armagh City, Banbridge & Craigavon Borough Council Fashion Week, the John O'Connor Writing School and the William Kennedy Piping Festival. In October and November 2017, the Planetarium also hosted a series of collaborative workshops with the Science Technology & Facilities Council (STFC) aimed at high school science students.

The Planetarium also hosted several astronomy events that proved popular with the public, including an evening with visiting academics from the Sydney Institute of Astrophysics (Australia) discussing their book – "A Fortunate Universe – Life in a Finely Tuned Cosmos". During November – March, Armagh Observatory and Planetarium ran a series of 'Star Tracker' evenings in the Planetarium. These events provided an opportunity for more than 250

visitors to hear from our academic staff and students, view special screenings in the digital theatre and get 'hands on' with our Dobsonian telescopes. Topics covered during the Star Tracker evenings included 'The Death of Stars', 'An Introduction to Astrophotography' and 'The First Stars and Black Holes'.

The programme of major events included Jedi Training, Heroes and Legends (based around superheroes), Jurassic Week and Rex the Dinosaur (looking at the role that a meteorite may have played in their demise), and in December "Mystery of the Christmas Star". One of our most popular events was Minecraft – an online and interactive design game that enables children and young people to develop basic programming and virtual world building and design skills.

During the year staff also maintained an active programme of science in the community, for example by providing guided tours of the Observatory and Astropark (such as on European Heritage Day and Armagh Georgian Day), 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 Astropark is maintained as a unique facility to enrich the lives of visitors to Armagh and residents alike.

In addition, there are more formal education programmes associated with work experience, student and teacher training, and engagement with the local community, elements of which draw on the professional knowledge and expertise of research astronomers at Armagh. Our programme of science in the community helps 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.

Staff also supported a number of high profile public engagement and outreach activities in partnership with the Royal Belfast Hospital for Sick Children (RBHSC), Libraries NI and the Ulster Museum. These projects enabled staff to promote awareness of STEM and improve young peoples' engagement with popular events such as World Space Week, Maths Week and the NI Science Festival.

We also worked with Sentinus, providing Nuffield research placements for young students, raising awareness of the role of STEM in developing essential life skills among high school students.

Management
A key feature of sustaining visitor growth is strengthening customer engagement systems. To that end, during 2017/18, Armagh Observatory and Planetarium undertook a tendering process, through the Department of Finance (DoF) Central Procurement Directorate (CPD), for the provision of online ticketing. This process was successfully concluded in February 2018 with the appointment of Ticketsolve as the preferred provider. The introduction of online ticketing will make it easier for customers to book tickets for a range of events, including digital theatre shows. This will improve the customer experience and, it is hoped, contribute to a continued growth in visitors throughout. In February 2018 Armagh Observatory and Planetarium initiated a review of café and catering provision within the Planetarium. It is hoped that this will result in an improved customer experience and reduced costs in 2018/19.

During the year, Armagh Observatory and Planetarium also developed a series of business insight tools to identify opportunities to maximise efficiency. This included improved business case development and post project evaluations, strengthened procurement processes and a review of digital theatre occupancy. This work has helped inform Armagh Observatory and Planetarium business activities throughout the year and contributed to improved governance and financial stability.

History and Heritage

Heritage Policy

Armagh Observatory and Planetarium'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 Grade A-listed Georgian Observatory 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. We seek to widen access to this material where possible so that researchers, or visitors 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. Eleven virtual tours are available online through our website (www.Armagh.ac.uk).

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 contains a unique variety of historic books and manuscripts, images, photographic plates, scientific instruments, clocks and other artefacts concerning the development of modern astronomy from the Age of Enlightenment up to the present day, with specific reference to the important discoveries and scientific contributions made by the international research community 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 digitized documents. The library catalogue, containing over 3,000 entries, is also available on-line. Armagh.ac.uk.

Meteorological Record

As part of the organisation'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. 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. The data are released to the general public on a monthly basis through press releases and on our 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'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.

Support

Research Computer Facilities
The comprehensive research computer facilities are used primarily for numerical analysis, computer modelling and data reduction. The computers and peripherals are largely funded by the Department, 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.

There are 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, there is over 130TB of on-line storage capacity. The internal network is a 1 Gbps backbone ethernet linked with switched hubs. The external connection to the Internet is via a commercial ISP, Atlas, and operates at 100Mbps both upstream and downstream.

Disabled Access
The Armagh Observatory and Planetarium has implemented reasonable adjustments necessary to widen access to its facilities by people with disabilities, whether visiting the Observatory, Planetarium or 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 Observatory building to improve wheelchair access; and (c) the installation of a disabled toilets in the Library and Administration buildings. As part of expanding access, we maintain a rich website which contains a wealth of information regarding the organization and astronomy and related sciences more generally, including eleven 'Virtual Visits'.

The Planetarium has also made adjustments for people with disabilities. These have included the provision of a ramp at the front entrance for admission and throughout the exhibition space with ramps and double door access. A lift is available to the upper level where the theatre is located. Wheelchair bays along with a loop system are installed in the theatre. Disabled toilets are located on both the lower and upper levels and in the event of an emergency, ramps outside aid exit from the upper level. In addition, the Planetarium has braille on signage inside the building.

Equal Opportunities
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.

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 former Department of Finance and Personnel.

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.

Achievements and Performance

The targets set for the Armagh Observatory and Planetarium in the 2017/18 Business plan are shown in the Table below. The actual performance achieved is shown along with the corresponding achievement for the previous financial year.

While targets were achieved or exceeded in most areas, a number were not met. One reason was that reduced staff resources had impacted on the ability to conduct external events to areas of deprivation and to achieve the number of school admissions planned. The implementation of new finance systems impacted on payment performance. Several targets were found to have ambiguous wording and have been revised for 2018/19 to ensure better performance monitoring going forward.

Area		Description	Target	Actual as at 30 March 2018	Progress	As at 30 March 2017	Comments
Visitors	1	Total number of visitors to the Armagh Observatory and Planetarium by 31 March 2018	40,000	51,145	128%	48,535	
	2	Percentage of visitors from schools on the Extended Schools Register or with high proportion of Free School Meals by 31 March 2018	25%	22%	89%	27%	The reported KPI is based on % of children from schools on Extended Schools Register. The target wording notes % of pupils on either Extended School Register or in schools with a high % of Free School Meals (<20%). When AOP dataset is analylsed for %FSM, KPI performance increased to 45%. The 2017/18 target wording is ambiguous; it is recommended that in 2018/19 AOP redrafts this target to focus on % FSM only.
			25%	43%	170%	51%	% of pupils with FSM % > 20%
	3	Number of visitors to the AOP's websites by 31 March 2018 (millions)	1	0.7	73%	79.0%	This KPI will not be included for 2018/19. Social media platforms such as Facebook afford more effective audience engagement tools allowing for an interactive and realtime vistor engagement (feedback/interaction etc). Over the last 12 months AOP has seen significant growth in audience engagement ('reach') of its FB posts and we plan to continue to use this along with tools such as the new online booking system.
	4	Number of participants in STEM/STEAM programmes on site at AOP by 31 March 2018	1,800	3,015	168%	6,279	
Outreach	5a	Number of outreach events held external to AOP by 31 March 2018	30	31	103%	NEW KPI	
	5b	Number of events targeted to areas of deprivation by 31 March 2018	10	4	40%	11	Target not met due to staff/resource pressures
Research	6	Number of articles published in refereed scientific journal publications by 31 March 2018	35	70	200%	58	
	7	Number of citations to refereed scientific journal publications, averaged over a rolling 3-year period, to 31 March 2018.	300	913	304%	NEW KPI	
Resources	8	Total external income of £450k (equivalent to 25% of total expenditure) by 31 March 2018	450	432.0	96%	25.5%	Reduced ESO resources from September meant a reduction in the number of school admissions and thus a slight reduction in external income.
	9	Payments processed within 10 days by 31 March 2018	90%	74%		89%	Difficulties with migration to a single organisation finance system resulted in a failure to meet targets in the first quarter and part of the second quarter. In the second half of the year, the average was 94%
Governance	10	To continue to develop and maintain robust governance arrangements including financial policies and procedures, the management statement and financial memorandum (MSFM) and the terms of reference for committees (ToR).					Complete
Organisational Change	11	To deliver the key actions detailed in the Business Plan relating to creating a single unified organisation					Of the 6 key actions, strategic documents and plans are complete (2), SMT recruitment is complete (1), engagement with key stakeholders is ongoing (1) and governance arrangements and organisational structure will be finalised next year with DfC (2)

[1] A deprived area is denoted by a school a) with 20% or greater entitlement to Free School Meals

Financial Review: Armagh Observatory and Planetarium

Operating Results

In the financial year to 31 March 2018, Armagh Observatory and Planetarium increased the value of charity funds by £417,950, summarised below.

Armagh Observatory and Planetarium

	2018	2017
	£	£
Total Income	2,451,014	2,421,614
Total Expenditure	2,662,763	2,495,199
Net Income (Expenditure)	(211,749)	(73,585)
Gains (losses) on the revaluation of Fixed Assets	366,699	810,105
Gains on the revaluation of Heritage Assets	50,000	1,191,960
Actuarial gains/(losses) on defined benefit pension	213,000	(667,026)
Net movement in funds for the year.	**417,950**	**1,261,454**
Movement in Unusable Funds		
Capital Financing		
Capital Grants Received	196,000	209,194
Donated Assets	(36,285)	(18,642)
Government Grant Fund	(301,950)	(269,804)
Revaluation	416,699	2,002,065
Pension Reserve	118,000	(655,000)
Movement in Usable Funds		
Restricted	57,112	(16,939)
Unrestricted	(31,626)	10,580
	417,950	**1,261,454**

The total income for the year was £2.451m, an increase of £0.029m from 2016/17, mainly due to an increase in external grant income.

Expenditure was £2.663m, an increase of £0.168m from the previous year. Staff costs remain the largest component of operational expenditure. The number of permanent staff in post is consistent with the previous year and some vacant posts remain unfilled.

Unrestricted operating costs are funded primarily by Department Grant-in-aid. The balance of such unrestricted operating costs is funded by contributions from external grants and miscellaneous income in an increasingly competitive financial environment. We continue to seek other funding streams to maintain this important source of funds. In 2017/18 the Department provided 79% of the total income through recurrent and capital grant allocations (2016/17: 77%).

Net Assets

Net assets at 31 March 2018 were £8.110m (31 March 2017: £7.692m). This includes an increase £0.367m in value of land and buildings following a revaluation, an increase in the value of heritage assets of £0.05m, and a reduction of £0.118m in the pension scheme liability from £1.566m at 31 March 2017 to £1.448m at 31 March 2018.

Reserves

Armagh Observatory and Planetarium has total accumulated funds of £8.110m at 31 March 2018 (2016/17: £7.692m). The reserves policy is included in note 1 of the accounts. Funds are as follows:

Funds at 31st March	**2018**	**2017**
	£	£
Restricted funds	229,019	171,907
Unrestricted funds	2,648,633	2,822,494
Revaluation Reserve	6,680,284	6,263,585
Pension Reserve	(1,448,000)	(1,566,000)
Total Charity Funds	**8,109,936**	**7,691,986**

Going Concern

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

Pension Liability

Armagh Observatory and Planetarium is a member of Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC) which provides a defined benefits pension to employees. The scheme is currently in deficit and at the 31st March 2018 the deficit was calculated by independent Actuaries at £1,448,000 (£1,566,000 2017).

Key Risks and Uncertainties

During the year the following key risks relating to business objectives were identified

- Damage to Armagh Observatory and Planetarium's reputation at either national or international level through inattention/ignorance of best practice and/or neglect of duties
- Damage to Armagh Observatory and Planetarium's reputation as a unique centre for research in space and science through lack of funding
- Lack of funding to carry out planned programmes and/or live within budgets
- Loss due to fire/catastrophic natural or man-made event, including damage to or loss of heritage assets, library and archives due to water ingress
- Financial loss/irregular spend as a result of theft or fraud
- Inability to implement structures required to unify and stabilise the organisation within the allocated budget while ensuring compliance with good governance
- Loss of key personnel leading to single point failure risk
- Loss of income by lower visitor numbers at the Planetarium or reduced grant funding at the Observatory
- Failure to safeguard children and vulnerable adults while visiting the organisation
- Injury to staff or members of the public due to identified maintenance and health and safety related issues not being carried out
- Failure of key Armagh Observatory and Planetarium systems
- Failure to achieve a unified coherent organisation.

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

The above risks also take account of recommendations from internal and external audit investigations and reports. Good work has been done to address the weaknesses identified in previous years and considerable effort has been put into the management of these risks going forward. While the organisation is within striking distance of establishing sound systems of control, there remains work to be done.

For the 2018/19 year, the Risk Register has been revised to better reflect the key risks against the Business Plan.

Plans for Future Periods

While the 4% baseline reduction initially planned for 2017/18 was restored following Board representations, for 2018/19 the budget reflects this 4% reduction deferred from 2017/18 plus a further 4% reduction.

With the fall of The Northern Ireland Executive, a one-year budget has been set for 2018/19, but no budget has been decided for future years, making longer term planning very difficult.

Following the completion of the *Review of the Organisation and Management of Armagh Observatory and Planetarium*, the Board of Governors has commenced a programme of Organisational Change which will be ongoing for a number of years.

The primary function of the Corporation will continue to be to carry out international-quality research in astronomy and related sciences, to disseminate these results widely through a vibrant programme of Science in the Community, and to identify new ways to attract visitors to Armagh as part of its wider contribution to enriching the economic, social and cultural life of the local and national communities that it serves. This is in full alignment with the Department's vision to promote equality and tackle poverty and social exclusion.

Structure, Governance and Management

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

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

The Armagh Observatory and Planetarium is a recognized charity (HMRC reference NIC 103948).

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

The Armagh Observatory and Planetarium (Northern Ireland) Order 1995 (the Order) places a statutory duty on "the Governors of Armagh Observatory and Planetarium" to maintain and manage Armagh Observatory and Planetarium with the purpose of "developing and improving the knowledge, appreciation and practice of astronomy and related sciences."

In accordance with paragraph 8(1) of Schedule 1 of the Order, the Governors have delegated primary responsibility for the governance and management of Armagh Observatory and Planetarium to a Management Committee.

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

Management Committee of Armagh Observatory and Planetarium

The Board has delegated primary responsibility for the governance and management of Armagh Observatory and Planetarium to a Management Committee. The Management Committee has corporate responsibility for ensuring that Armagh Observatory and Planetarium fulfils the aims and objectives set by the Department and approved by the Minister and for promoting the efficient, economic and effective use of resources. The Management Committee provide leadership, challenge, oversight, support and encouragement to the CEO and his/her staff.

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 the Department;
- 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. This is by exception and subject to Departmental approval.

Audit and Risk Assurance Committee (ARAC)

The ARAC is a sub-committee of the Management Committee established in accordance with DAO (DFP) 06/13 - Corporate governance in central government departments: Code of Good Practice NI 2013, and in line with the HM Treasury Audit and Risk Assurance Committee Handbook (DFP 05/14) to advise the Board of Governors, the Management Committee and the Director of Armagh Observatory and Planetarium as Accounting Officer and to support them in their responsibilities for issues of organisational risks, internal control, governance and their associated assurances and in reviewing the reliability and integrity of these assurances.

Staffing Policy and Remuneration Committee

Previously known as the Employment Conditions and Remuneration Committee, the Committee is a sub-committee of the Management Committee and advises it on employment issues and provide assurance that Armagh Observatory and Planetarium employment policies and practices are compliant with legal and statutory requirements.

Further details on the membership of these Committees is set out in the Governance Statement on page 22.

Reference and Administrative Details

Name of the Charity

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

Charity number

HMRC reference NIC 103498

Principal Office

College Hill, Armagh, BT61 9DG

Trustees

Archbishop Richard Clarke, CHAIR
The Very Rev G. Dunstan
The Venerable Archdeacon T. Scott
The Venerable Archdeacon A. Forster
Rev Canon W.J.A. Dawson
Rev Canon W.M. Adair
Rev Canon R.J.N. Porteus
Rev Canon N.J. Hughes
Rev Canon J. Moore
Rev Canon D. Hilliard
Rev Canon B. Paine
Professor R. Oudmaijer
Mr W.G. Berry
Professor A. Hibbert

Director and Accounting Officer

Professor Michael Burton – Chief Executive Armagh Observatory and Planetarium from 1 August 2016 and Accounting Officer from 1 September 2016.

Auditors

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

Internal Auditors

Grant Thornton (NI) LLP, 12-15 Donegall Square West, Belfast, BT1 6JH

Bankers

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

Register of Interests

A Register of Interests is maintained for Board members and the Executive Team and is available for inspection at the Principal Address.

Related party transactions are shown in note 22 of the accounts.

Personal data related incidents

Armagh Observatory and Planetarium has considered the requirement to report personal data related incidents. It is content that there were no such incidents in the year ended 31 March 2018.

Disclosure of Audit Information

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

Important events since the end of the financial year

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

Archbishop Richard Clarke
Chair of the Board of Trustees
Date: 10th December 2018

Professor Michael Burton
Chief Executive
Date: 10th December 2018

Remuneration and Staff Report — Armagh Observatory and Planetarium

Remuneration Policy

Board Members

Board members do not receive any remuneration. They receive travel and subsistence allowances at rates and on conditions determined by Armagh Observatory and Planetarium, subject to Departmental approval. No Board member receive pension benefits or make pension contributions in their capacity as a Board member.

Senior Managers

The Chair of the Board of Trustees or his nominee is responsible for monitoring and reviewing the performance of the Chief Executive in accordance with the SCS Pay Strategy.
The Chief Executive is responsible for monitoring and reviewing the performance of the Senior Managers in accordance with The Northern Ireland Civil Service Pay Strategy.

Pay and Conditions of Service

The staff of Armagh Observatory and Planetarium, (other than those paid in accordance with the Joint Negotiating Committee for Higher education) are subject to levels of remuneration within the general NICS pay structure, as approved by the Department and DoF. Current terms and conditions for staff are those set out in its Employee Handbook. These are currently under review.

Policy on duration of contracts, notice periods and termination payments.

Senior staff, including the Chief Executive, are permanent employees of Armagh Observatory and Planetarium. The notice period for senior staff is three months. Termination payments are in accordance with contractual terms and those of the principal Civil Service Pension Scheme (NI)

The following tables provide details of the remuneration and pension entitlements of the Directors and Acting Heads of the organisation.

Remuneration (Audited Information)

Single Total Figure of Remuneration						
Name	**Salary 2017/2018**	**Pension Benefits* 2017/2018**	**Total 2017/2018**	**Salary 2016/2017**	**Pension Benefits 2016/2017**	**Total 2016/2017**
	£'000	**£**	**£'000**	**£'000**	**£**	**£'000**
M.G. Burton	70-75	23,054	95-100	45-50[1]	15,643	60-65
M.E. Bailey				10-15[2]	8,650	20-25
J.S. Vink				20-25[3]	3,783	25-30
J.G. Doyle				45-50[4]	31,846	75-80

*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.

[1] *Prof. Burton was appointed Director of Armagh Observatory and Planetarium on 01 August 2016. The full year equivalent of his 2016/17 salary was in the range £70,000-75,000.*
[2] *Prof Bailey retired from service on 31 May 2016. The full year equivalent is £63,346.*
[3] *Dr Vink's term as Acting Head of the Planetarium ran from 1 April 2016 to 31 August 2016. The full year equivalent is £51,616.*
[4] *Prof. Doyle's term as Acting Head of the Observatory ran from 01 June 2016 to 31 March 2017. The full year equivalent is £54,406.*

Pension Entitlements (Audited Information)

Name	Accrued Pension at 31 March 2018	Real Increase in Accrued Pension	Accrued Lump Sum at 31 March 2018	Real Increase in Lump Sum	CETV at 31 March 2018	CETV at 31 March 2017	Real Increase in CETV
	£'000	£'000	£'000	£'000	£'000	£'000	£'000
M.G. Burton	0-5	0-2.5	0	0	31	12	12

The CETVs above have been calculated in accordance with guidance used by the Northern Ireland Civil Service in Employer Pension Notice EPN13/2017.

1. The Director of Armagh Observatory and Planetarium is the person in senior position having authority and responsibility for directing and controlling the activities of the organisation.

2. The salary of Director shown above is based on the Northern Ireland Civil Service Grade 5 pay scale. No bonus was paid in the year and no benefits in kind were received.

3. The service contract of the Director of Armagh Observatory and Planetarium commenced on 01 August 2016.

4. The Director was not a member of the pension scheme previously and has no lump sum due.

5. Pension benefits are provided through the Northern Ireland Local Government Officers' Superannuation Committee Pension Scheme (NILGOSC).

6. 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 1/60th 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. For service from the 1st April 2015 retirement pension will be based on 1/49th of salary paid in year and pension is based on career average earnings a change from final salary. Details of the changes can be obtained at http://www.nilgosc.org.uk.

7. 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.

8. 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.

Band of highest paid senior post holder (Audited Information)

	2017-18	Restated 2016-17
Band of highest paid director's total remuneration (£'000)	70-75	70-75
Median total remuneration	£30,514	£30,255
Ratio	2.38	2.40

Reporting bodies are required to disclose the relationship between the remuneration of the highest paid worker in the organisation and the median remuneration of the organisations workforce. The banded remuneration of the highest paid director in 2017/18 was £70,000 - £75,000 (2016/17: £70,000 - £75,000). No employee received remuneration in excess of the highest paid director.

Total Staff Costs (Audited Information)

	Permanent staff £	Others[1] £	2018 £	2017 £
Wages and salaries	739,573	377,459	1,117,032	963,188
Social security costs	78,406	-	78,406	86,993
Employer's pension contributions	144,832	-	144,832	159,624
Defined benefit pension service cost	95,000	-	95,000	12,000
Termination costs	6,301	-	6,301	195,964
	1,064,112	377,459	1,441,571	1,417,769

[1] "Others" includes £143,927 for secondees and £233,532 for agency staff

Average staff numbers

	Permanent staff	Others[2]	2018 Number	2017 Number
Average staff numbers	18.8	8.3	27.1	26.3

[2] "Others" includes 2.7 secondees and 5.6 agency staff

Staff banding

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

	2018	2017
£70,001 - £80,000	1	2
£120,001- £130000	-	1

Staff Composition – employed (full time equivalent)

	Male	Female
Directors/senior managers	1	-
Employees	13	8

Sickness Absence

Staff absenteeism for the period 1 April 2017 to 31 March 2018 was 119 days which equates to an average per FTE of 2.33%.

Staff policies

As an equal opportunities employer, Armagh Observatory and Planetarium does not discriminate against staff or applicants for posts on any grounds, including disability. Care is taken to ensure the needs of disabled applicants are considered in the application process. Armagh Observatory and Planetarium also considers and introduces reasonable adjustments to support the employment of people with disabilities and to support the continuing employment of staff who have a disability.

Armagh Observatory and Planetarium is committed to the priorities as set out in legislation on equality, disability, discrimination, health and safety, child and vulnerable adult protection, data protection and freedom of information.

Expenditure on Consultancy

Expenditure on consultancy during the year was £38,750 (2016/17 £37,965).

Off –payroll Engagements

There were no "off-payroll" engagements in place as at 31 March 2018, nor were any arrangements entered into between 1 April 2017 and 31 March 2018.

Exit Packages (Audited Information)

Exit package cost band	No of compulsory redundancies	No of other departures agreed	Total no. of exit packages by cost band	Total no. of exit packages by cost band
	2017-18	2017-18	2017-18	2016-17
< £10,000		1	1	1
10,001 - 25,000				
25,001 - 50,000				2
50,001 - 100,000				2
Total no. of exit packages				5
Total resource cost	Nil	6,301	6,301	195,964

Signed:

Professor Michael Burton
Accounting Officer for the Armagh Observatory and Planetarium

Date: 10th December 2018

Statement of the Responsibilities of the Governors and Accounting Officer

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 the Department, with the approval of the Department of Finance, shall direct.

The Accounting Officer has personal responsibility for the propriety and regularity of the public finances for which he is answerable and for the keeping of proper accounts. He is required to sign the accounts thereby accepting personal responsibility for their proper presentation and to sign the Governance Statement. The Accounting Officer's relevant responsibilities, including his 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 2015). 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 Officer is 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 Officer of the Armagh Observatory and Planetarium, in office at the date of the approval of these financial statements, is aware:

- there is no relevant audit information relating to these respective charitable organisations of which the auditors are unaware;
- he has taken all the steps that he ought to have taken as Accounting Officer in order to make himself aware of any relevant audit information relating to these charitable organizations and to establish that the auditors are aware of that information;
- he confirms that the Annual Report and Accounts as a whole is fair, balanced and understandable; and
- he confirms that he takes personal responsibility for the Annual Report and Accounts and the judgements required for determining that it is fair, balanced and understandable.

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 the financial position at the end of the year.

In preparing the Armagh Observatory and Planetarium accounts, the Board of Governors 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.

2. Compliance with Corporate Governance Code

In April 2013 the former 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, comply with the principles of good practice in the Corporate Governance Code.

3. Governance Framework

Accounting Officer

Michael Burton was appointed as Chief Executive of Armagh Observatory and Planetarium on 1 August 2016 and appointed as Accounting Officer on 1 September 2016. He is responsible for the maintenance of a sound system of internal control as outlined in section 1.

Name	**Accounting Officer** – Period in 2017/18
Professor Michael Burton – Chief Executive Armagh Observatory and Planetarium	From 1 September 2016 onwards

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

During 2017/18 there was one addition to the Chapter of the Church of Ireland Cathedral of Armagh and hence the Board of Governors. There remains one vacancy from within the Board of Governors nominees. A new QUB nominee was appointed.

BOARD OF GOVERNORS			
GOVERNOR	**DATE OF APPOINTMENT**	**DATE OF EXPIRY**	**MEETINGS ATTENDED (max. 0)**
CHAIR Archbishop Richard Clarke	15 December 2012		0
The Dean: Very Rev G. Dunstan	4 December 2011		0
The Venerable Archdeacon T. Scott	9 November 2006		0
The Venerable Archdeacon A. Forster	11 October 2015		0
Rev Canon W.J.A. Dawson	1998		0
Rev Canon W.M. Adair	10 September 2008		0
Rev Canon R.J.N. Porteus	1998		0
Rev Canon N.J. Hughes	16 November 2014		0
Rev Canon J. Moore	13 March 2016		0
Rev Canon D. Hilliard	13 March 2016		0
Rev Canon B. Paine	7 May 2017		0
Dr Katia Poppenhaeger	19 April 2018		0
Professor R. Oudmaijer	1 July 2015		0
Mr W.G. Berry	1 January 2016	Up to 31 December 2019	0
Professor A. Hibbert	28 March 2014		0

Under the revised Terms of Reference of the Board of Governors and its Committees it was decided to re-schedule the Board of Governors annual meeting to after year end so that it could receive the minutes of the March Management Committee and its review of year end reports. Therefore, there was no meeting of the Board of Governors in 2017/18. The annual meeting was held in April 2018 to formally approve the reports from the March 2018 Management Committee.

At the annual meeting on 23 April 2018 the Board of Governors reviewed and approved all of the minutes from the Management Committee and the Audit and Risk Assurance Committee meetings. The Board formally approved the revised Terms of Reference of the Board, the Management Committee, the Audit and Risk Assurance sub-committee and the Staffing Policy and Remuneration sub-committee and also approved the draft Annual Report and Accounts for 2016/17. The Board reviewed the Management Report on performance against 2017/18 targets and approved the direction of the 2018/19 Business Plan and the Annual Review of Information.

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

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

During 2017/18 Queen's University made one nomination and the Board of Governors made one nomination leaving one vacant nominee position and two Board of Governors' co-opted positions vacant.

MANAGEMENT COMMITTEE

MEMBER	DATE OF APPOINTMENT	DATE OF EXPIRY	MEETINGS ATTENDED (max. 4)
CHAIR Archbishop R. Clarke	15 December 2012	January 2018	3
CHAIR Mr J Briggs	January 2018	January 2022	1
DEPUTY CHAIR Professor A. Hibbert	18 March 2005	June 2017	1
Professor T. Ray	4 March 2009		4
Professor M. Merrifield	1 January 1999		1
Professor R. Oudmaijer	1 July 2015		3
Mr B. Hannam	1 January 2016	Up to 31 December 2019	4
Dr M. McKay	1 January 2016	Up to 31 December 2019	3
Mrs P. Wilson	1 November 2014	31 October 2018	3
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
Professor M Mathioudakis	11 November 2016	10 November 2021	2
Canon Hilliard	7 June 2016	6 June 2021	1
Dr Katia Poppenhaeger	19 April 2018		-

During 2017/18 the Management Committee considered a wide range of business including updates on key performance indicators focusing particularly on ongoing financial pressures and resulting staffing pressures. The Committee received regular updates from its two sub-committees, the Audit and Risk Assurance Committee and the Employment Conditions and Remuneration Committee (subsequently renamed as the Staffing Policy and Remuneration Committee) and approved relevant reports. The Committee approved the third and last vision document, the History and Heritage Vision and the Corporate Pan 2018-2021. Regular governance reports such as the Bi-Annual Assurance Statement, the Risk Register and Finance monitoring reports were also reviewed and approved. Revised Terms of Reference for the Board and its committees and sub-committees were approved. Looking to the future, the Committee approved an employee satisfaction and engagement strategy, options for dealing with 2018/19 possible budget cuts and plans for the 50th anniversary of the Planetarium. Internal controls are in place to validate the accuracy and completeness of information presented to the Management Committee. In view of the comprehensive reporting outlined above, the Board/Management Committee are content with the quality of information received.

The Committee approved a self-assessment evaluation questionnaire in March 2018. There were no material findings identified as a result of this exercise.

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

Audit and Risk Assurance Committee

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

AUDIT AND RISK ASSURANCE COMMITTEE	
MEMBER	**MEETINGS ATTENDED (max. 4)**
CHAIR Mr B. Hannam	4
Professor A. Hibbert (resigned June 2017)	1
Professor L. Harra	3
Mr P. McGurgan	4
Mr S. Brown (appointed September 2017)	1

During 2017/18 the Audit and Risk Assurance Committee considered a number of areas including review of the newly appointed Internal Auditor's Charter, Terms of Reference and responsibilities, and approval of the three-year Audit Strategy and 2017/18 Audit Plan. The Committee considered reports from Internal Audit on progress against their audit plan and progress on outstanding recommendations; reports from external audits on the 2014/15 and 2015/16 Annual Report and Accounts; review of the Accounting Officer's Governance Statement and Assurance Statements and the Board's Assurance Statement and review of risk registers and risk assessment process. The Committee is satisfied that the integrated approach, the frequency of meeting, the breadth of the business undertaken and the range of attendees at meetings of the Committee has allowed the Committee to meet the governance requirements of the organisation and assisted the Management Committee to demonstrate its stewardship of the public resources with which it is charged. Minutes of the meetings record the business carried out and actions agreed.

The Committee is satisfied that the organisation now 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 a detailed work programme exists with the aim of implementing the recommendations arising from the Internal Audit, external audit and the special investigation. Progress is implementing outstanding recommendations has been slower than planned because of the time and resource involved in dealing with legacy issues and due to delays in implementing revised organisational structures.

The Committee undertook a self-assessment exercise in June 2017. There were no material findings identified as a result of this exercise.

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

Employment Conditions and Remuneration Committee/Staffing Policy and Remuneration Committee

The Employment Conditions and Remuneration Committee, by necessity, met infrequently as two of the members reside outside of Northern Ireland. Given these circumstances, alternative arrangements have been made so that when necessary its extensive business can be conducted by email or other communication methods. In 2017/18 four formal meetings of the Committee were held prior to the Management Committee meeting.

The Committee advises the Directors, Management Committee and/or Board of Governors when there are specific matters relating to the terms of employment, temporary promotions and pay to be considered. Following a review of its Terms of Reference, the Committee's name was changed to the Staffing Policy and Remuneration Committee to more accurately reflect its remit. In 2017/18, amongst other matters, the Committee considered the areas of:

- The Voluntary Exit Scheme
- Business Continuity
- The recruitment of the Head of Research.
- Unification of Terms and Conditions of Employment and Employment Policies
- Progress on the GDPR/Records management project
- Draft HR strategy

The Committee comprises four named members of the Management Committee.

EMPLOYMENT CONDITIONS AND REMUNERATION COMMITTEE	
MEMBER	MEETINGS ATTENDED (max 4)
CHAIR Professor A. Hibbert (resigned June 2017)	1
Dr M. McKay	3
Professor T. Ray (appointed Chair December 2017)	4
Mrs P. Wilson	3
Mr S. Brown	4

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 Michael Burton Director and Chief Executive, Armagh Observatory and Planetarium

The Operations Manager provides a range of secretarial support services 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 interactive engagement and the execution, promotion and dissemination of astronomical research nationally and internationally in order to enrich the intellectual, economic, social and cultural life of all members of the community".

This aligns closely with the aims and objectives of the Armagh Observatory and Planetarium's sponsor - the Department, and also with the broader aims and objectives of the Northern Ireland Executive's Programme for Government. The organisation's unified Business Plan received Departmental approval.

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

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

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

No Ministerial Directions have 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 realise sustainable improvements in the organisation's research and educational services. For this reason, the organisation's Risk Appetite is 'Open'.

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

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 Officer with objective advice on issues concerning the risk, control and governance of the organisation and the associated assurances. An update on the main points considered by the Audit and Risk Assurance Committee is provided to the Management Committee following each meeting.

5. Fraud and Information Risk

The Accounting Officer of the Armagh Observatory and Planetarium has overall responsibility for managing the risk of fraud including:

- developing a fraud risk profile and undertaking a regular review of the fraud risks associated with each of the key organisational objectives in order to keep the profile current;
- establishing an effective fraud prevention policy and fraud response plan, commensurate with the level of fraud risk identified in the fraud risk profile;
- designing an effective control environment to prevent fraud commensurate with the fraud risk profile;
- operating appropriate pre-employment screening measures;
- establishing appropriate mechanisms for reporting fraud risk issues, reporting significant incidents of fraud, and coordinating assurances about the effectiveness of fraud prevention policies to support the Governance Statement;
- liaising with the Audit and Risk Assurance Committee;
- ensuring that all staff are aware of the organisation's fraud prevention policy and know what their responsibilities are in relation to combating fraud;
- ensuring fraud awareness training is provided as appropriate and, if necessary, more specific fraud prevention training and development is provided to relevant staff;
- ensuring that vigorous and prompt 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 organisation are owned and managed by individuals designated as information asset owners. The Operations Manager responds to requests for information under the Data Protection and Freedom of Information Acts following consultation with the Accounting Officer and the organisation’s governing committees, as appropriate.

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 Armagh Observatory and Planetarium, leadership was exercised by the Director and his Senior Management team who are responsible for the management and effective operation of their organisation. Their operational responsibilities include:

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

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

The members of these committees are drawn from a very wide community background within, and beyond, Northern Ireland, and provide the 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 Committee approved a self-assessment evaluation questionnaire in March 2018. There were no material findings identified as a result of this exercise.

It was agreed by the Board of Governors and the Management Committee that there is no requirement for the current Board of Governors to complete an internal self-assessment of its effectiveness.

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

7. Sources of Independent Assurance

Internal Audit

Following the end of the previous contract, a further competitive tender process to appoint Internal Auditors for the 3 years 2017/18 – 2019/20 was initiated using CPD as the Centre of Procurement Expertise. The appointed firm operates to the standards defined in the Public Sector Internal Audit Standards. Grant Thornton were appointed and met with senior management on 12 June 2017 to develop a proposed audit plan.

The three-year Audit Strategy and 2017/18 Audit Plan for the Internal Audit work was approved by the Audit and Risk Assurance Committee in September 2017. The Audit and Risk Assurance Committee considered reports on the following areas:

Audit Assignment	**Assurance Rating**
Key Financial Controls	Limited
Fixed Assets	Limited
Follow up on previously accepted recommendations – Tranche 1	N/A
Follow up on previously accepted recommendations – Tranche 2	N/A
Overall	Limited*

*Limited overall assurance rating – audit work in 2017/18 identified a number of priority 1 or high risk weaknesses within the system of internal control, but internal auditors noted that there has been a significant improvement in the management and governance structure, with management capacity and commitment to address and improve internal control issues, many of which are historic.

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 is invited to all Audit and Risk Assurance Committee meetings.

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

The system of internal governance is designed to manage risk to a reasonable level, rather than to eliminate all risk of failure to achieve certain policies, aims and objectives; it can therefore only provide reasonable and not absolute assurance of effectiveness. The system of internal governance is based on an ongoing process designed to identify and prioritise risks to the achievement of the Armagh Observatory and Planetarium policies, aims and objectives; to assess the likelihood of the events occurring and the impact should they be realised; and to manage the risks effectively, efficiently and economically. The system of internal governance has been in place in the Armagh Observatory and Planetarium for the year ended 31 March 2018 and up to the date of approval of the annual accounts and accords with Department of Finance guidance.

As previously detailed in Section 3, the responsibilities of the Accounting Officer include the need to maintain a sound system of internal control which supports the achievement of the organisation's policies, aims and objectives. The review of the effectiveness of the system of internal governance has been informed by the assurances provided by relevant parties such as: Internal Audit and the Senior Management Team. Where weaknesses have been identified these have been promptly drawn, through normal reporting mechanisms, to the attention of the Audit and Risk Assurance Committee, Management Committee and/or Board of Governors, as appropriate.

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

- The ongoing independent assessment of the Observatory's research outputs;
- regular reports by financial staff on progress against principal financial targets and the projected financial outcome for the year and progress reports by staff responsible for major projects;
- detailed progress reports to the Management Committee and Board of Governors at their regular meetings and inclusion of performance measures and results against targets in the annual operating plan;
- annual reports on the system of internal control from internal auditors to the Audit and Risk Assurance Committee;
- regular Accountability meetings with officials from the Sponsor Department to consider operational and strategic issues and matters relating to the system of internal control;
- Bi-Annual Assurance Statements and ALB Quarterly Monitoring Data Collection Templates submitted to the Sponsor Department;
- periodic review of the Armagh Observatory and Planetarium Risk Register by the Audit and Risk Assurance Committee, the Management Committee the Accounting Officer and Senior Management Team and the Sponsor Department;
- continuous assessment of the quality of research through peer review of grant applications, applications for telescope time, and the submission of scientific papers to academic journals of international standing by Armagh Observatory staff;
- peer review of the research quality, capability and output of the Observatory, and through participation in an objective external Assurance Committee, which provides an opinion on the adequacy and effectiveness of the system and contain recommendations for improvement; and
- annual reports from external auditors to the Audit and Risk Assurance Committee, 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 or Deputy Chair to the Management Committee and the Board of Governors.

A range of weaknesses identified in the Corporation's control systems and internal governances are set out within the next section. Upon identification, plans were immediately put into place to addresses these issues.

9. Internal Governance Divergences

Update on Prior Years:

2016/17 Internal Audit Recommendations

In total 86 open recommendations were carried forward from prior years for implementation and review by the newly appointed Internal Auditors in 2017/18. Of these, 62 were fully implemented, 2 were no longer applicable and the remaining 22 will be carried forward and reviewed as part of the 2018/19 follow up review.

The Armagh Observatory and Planetarium accounts for the year ended 31st March 2016 were qualified by the Controller and Auditor General to the Northern Ireland Assembly in respect of irregular spend on three contracts of £49,969. One of the contracts was for a three-year period and during the year to 31st March 2018 spend of £11,346 was incurred on this contract which expired on 31 March 2018.

The 2016/17 Annual Report and Accounts contained a qualified opinion by the Comptroller and Auditor General in respect of the valuation of Heritage Assets. The 2017/18 audit report contains a similar qualification.

Identification of New Issues:

2017/18 Internal Audit Recommendations

Four internal audit reviews were carried out in 2017/18. “Limited” assurance ratings were provided for both the Key Financial Controls audit and the Fixed Assets audits, each of which identified 2 priorities one high risk recommendations. However, Internal Audit noted the large number of changes which the organisation has gone through over the last two years and acknowledged the improvements already made and where Armagh Observatory and Planetarium sits within their improvement process. Of the four priority 1 recommendations, Internal Audit verified that two were fully implemented by the year end. The remaining two audits focussed on the open internal audit recommendations carried forward from previous years.

2017/18 NIAO Audit Recommendations

As in 2016/17, in their Report To Those Charged With Governance, the NIAO has qualified their opinion in relation to the existence and valuation of heritage assets. Armagh Observatory and Planetarium have recognised heritage assets with a value of £1,241,960 in its financial statements as at 31 March 2018. This is based on a 2010 valuation provided for insurance purposes. Since that time Armagh Observatory and Planetarium has not sought to update the valuation. As a result, the NIAO was unable to obtain sufficient, appropriate audit evidence to support the amount of £1,241,960 included on the Balance Sheet in respect of these assets and to confirm the existence and completeness of the heritage assets as at 31 March 2018.

10. Conclusion

The Armagh Observatory and Planetarium has an effective governance structure and is operating to a high standard of integrity and probity.

In signing this report, I have taken assurances, where available, from the Audit and Risk Assurance Committee and I will continue to monitor the Internal Audit and Northern Ireland Audit Office recommendations to ensure that all issues are appropriately addressed.

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

Signed:

Professor Michael Burton
Accounting Officer
Armagh Observatory and Planetarium
Date: 10th December 2018

Armagh Observatory and Planetarium
Refereed Publications: April 2017 – March 2018

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Armagh Observatory and Planetarium
Non Refereed Publications: April 2017 – March 2018

1. Bagnulo S., 2017, in ESO Calibration Workshop: The Second Generation VLT Instruments and Friends. Polarimetric Calibration and Accuracy: Lessons Learnt from Present Instrumentation. p. 2, doi:10.5281/zenodo.887223
2. Christou A., 2017, in AAS/Division of Dynamical Astronomy Meeting. Orbital evolution and escape of Martian Trojans due to the Yarkovsky effect. p. 402.02
3. Christou A., Borisov G., Jacobson S. A., Colas F., dell'Oro A., Cellino A., Bagnulo S., 2017, in AAS/Division for Planetary Sciences Meeting Abstracts. Population control of Martian Trojans by the Yarkovsky & YORP effects. p. 302.05
4. Crowther P. A., Castro N., Evans C. J., Vink J. S., Melnick J., Selman F., 2017, Dissecting the Core of the Tarantula Nebula with MUSE, The Messenger, 170, 40, doi:10.18727/0722-6691/5053, https://ui.adsabs.harvard.edu/abs/2017Msngr.170...40C
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8. Lee Y.-H., Koo B.-C., Lee J.-J., Jaffe D. T., Burton M. G., Ryder S. D., 2018, in American Astronomical Society Meeting Abstracts. Near-Infrared [Fe II] and H_2 Study of the Galactic Supernova Remnants
9. Li D., Christou A., 2017a, in AAS/Division of Dynamical Astronomy Meeting. Dispersion of the Himalia family of jovian irregular satellites by planetesimal encounters. p. 402.04

10. Li D., Christou A., 2017b, in AAS/Division for Planetary Sciences Meeting Abstracts. The Nice model can explain the dispersion of the prograde Himalia family of irregular satellites at Jupiter. p. 511.04
11. Maguire C., McDonnell L., McGlinchey M., Derry T. C., Asher D., Ramsay G., 2017, Observations made using the LCOGT network of supernovae SN 2017gax and SN 2017hjw., The Astronomer's Telegram, 10956, 1, https://ui.adsabs.harvard.edu/abs/2017ATel10956....1M
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13. Murphy M., Chenaux A., Keenaghan G., GIbson V.., Butler J., Pybusr C., 2017, Armagh Observatory - Historic Building Information Modelling for Virtual Learning in Building Conservation, ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 62W5, 531, doi:10.5194/isprs-archives-XLII-2-W5-531-2017, https://ui.adsabs.harvard.edu/abs/2017ISPAr62W5.531M
14. Nazé Y., Bagnulo S., Walborn N. R., Morrell N., Wade G. A., Szymanski M. K., Townsend R. H. D., 2017, in The Lives and Death-Throes of Massive Stars. The quest for magnetic massive stars in the Magellanic Clouds. pp 430–430, doi:10.1017/S1743921317000990
15. Romano D., Burton M., Braiding C., Molinari S., Ashley M., 2017, in IV Workshop sull'Astronomia Millimetrica in Italia. The MopraCO Galactic Survey. p. 14, doi:10.5281/zenodo.1116248
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17. Sekhar A., Asher D. J., Morbidelli A., Werner S. C., Vaubaillon J., Li G., 2017b, in European Planetary Science Congress. GR Precession and Kozai Mechanism in Asteroid-Comet Continuum. pp EPSC2017–270–2
18. Sekhar A., Asher D. J., Werner S. C., Vaubaillon J., Li G., 2017c, in EGU General Assembly Conference Abstracts. Change in General Relativistic precession rates due to Lidov-Kozai oscillations in the Solar System. p. 9018
19. Sekhar A., Asher D., Morbidelli A., Werner S., Vaubaillon J., Li G., 2017d, in AAS/Division of Dynamical Astronomy Meeting. Rapid Enhancement in General Relativistic Precession Rates due to Kozai Mechanism in Solar System Bodies. p. 202.05
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23. Vink J. S., Evans C. J., Bestenlehner J., McEvoy C., Ramírez-Agudelo O., Sana H., Schneider F., VFTS Collaboration 2017, in The Lives and Death-Throes of Massive Stars. The VLT-FLAMES Tarantula Survey. pp 279–286, doi:10.1017/S1743921317002496
24. Walmsley S., Beyond Limits: using participatory arts practices to explore the world of astronomy at Armagh Observatory. Building interdisciplinary and intercultural bridges: Where practice meets research and theory. (2017). [Book]. p182-189 https://www.repository.cam.ac.uk/handle/1810/266165
25. Wickhusen K., Oberst J., Willner K., Christou A., 2017, in European Planetary Science Congress. Missions to Mars and his Trojan Asteroid Family - A Feasibility Study. p. EPSC2017
26. Yanamandra-Fisher P. A., McLean W., PACA Jupiter 2017a, in AAS/Division for Planetary Sciences Meeting Abstracts. Polarization of Hazes and Aurorae on Jupiter. p. 115.15
27. Yanamandra-Fisher P. A., McLean W., Wesley A., Miles P., Masding P., 2017b, in AGU Fall Meeting Abstracts. Polarimetric Study of Jupiter's Atmosphere. pp P11D–2537

Armagh Observatory and Planetarium - Outreach Activities
Period: 1 April 2017 - 31 March 2018

Date	Event Description	Location	Personnel	Category
04-Apr-17	Spaced Workshop with Dr Sally Walmsley. In association with AOP	Saints and Scholars Primary School, Armagh, BT61 9HG	Y Metodieva	Education
28-Apr-17	Opening of "Beyond Limits: The World of the Time Travelling Astronomer" a multimedia installation by Dr Sally Walmsley. In association with AOP	Armagh County Museum, The Mall, Armagh, BT61 9BE	M E Bailey, S Walmsley	Outreach
28-Apr-17 to 12-Jun-17	Beyond Limits: The World of the Time Travelling Astronomer" a multimedia installation by Dr Sally Walmsley in association with AOP. (Event will include Schools and adult special needs workshops and discussion session)	Armagh County Museum, The Mall, Armagh, BT61 9BE	M Burton, M E Bailey, S Walmsley, staff and students	Outreach
27-May-17	Ballyclare May Fair "Out of this World". With Outreach Dome.	Ballyclare Town Hall, The Square, Ballyclare BT39 9BB	H Taylor	Outreach
12-Jun-17	Sentinus Young Innovators Event	University of Ulster, Jordanstown Campus, Shore Road, Newtownabbey, Co. Antrim, BT37 0QB	N Parke	Outreach
01-Jul-17	Jedi Training	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	Staff	Event
05-Jul-17	An Evening with an Astronomer	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	N Parke, H Taylor, A Christou	Education
06-Jul-17	Children's Hospital Visit	The Royal Belfast Hospital for Sick Children, 247 Grosvenor Road, Belfast, BT12 6BA	N Parke	Outreach
13-Jul-17 to 18-Jul-17	Minecraft at AOP	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	Staff	Education
17-Jul-17 to 22-Jul-17	Jurassic Week at AOP	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	Staff	Education
24-Jul-17	Libraries NI Outreach Event	Omagh Library, 1 Spillars Place, Irishtown Road, Omagh BT78 1HL	N Parke	Outreach
25-Jul-17	Libraries NI Outreach Event	Larne Library, 36 Pound St, Larne BT40 1SQ	S Rotherham	Outreach
26-Jul-17	An Evening with an Astronomer	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	S Rotherham, N Parke, S Bagnulo	Education
29-Jul-17	Talk: Cosmic Timeline: From the Big Bang to Black Holes	Sunflowerfest, Tubby's Farm, 31 Cabra Road, Legacurry Road, Hillsborough, Co. Down, BT26 6NB	J Vink	Outreach
05-Aug-17 to 06-Aug-17	Heroes and Legends at AOP	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	Staff	Event

Date	Event Description	Location	Personnel	Category
10-Aug-17 to 11-Aug-17	Meeting: Evolution and Explosion of Massive Stars, 10 - 11 August 2018	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	J Vink	Research
16-Aug-17	Libraries NI Outreach Event	Cookstown Library, 13 Burn Rd, Cookstown BT80 8DJ	H Taylor	Outreach
16-Aug-17	An Evening with an Astronomer	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	J Vink, K Scullion, S McAnanely	Education
21-Aug-17 to 25-Aug-17	Astronaut Sculpting Week at AOP	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	Staff	Event
26-Aug-17	Micro Zoo Event	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	Staff	Event
30-Aug-17	An Evening with an Astronomer	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	M. Burton, S Rotherham, K Scullion	Education
09-Sep-17	Tour: Guided Tours of the Armagh Observatory and Planetarium Grounds and Astropark. In association with European Heritage Open Days	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	S Kelly, D Li, H Taylor	Outreach
16-Sep-17	Talk: Robert McKimm of Clogher: An Enduring Astronomical Legacy	William Carleton Summer School, Corick House Hotel, Clogher, Co. Tyrone, BT76 0BZ	M E Bailey	Outreach
20-Sep-17	Talk: Aidan Fitzgerald OBE (1900-1965) (Award of the IAA Aidan Fitzgerald Medal)	Irish Astronomical Association, Queen's University, Belfast. Co. Antrim, BT7 1NN	M E Bailey	Outreach
20-Sep-17	Talk: Ancient Stones and Comets: Developing the Giant-Comet Hypothesis			
02-Oct-17	Talk: Earth's Place in Space: Discovering Humanity's Shared Celestial Heritage	Coleraine U3A, Agherton Parish Centre, Portstewart, Co. Antrim, BT55 7AH	M E Bailey	Outreach
02-Oct-17 to 03-Oct-17	STFC Schools Workshops on the Solar System (talks and art workshop) lead by Helen Mason, University of Cambridge and Geraldine Cox, Artist in Residence, University College London. In association with STFC	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	J G Doyle, L Doyle, Y Metodieva	Education
13-Oct-17	Public Lecture: "Life in a Finely Tuned Cosmos" by Geraint Lewis and Luke Barnes, University of Sydney	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DB	M Burton, S McAnaley	Education
17-Oct-17	Talk: What's Out There?	Armagh Mother's Union, Crozier Hall, Armagh, Co. Armagh, BT61 9DT	M Burton	Outreach
19-Oct-17	Maths Week: Bubbly Maths	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	Staff	Education
27-Oct-17	Talk: Ireland and the Birth of Astrophysics	Mayo Dark Sky Festival, Newport, Co. Mayo, Ireland	M Burton	Outreach

Date	Event Description	Location	Personnel	Category

28-Oct-17 to 30-Oct-17	Minecraft at Halloween at AOP	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	Staff	Education
29-Oct-17	Talk: The Ancestors of Black Holes	Science Uncovered - Live Fast, Die Young, Ulster Museum, Belfast, Co. Antrim, BT9 5AB	E Higgins	Outreach
06-Nov-17	Talk: The First Stars and Black Holes in the Early Universe	Northern Ireland Amateur Astronomy Society, Ballyclare High School, Ballyclare, Co. Antrim, BT39 9HJ	J Vink	Outreach
13-Nov-17	Talk: Wonders of the Cosmos - As Seen by the Telescopes of the European Southern Observatory	National Science Week, Cavan, Co. Cavan, Ireland	M Burton	Outreach
13-Nov-17	STFC Schools Workshops on Gravitational Waves lead by Chris North, University of Cardiff. In association with STFC	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	J G Doyle	Education
15-Nov-17	Talk: The Armagh Human Orrery: Ground-Based Astronomy for All	Armagh City and District U3A, Armagh Golf Club, Armagh, Co. Armagh, BT60 1EN	M E Bailey	Outreach
15-Nov-17	Talk: Wonders of the Cosmos - As Seen by the Telescopes of the European Southern Observatory	National Science Week, Clones, Co. Monaghan, Ireland	M Burton	Outreach
22-Nov-17	Robinson Lecture: "Solar Orbitor - A Journey Towards the Sun: Exploring the Sun and Space Weather" by Professor Louise Harra, University College London. In association with ACBCBC Georgian Events	The Palace, The Palace Demesne, Armagh, BT60 4EL	M Burton	Outreach
23-Nov-17	Robinson Schools Lecture: "Space the Final Frontier: do you want to be part of it" by Professor Louise Harra, University College London.	Banbridge Academy, Lurgan Road, Banbridge, BT32 4AQ	M Burton	Education
25-Nov-17	Georgian Day Tours at Armagh Observatory and Planetarium in association with ACBCBC	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	M Burton, H Alexander	Outreach
10-Dec-17	Talk: The Star of Bethlehem	Bloomfield Presbyterian Church, Belfast, Co. Antrim, BT5 4DW	C S Jeffery	Outreach
19-Jan-18	Talk: Earth's Place in Space: Discovering Humanity's Shared Celestial Heritage	East Glendalough School, Glendalough, Co. Wicklow, Ireland	M E Bailey	Outreach
Date	**Event Description**	**Location**	**Personnel**	**Category**
25-Jan-18	Talk: Earth's Place in Space: Discovering Humanity's Shared Celestial Heritage	St. Mary's Primary School, Banbridge, Co. Down, BT32 3DJ	M E Bailey	Education
29-Jan-18	Talk: From Earth to the Universe	Stewartstown and District Local History Society, Crieve Centre, Stewartstown, Co. Tyrone, BT71 5HY	M E Bailey	Outreach
17-Feb-18	Science Festival: Astronaut Training Workshop	Armagh Observatory and Planetarium, Armagh, Co. Armagh, BT61 9DB	H Alexander, N Parke	Education
Date	**Event Description**	**Location**	**Personnel**	**Category**

21-Feb-18	Talk: The Life of a Cosmic Rockstar	Irish Astronomical Association, Queen's University, Belfast, Co. Antrim, BT7 1NN	E Higgins	Outreach
22-Feb-18 to 14-Apr-18	Eye in the Sky Exhibition, Aerial Photographs of Northern Ireland. In association with Armagh County Museum	Armagh County Museum, The Mall, Armagh, BT61 9BE	M E Bailey	Outreach
23-Feb-18	Tour: Guided Tour of the Armagh Observatory, Climate Change MSc students from Maynooth College, Co Kildare	Armagh Observatory and Planetarium, College Hill, Armagh, BT61 9DG	C J Butler	Research
06-Mar-18	Women in Science, International Women's Day Event. In partnership with ACBCBC	Craigavon Civic and Conference Centre, Lakeview Road, Craigavon, BT64 1AL	M Burton, ESOs, PhD Students	Outreach
09-Mar-18	Starry Starry Night Event. In association with ACBCBC	Navan Centre, 81 Killylea Road, Armagh, BT60 4LD	M Burton, H Alexander	Outreach
17-Mar-18	The Alchemy of Stars, St. Patrick's Day Public Lecture by Simon Jeffery. In association with ACBCBC	The Market Place Theatre, 9 Market Street, Armagh, BT61 7BW	C S Jeffery	Outreach
20-Mar-18	"We Are All Equal Under the Stars", a special event as a run-in for the Commonwealth Heads of Government Meeting (CHOGM) in London in April 2018	Armagh Observatory and Planetarium, Armagh, Co. Armagh, BT61 9DG	M Burton	Outreach
21-Mar-18	A-Level Physics Course. In association with Armagh Area Learning Community	Royal School, Armagh, BT61 9DH	M Burton, S Jeffery, Staff and Students	Education

Armagh Observatory and Planetarium

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

Opinion on financial statements

I certify that I have audited the financial statements of the Armagh Observatory and Planetarium for the year ended 31 March 2018 under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995. The financial statements comprise: the Statement of Financial Activities, the Balance Sheet, the Cash Flow Statement and the related notes. These financial statements have been prepared under the accounting policies set out within them. I have also audited the information in the Remuneration and Staff Report that is described in that report as having been audited.

In my opinion, except for the financial effect of such adjustment as may have been determined necessary had I been able to obtain sufficient and appropriate audit evidence concerning the issue outlined below in the basis of opinions paragraph, the financial statements:

- give a true and fair view of the state of Armagh Observatory and Planetarium's affairs as at 31 March 2018 and of its total incoming resources and expenditure of resources for the year then ended; and
- have been properly prepared in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995 and Department for Communities directions issued thereunder.

Opinion on regularity

In my opinion, in all material respects the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

Basis of opinions

Armagh Observatory and Planetarium has recognised heritage assets with a value of £1,241,960 in its financial statements as at 31 March 2018. This is based on a 2010 valuation provided for insurance purposes. Since that time Armagh Observatory and Planetarium has not sought to update the valuation. As a result I was unable to obtain sufficient, appropriate audit evidence to support the amount of £1,241,960 included on the Balance Sheet in respect of these assets and to confirm the existence and completeness of the heritage assets as at 31 March 2018.

I conducted my audit in accordance with International Standards on Auditing (UK) (ISAs) and Practice Note 10 'Audit of Financial Statements of Public Sector Entities in the United Kingdom'. My responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of this certificate. My staff and I are independent of Armagh Observatory and Planetarium in accordance with the ethical requirements of the Financial Reporting Council's Revised Ethical Standard 2016, and have fulfilled our other ethical responsibilities in accordance with these requirements. I believe that the audit evidence obtained is sufficient and appropriate to provide a basis for my opinions.

Other Information

The Governors and the Accounting Officer are responsible for the other information included in the annual report. The other information comprises the information included in the Trustees' annual report other than the financial statements, the parts of the Remuneration and Staff described in the report as having been audited, and my audit certificate and report. My opinion on the financial statements does not cover the other information and I do not express any form of assurance conclusion thereon.

In connection with my audit of the financial statements, my responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or my knowledge obtained in the audit or otherwise appears to be materially misstated. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact. I have nothing to report in this regard.

Opinion on other matters

In my opinion:

- the parts of the Remuneration and Staff Report to be audited have been properly prepared in accordance with the Department for Communities' directions made under the Armagh Observatory and Planetarium (Northern Ireland) Order 1995; and
- the information given in the Trustees' Annual Report for the financial year for which the financial statements are prepared is consistent with the financial statements.

Responsibilities of the Governors and Accounting Officer for the financial statements

As explained more fully in the Statement of the Governors and Accounting Officer Responsibilities, the Governors and the Accounting Officer are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view.

Auditor's responsibilities for the audit of the financial statements

My responsibility is to audit, certify and on the financial statements in accordance with the Armagh Observatory and Planetarium (Northern Ireland) Order 1995.

I am required to obtain 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. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with ISAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

A further description of my responsibilities for the audit of the financial statements is located on the Financial Reporting Council's website www.frc.org.uk/auditorsresponsibilities. This description forms part of my certificate.

In addition, I am required to obtain evidence sufficient to give reasonable assurance that the expenditure and income recorded in the financial statements have been applied to the purposes intended by the Assembly and the financial transactions recorded in the financial statements conform to the authorities which govern them.

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 parts of the Remuneration and Staff 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 the Department of Finance's guidance.

Report

Other that the information included above in the basis of opinion paragraph, I have no other observations to make on these financial statements.

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

Date: 21 December 2018

Armagh Observatory and Planetarium

Statement of Financial Activities for the year ended 31 March 2018

	Note	Unrestricted Funds 2018 £	Restricted Funds 2018 £	**Total Funds 2018 £**	Unrestricted Funds 2017 £	Restricted Funds 2017 £	**Total Funds 2017 £**
Income from:							
Charitable Income	2	1,881,102	481,590	**2,362,692**	1,646,384	685,755	**2,332,139**
Trading activities	4	88,322	-	**88,322**	89,475	-	**89,475**
Total incoming resources		1,969,424	481,590	**2,451,014**	1,735,859	685,755	**2,421,614**
Expenditure on:							
Charitable activities	5	2,400,811	225,326	**2,626,137**	2,031,718	424,813	**2,456,531**
Trading activities	8	36,626	-	**36,626**	38,668	-	**38,668**
Total outgoing expenditure		2,437,437	225,326	**2,662,763**	2,070,386	424,813	**2,495,199**
Net Income / (Expenditure)		(468,013)	256,264	**(211,749)**	(334,527)	260,942	(73,585)
Transfers between funds	15	199,152	(199,152)	**-**	277,880	(277,880)	**-**
Other Recognised Gains/(Losses):							
Gains/(losses) on the revaluation of Fixed Assets		366,699	-	**366,699**	810,105	-	**810,105**
Gains/(losses) on the revaluation of Heritage Assets		50,000	-	**50,000**	1,191,960	-	**1,191,960**
Actuarial gains/(losses) on defined benefit pension scheme	19	213,000	-	**213,000**	(667,026)	-	**(667,026)**
Net Movement in Funds		**360,838**	**57,112**	**417,950**	**1,278,392**	**(16,938)**	**1,261,454**
Reconciliation of funds							
Total funds brought forward at 1 April 2017		7,520,079	171,907	**7,691,986**	6,241,687	188,845	**6,430,532**
Total funds carried forward at 31 March 2018		7,880,917	229,019	**8,109,936**	7,520,079	171,907	**7,691,986**

All amounts above relate to continuing operations of the organisation.
The notes on pages 47 to 59 form part of the financial statements.

Armagh Observatory and Planetarium

Balance Sheet as at 31 March 2018

	Note	2018	2017
Fixed Assets		£	£
Tangible assets	10	8,099,582	7,875,119
Heritage Assets	11	1,241,960	1,191,960
Total Fixed Assets		9,341,542	9,067,079
Current assets			
Inventories	12	11,503	7,946
Debtors	13	128,848	103,628
Cash at bank and in hand	18	673,851	486,805
		814,202	598,379
Creditors: amounts falling due within one year	14	(597,808)	(407,472)
Net current assets		216,394	190,907
Total assets less current liabilities		9,557,936	9,257,986
Creditors: amounts falling due after more than one year		-	-
Net assets excluding pension liability		9,557,936	9,257,986
Defined benefit pension scheme liability	19	(1,448,000)	(1,566,000)
Net assets		**8,109,936**	**7,691,986**
Funds			
Restricted funds	15	229,019	171,907
Unrestricted funds	15	2,648,633	2,822,494
Revaluation Reserve	15	6,680,284	6,263,585
Pension Reserve	15	(1,448,000)	(1,566,000)
Total Charity Funds	**15**	**8,109,936**	**7,691,986**

The financial statements on pages 44 to 59 were approved by the Board of Trustees of Armagh Observatory and Planetarium on 10th December 2018 and were signed on its behalf by:

Chair of the Board of Trustees

Accounting Officer

Armagh Observatory and Planetarium

Cash Flow Statement for the year ended 31 March 2018

	Note	2018 £	2017 £
Net cashflow from operating activities	17	394,499	327,177
Cashflows from investing activities			
Interest received		137	33
Proceeds from sale of assets		1,159	60
Purchase of tangible fixed assets		(208,748)	(209,194)
		(207,452)	(209,101)
Increase in cash and cash equivalents		187,047	118,076

Further detail is reported in Notes 17 - 18.

Reconciliation of net cashflow to movement in net cash funds

		2018 £	2017 £
Increase in cash and cash equivalents in the year		187,047	118,076
Cash and cash equivalents at 1 April 2017		486,804	368,728
Cash and cash equivalents at 31 March 2018	18	673,851	486,804

Further detail is reported in note 18
The notes on pages 47 to 59 form part of the financial statements.

Armagh Observatory and Planetarium

Notes to the financial statements for the year ended 31 March 2018

1 Summary of significant accounting policies

(a) Basis of accounting

The financial statements have been prepared under direction issued by the Department for Communities (DfC), 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. Following restructuring of the NICS department on 9 May 2016, the funding department for Armagh Observatory Planetarium became DfC. With the exception of this departure from the SORP, in all other aspects the financial statements comply with the Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS102) (Charities SORP (FRS102)).

The Trustees of Armagh Observatory and Planetarium confirm that they have complied with their duty to have regard to the guidance on Public Benefit produced by the Charities Commission of Northern Ireland under section 4(b) of the Charities Act (the public benefit requirement statutory guidance) and that this has informed the activities of the organisation in the year to 31 March 2018.

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

(b) Incoming resources

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

(c) Resources expended

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

(d) Pension scheme

The organisation provides pension benefits to its employees by participating in the Local Government Pension Scheme for Northern Ireland, administered by Northern Ireland Local Government Officers' Superannuation Committee (NILGOSC), which is a defined benefit scheme. Annual contributions to the NILGOSC scheme are based on actuarial advice. The operating costs of providing retirement benefits to the organisation's employees are recognised in accounting periods in which the benefits are earned by employees, and the related finance costs and other changes in value of the assets and liabilities are recognised in the period in which they arise.

(e) 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:

	%
Digistar	10
Furniture and fittings	2 - 15
Office equipment	10 - 25
Scientific equipment and other equipment	10 - 25
Buildings	Remaining Asset Life as valued
Astropark	2 - 5
Exhibits and grounds	6 - 25
Motor Vehicles	25

Land and buildings are included in the balance sheet at depreciated replacement cost, estimated value in use or market value. Land and buildings are professionally revalued every 5 years in accordance with accounting guidance. Land and buildings were last revalued as at the 31st March 2018. Revaluation gains (losses) net of accrued depreciation are transferred to a revaluation reserve. Land and buildings in years where no revaluation occurs are restated using indices.

Land and Buildings were revalued by Land and Property Services (LPS). The valuations were prepared by LPS in accordance with the RICS Valuation Standards, insofar as these are consistent with the requirements of the client. The valuations were undertaken having regard to International Financial Reporting Standards (IFRS) as applied to the United Kingdom public sector and in accordance with HM Treasury guidance, International Valuation Standards and the requirements of the Royal Institution of Chartered Surveyors Valuation – Professional Standards.

Other fixed assets (non Land & Buildings) with a life estimated over 5 years have a net book value of £358,616 at 31st March 2018. This accounts for 3.8% of the net book value of fixed assets. The Trustees do not consider it appropriate to carry out an annual indexation exercise on grounds of immateriality.

Notes to the financial statements for the year ended 31 March 2018 (continued)

(f) Heritage Assets

Armagh Observatory was founded in 1789 and from this date the Observatory has collected through its operations scientific items, books, furniture and other artefacts which would be considered heritage assets. It is not the policy of Armagh Observatory and Planetarium to acquire heritage assets but has collected such assets through donations and operations. These asset were recorded on the Balance Sheet at March 2017 at £1,191,160 based on a 2010 insurance valuation. An adjustment of £50,000 was made at March 2018 for an asset not included in the 2010 valuation, but included in a 2008 valuation. Heritage assets are categorised as follows:

Books	£297,180
Clocks	£430,300
Scientific Instruments	£488,300
Furniture, Artworks etc.	£26,180

Assets are recorded in catalogues and on databases. The assets are valued for insurance purposes with reference to auction estimates for replacement. Included within operational assets are historic buildings which have heritage value. These were included within the recent property revaluation as operational assets and continue to be used for operational purposes.

(g) Inventories

Inventories are stated at the lower of cost and net realisable value. In general, cost is determined on a first in first out basis.

(h) Debtors

Debtors comprise amounts due from customers, grants due, prepayments made and value added tax.

(i) Cash at bank and in hand

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

(j) Creditors

Creditors comprises payments due to suppliers and accruals for amounts due at the year end.

(k) Fund accounting

The organisation has various types of funds for which it is responsible, and which require separate disclosure. These are as follows:

Restricted funds

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

Unrestricted funds

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

Government Grant fund - this fund represents the value of grants received to finance expenditure on assets, namely land and buildings, exhibits and grounds, astropark, equipment and historic telescopes, fixtures, equipment and motor vehicles. The fund is reduced annually by the value of depreciation charged on the related assets.

Designated funds - Donated Assets fund and Government Grants fund represent the capital financing of the Charity's assets and are released in line with depreciation policy. Donated assets are the buildings and grounds donated to the organisation in 1790 by it's founder Archbishop Richard Robinson. The General Fund is the day to day operating fund.

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

(l) Reserves policy

The Armagh Observatory and Planetarium adopts a risk-based approach to establishing a sound system of control covering all types of risks to the aims and objectives of the organisation. There is a need to retain a sufficient level of unrestricted cash reserves to meet the risks associated with financial contingencies, uncertainties and demands.

Armagh Observatory and Planetarium forecasts to operate on an annual basis within a balanced funding formula of grant in aid and self generated income. Annual operating surpluses (deficits) are kept to a minimum and are transferred to an unrestricted general reserve at 31 March each year. The level of unrestricted funds at 31 March 2018 was £3,093 (£34,719 at 31 March 2017). The policy is reviewed on an annual basis.

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

Notes to the financial statements for the year ended 31 March 2018 (continued)

2 Income from charitable activities

	Note	Unrestricted Funds 2018 £	Restricted Funds 2018 £	Total Funds 2018 £	Total Funds 2017 £
Grant Income					
DfC Recurrent grant-in-aid		1,731,000	-	1,731,000	1,498,004
DfC VES grant-in-aid		-	-	-	188,000
DfC In-year capital grant-in-aid		-	196,000	196,000	173,237
Total grant-in-aid from the DfC		1,731,000	196,000	1,927,000	1,859,241
Income from other grants and receipts	3	-	285,590	285,590	326,048
Total Grant Income		1,731,000	481,590	2,212,590	2,185,289
Operating Income					
Admissions		148,420	-	148,420	140,601
Outreach income		-	-	-	3,475
Miscellaneous income		1,682	-	1,682	2,774
Total Operating Income		150,102	-	150,102	146,850
Total Income from Charitable Activities		**1,881,102**	**481,590**	**2,362,692**	**2,332,139**

3 Other revenue grants and receipts

	Note	Unrestricted Funds 2018 £	Restricted Funds 2018 £	Total Funds 2018 £	Total Funds 2017 £
STFC Research, Visitor and Travel grants		-	278,838	278,838	269,615
STFC Capital grant income		-	-	-	9,194
Lindsay Scholar		-	-	-	21,349
Leverhulme Trust		-	-	-	22,565
Space Awareness Project		-	5,166	5,166	-
IAESTE		-	1,586	1,586	-
Around North Project		-	-	-	995
Royal Society		-	-	-	800
ASDC-STFC World Space Week		-	-	-	902
Titan - TBUC Event		-	-	-	150
Sundry donations		-	-	-	478
Total other grants and receipts	2	-	285,590	285,590	326,048

4 Income from other trading activities

	Unrestricted Funds 2018 £	Restricted Funds 2018 £	Total Funds 2018 £	Total Funds 2017 £
Shop income	70,624	-	70,624	71,762
Rental income	17,698	-	17,698	17,713
Total Income from other trading	88,322	-	88,322	89,475

Notes to the financial statements for the year ended 31 March 2018 (continued)

5 Expenditure on charitable activities

	Note	Unrestricted Funds 2018 £	Restricted Funds 2018 £	Total Funds 2018 £	Total Funds 2017 £
Research	6	926,757	225,326	1,152,083	1,226,291
Education	6	740,692	-	740,692	722,558
Governance and Support	6	733,362	-	733,362	507,682
		2,400,811	225,326	2,626,137	2,456,531

6 Expenditure on charitable activities

	Unrestricted Funds 2018 £	Restricted Funds 2018 £	Total Funds 2018 £	Restated Total Funds 2017 £
Research				
Staff costs	464,359	100,304	564,663	705,847
Direct costs	144,436	125,022	269,458	294,618
Support costs	180,585	-	180,585	91,669
Depreciation	137,377	-	137,377	134,157
	926,757	**225,326**	**1,152,083**	**1,226,291**
Education				
Staff costs	279,233	-	279,233	351,726
Direct costs	111,230	-	111,230	51,769
Support costs	136,623	-	136,623	164,773
Depreciation	213,607	-	213,607	154,290
	740,692	-	**740,692**	**722,558**
Governance and Support				
Staff costs	597,675	-	597,675	360,195
Direct costs	97,345	-	97,345	133,251
Support costs	38,342	-	38,342	14,236
	733,362	-	**733,362**	**507,682**

*Restated 2016/17 figures for research direct and support costs to ensure consistency with 2017/18.

7 Analysis of governance costs

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

	Unrestricted Funds 2018 £	Restricted Funds 2018 £	Total Funds 2018 £	Total Funds 2017 £
Management Committee expenses	2,261	-	2,261	6,575
Audit	29,706	-	29,706	28,245
	31,967	-	31,967	34,820

8 Expenditure on trading activities

	Unrestricted Funds 2018 £	Restricted Funds 2018 £	Total Funds 2018 £	Total Funds 2017 £
Trading				
Direct costs	36,626	-	36,626	38,668
	36,626	**-**	**36,626**	**38,668**

Notes to the financial statements for the year ended 31 March 2018 (continued)

9 Average staff numbers and related costs

	Permanent staff	Others	2018 Number	2017 Number
Average staff numbers	18.8	8.3	27.1	26.3

Staff costs comprise:	Permanent staff £	Others £	2018 £	2017 £
Wages and salaries	739,573	377,459	1,117,032	963,188
Social security costs	78,406	-	78,406	86,993
Employer's pension contributions	144,832	-	144,832	159,624
Defined benefit pension service cost	95,000	-	95,000	12,000
Termination costs	6,301	-	6,301	195,964
	1,064,112	377,459	1,441,571	1,417,769

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

	2018 Number	2017 Number
£70,001 - £80,000	1	2
£120,001 - £130,000	-	1

The key management personnel of the organisation comprise the trustees and the executive director.

The total amount of employee benefits (including employer pension contributions) received by the executive director for his services to the organisation was £85,623 (2017: £80,507).

There was no remuneration paid to trustees during the year (2017: nil). Travel and subsistence expenses totalling £1,667 was reimbursed to 7 trustees (2017: £673 to 2 trustees).

Average student numbers and related costs (not included above)

	2018 Number	2017 Number
PhD students	8	10

	2018 £	2017 £
Student maintenance grants & stipends	36,799	140,733

Notes to the financial statements for the year ended 31 March 2018 (continued)

10 Tangible fixed assets

	Freehold Land & buildings £	Exhibits grounds and Astropark £	Digistar Projection System £	Observatory Equipment & Historic telescopes £	Other Equipment & Vehicles £	Total £
Cost or valuation						
At 1 April 2017	7,293,210	556,194	1,200,332	934,048	514,042	10,497,826
Asset reclassification	-	-	-	(3,860)	3,860	-
Asset revaluation	175,418	-	-	-	-	175,418
Additions	109,809	-	-	25,000	73,939	208,748
Disposals	-	(6,009)	-	(23,522)	(58,604)	(88,135)
At 31 March 2018	7,578,437	550,185	1,200,332	931,666	533,237	10,793,857
Depreciation						
At 1 April 2017	-	506,862	1,075,445	637,392	403,008	2,622,707
Adjustment for asset revaluation	(191,281)	-	-	-	-	(191,281)
Charge for year	191,281	12,447	29,428	58,798	59,030	350,984
Disposals	-	(6,009)	-	(23,522)	(58,604)	(88,135)
At 31 March 2018	-	513,300	1,104,873	672,668	403,434	2,694,275
Net book value						
At 31 March 2018	7,578,437	36,885	95,459	258,998	129,803	8,099,582
At 31 March 2017	7,293,210	49,332	124,887	296,656	111,034	7,875,119

Tangible fixed asset additions of £208,748 as shown above were funded as follows:

	£
DfC in-year capital grant-in-aid	196,000
Revenue	12,748
	208,748

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

	2018 £	2017 £
Cost	2,066,573	2,066,573
Aggregate depreciation	(873,424)	(832,370)
Net book value based on historic cost	1,193,149	1,234,203

Depreciation on fixed assets for the year was £350,984 (2017: £288,447).

Land and buildings include grounds and buildings with a net book value of £1,877,922 at 31 March 2018 which were donated to the organisation in 1790 by Archbishop Richard Robinson, the founder of the organisation (31 March 2017: £1,838,725).

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

Notes to the financial statements for the year ended 31 March 2018 (continued)

11 Heritage assets

	Books	Furniture & Artworks	Clocks & Scientific Equipment	Total
	£	£	£	£
Cost / Valuation 1 April 2017	297,180	26,180	868,600	1,191,960
Additions	-	-	-	-
Disposals	-	-	-	-
Depreciation impairment	-	-	-	-
Revaluation	-	-	50,000	50,000
Cost / Valuation 31 March 2018	297,180	26,180	918,600	1,241,960

Armagh Observatory was founded in 1789 and from this date the Observatory has collected through its operations scientific items, books, furniture and other artefacts which would be considered heritage assets. It is not the policy of Armagh Observatory and Planetarium to acquire heritage assets but has collected such assets through donations and operations. These assets were not previously recorded on the Balance Sheet. In 2017 these assets were included on the Balance Sheet at the 2010 insurance valuation of £1,191,960.

Summary Analysis of heritage asset transactions

	2018	2017	2016	2015	2014
	£	£	£	£	£
Purchases					
Books	-	-	-	-	-
Furniture & Artworks	-	-	-	-	-
Clocks & Scientific Equipment	-	-	-	-	-
Donations	-	-	-	-	-
Books	-	-	-	-	-
Furniture & Artworks	-	-	-	-	-
Clocks & Scientific Equipment	-	-	-	-	-
Total Additions	-	-	-	-	-
Impairment					
Books	-	-	-	-	-
Furniture & Artworks	-	-	-	-	-
Clocks & Scientific Equipment	-	-	-	-	-
Total	-	-	-	-	-
Disposals					
Books	-	-	-	-	-
Furniture & Artworks	-	-	-	-	-
Clocks & Scientific Equipment	-	-	-	-	-
Total	-	-	-	-	-
Proceeds from disposals					
Books	-	-	-	-	-
Furniture & Artworks	-	-	-	-	-
Clocks & Scientific Equipment	-	-	-	-	-
Total	-	-	-	-	-

Notes to the financial statements for the year ended 31 March 2018 (continued)

12 Inventories

	2018	2017
	£	£
Goods for resale	11,503	7,946

13 Debtors

	2018	2017
	£	£
Trade and grant debtors	2,853	14,813
Prepayments	96,977	77,311
VAT recoverable	29,018	11,504
	128,848	103,628

14 Creditors: amounts falling due within one year

	2018	2017
	£	£
Trade creditors	180,528	87,691
Accruals	398,160	319,781
Social security costs	19,120	-
	597,808	407,472

15 Statement of Funds

	At 1 April 2017	Income	Expenditure	Revaluation	Transfers	At 31 March 2018
	£	£	£	£	£	£
Restricted Funds						
Government grant for fixed assets	-	196,000	-	-	(196,000)	-
Deferred grants	171,907	285,590	(225,326)	-	(3,152)	229,019
Total restricted funds	**171,907**	**481,590**	**(225,326)**	**-**	**(199,152)**	**229,019**
Unrestricted Funds						
Designated Funds						
Donated assets reserve	1,748,876	-	-	-	(36,285)	1,712,591
Government & revenue grant for assets	1,038,899	-	-	-	(105,950)	932,949
General fund	34,719	1,969,424	(2,342,437)	-	341,387	3,093
	2,822,494	**1,969,424**	**(2,342,437)**	**-**	**199,152**	**2,648,633**
Undesignated Funds						
Revaluation reserve	6,263,585	-	-	416,699	-	6,680,284
Pension reserve	(1,566,000)	-	(95,000)	213,000	-	(1,448,000)
	4,697,585	**-**	**(95,000)**	**629,699**	**-**	**5,232,284**
Total Unrestricted Funds	**7,520,079**	**1,969,424**	**(2,437,437)**	**629,699**	**199,152**	**7,880,917**
Total Funds	**7,691,986**	**2,451,014**	**(2,662,763)**	**629,699**	**-**	**8,109,936**

Details of Transfers between funds	£	£
Transfer of unrestricted capital grants received to unrestricted fund		196,000
Release of deferred capital grant	314,699	
Capital grants to government grant	(196,000)	
Revenue financing of capital	(12,749)	105,950
Transfer of donated asset reserve to match depreciation		36,285
Release of deferred capital grant		3,152
General fund		**341,387**

Notes to the financial statements for the year ended 31 March 2018 (continued)

16 Analysis of net assets between funds

	Pension Reserve	Revaluation Reserve	Unrestricted Funds	Restricted Funds	Total Funds
	£	£	£	£	£
Tangible fixed assets	-	6,680,284	2,661,258	-	9,341,542
Current assets	-	-	585,183	229,019	814,202
Creditors: amounts falling due within one year	-	-	(597,808)	-	(597,808)
Pension scheme liability	(1,448,000)	-	-	-	(1,448,000)
Net assets/(liabilities)	(1,448,000)	6,680,284	2,648,633	229,019	8,109,936

17 Reconciliation of net income/(expenditure) to net cash flow from operating activities

	2018	2017
	£	£
Net (expenditure) per statement of financial activities	(211,749)	(73,585)
Loss/(profit) on sale of assets	(1,159)	(61)
Depreciation	350,984	288,447
Interest received	(137)	(33)
Defined benefit pension scheme service cost less contributions payable	95,000	(12,026)
(Increase)/decrease in stock	(3,557)	2,240
(Increase)/decrease in debtors	(25,220)	117,831
Increase in creditors	190,336	4,364
Net cash inflow from operating activities	394,499	327,177

18 Analysis of cash and cash equivalents

	31 March 2018	1 April 2017
	£	£
Cash at bank and in hand	673,851	486,805
Total cash and cash equivalents	673,851	486,805

19 Pension scheme

The disclosures below relate to the funded liabilities within the Local Government Pension Scheme for Northern Ireland (the "LGPS"), administered by NILGOSC, and certain related unfunded liabilities which have been separately disclosed.

The LGPS is a funded defined benefit plan with benefits earned up to 31 March 2015 being linked to final salary. Benefits after 31 March 2015 are based on a Career Average Revalued Earnings Scheme. The unfunded pension arrangements relate to termination benefits made on a discretionary basis upon early retirement in respect of members of the LGPS under the Local Government (Early Termination of Employment) Regulations (Northern Ireland) 2007.

The last actuarial valuation of the LGPS funded benefits was carried out at 31 March 2016 and the contributions to be paid until 31 March 2020 are set out in the Fund's Rates and Adjustment Certificate. The funding level (ratio of assets to past service liabilities) at 31 March 2016 was 96% compared to 91% at 31 March 2013 corresponding to a funding deficit of £262.6 million (£467m at 31 March 2013).

The NILGOSC actuary, Aon Hewitt Ltd, has provided the following details for the purposes of accounting for the Observatory and Planetarium's joint share of the scheme deficit in accordance with FRS 102 at 31 March 2018.

Notes to the financial statements for the year ended 31 March 2018 (continued)

19 Pension scheme (continued)

Key assumptions used by the actuary were:

	31/3/2018 %	31/3/2017 %	31/3/2016 %
Discount rate	2.6	2.5	3.4
RPI inflation	3.2	3.1	2.9
CPI inflation	2.1	2.0	1.8
Pension increases	2.1	2.0	1.8
Pension accounts revaluation rate	2.1	2.0	1.8
Rate of increase in salaries	3.6	3.5	3.3

Mortality assumptions

	2018 Years	2017 Years
Males		
Member aged 65 at accounting date	23.3	23.2
Member aged 45 at accounting date	25.5	25.4
Females		
Member aged 65 at accounting date	25.9	25.8
Member aged 45 at accounting date	28.2	28.1

Asset Allocation

	Value at 31/3/2018 %	Value at 31/3/2017 %
Equities	71.4	74.5
Property	10.0	10.5
Government bonds	5.2	5.4
Corporate bonds	7.2	6.1
Cash	4.5	2.6
Other	1.7	0.9
Total	100.0	100.0

Reconciliation to balance sheet

	2018 £'000	2017 £'000
Fair value of assets	9,831	9,340
Present value of funded defined benefit obligation	11,276	10,903
Funded status	(1,445)	(1,563)
Present value of unfunded defined benefit obligation	(3)	(3)
Liability recognised on the balance sheet	(1,448)	(1,566)

Amounts recognised in income statement

	Year to 31/3/2018 £'000	Year to 31/3/2017 £'000
Operating cost		
Current service costs	205	172
Past service cost	31	-
Financing cost		
Interest on net defined benefit liability	36	31
Pension expense recognised in profit and loss	272	203
Allowance for administrative expenses included in Current Service Cost	3	3

Notes to the financial statements for the year ended 31 March 2018 (continued)

19 Pension scheme (continued)

Assets recognised in other comprehensive income

	Year to 31/3/2018 £'000	Year to 31/3/2017 £'000
Asset gains/(losses) arising during the period	255	1,130
Liability gains/(losses) arising during the period	(42)	(1,654)
Total	213	(524)

Changes to the present value of defined benefit obligation

	Year to 31/3/2018 £'000	Year to 31/3/2017 £'000
Opening defined benefit obligation	10,903	8,946
Current service cost	205	172
Interest expense on defined benefit obligation	270	301
Contributions by participants	56	60
Actuarial (gains)/ losses on liabilities	42	1,653
Net benefits paid out	(231)	(229)
Past service costs	31	-
Closing defined benefit obligation	11,276	10,903

Changes to the fair value of assets

	Year to 31/3/2018 £'000	Year to 31/3/2017 £'000
Opening fair value of assets	9,340	7,949
Interest income on assets	234	270
Remeasurement gains/(losses) on assets	255	1,130
Contributions by the employer	177	160
Contributions by participants	56	60
Net benefits paid out	(231)	(229)
Closing fair value of assets	9,831	9,340

Liability of Members

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

Active members	46%
Deferred pensioners	18%
Pensioners	36%

Sensitivity Analysis
Funded LGPS benefits

Discount rate assumptions

Adjustment to discount rate	**+0.1%pa**	**Base Figure**	**-0.1%pa**
Present value of total obligation (£m)	11.083	11.276	11.473
% change in present value of total obligation	-1.7%		1.7%
Projected service cost (£m)	0.207	0.212	0.218
Approximate % change in projected service cost	-2.5%		2.6%

Rate of general increase in salaries

Adjustment to salary increase rate	**+0.1%pa**	**Base Figure**	**-0.1%pa**
Present value of total obligation (£m)	11.317	11.276	11.235
% change in present value of total obligation	0.4%		-0.4%
Projected service cost (£m)	0.212	0.212	0.212
Approximate % change in projected service cost	0.0%		0.0%

Notes to the financial statements for the year ended 31 March 2018 (continued)

19 Pension scheme (continued)

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

Adjustment to pension increase rate	**+0.1%pa**	**Base Figure**	**-0.1%pa**
Present value of total obligation (£m)	11.431	11.276	11.123
% change in present value of total obligation	1.4%		-1.4%
Projected service cost (£m)	0.218	0.212	0.207
Approximate % change in projected service cost	2.6%		-2.5%

Post retirement mortality assumption

Adjustment to mortality age rating assumption	**+0.1%pa**	**Base Figure**	**-0.1%pa**
Present value of total obligation (£m)	11.61	11.276	10.944
% change in present value of total obligation	3.0%		-2.9%
Projected service cost (£m)	0.22	0.212	0.204
Approximate % change in projected service cost	3.8%		-3.8%

20 Capital commitments

There were no outstanding capital commitments at 31 March 2018 (2017: £nil).

21 Contingent liabilities

There were no contingent liabilities at the 31st March 2018 (2017: £nil).

22 Related-party transactions

None of the members of the Board of Governors, the Management Committee, the Director or other related parties have undertaken any material transactions with the Armagh Observatory and Planetarium during the year. The Armagh Observatory and Planetarium has had various material transactions with a number of Government Departments, Executive Agencies and Non-Departmental Public Bodies in Northern Ireland and the UK. Most of these transactions have been with DfC, Construction and Procurement Delivery (CPD), the Science and Technology Facilities Council (STFC) and the Education Authority (EA). DfC provides recurrent and capital grant-in-aid (note 2), the STFC provides grants for research projects (note 2) and CPD and EA are the Centres of Procurement Expertise for the organisation.

No related party transactions took place in the year, other than certain trustees' expenses already disclosed in note 9.

23 Losses and special payments

There were no losses or special payments during the year.

24 Financial instruments

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

Notes to the financial statements for the year ended 31 March 2018 (continued)

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

Statement of Financial Activities prepared under FReM

	Note	2018 £	2017 £
Incoming resources			
Incoming resources from research and other non-DfC grants	2	285,590	326,048
Operating income	2	150,102	146,851
Trading income	4	88,322	89,474
Total incoming resources		524,014	562,373
Resources expended			
Direct expenditure of the organisation		2,662,763	2,495,199
Total Resources expended		2,662,763	2,495,199
Net deficit for the year		(2,138,749)	(1,932,826)
Gain on revaluation of Fixed Assets		366,699	810,105
Gains on the revaluation of Heritage Assets		50,000	1,191,960
Actuarial gain/(loss) - pension scheme		213,000	(667,026)
Amount transferred to funds		(1,509,050)	(597,787)

Analysis of funds prepared under the FReM

		2018 £	2017 £
Balance at 1 April 2017		7,691,986	6,430,532
Grant-in-aid received in the year	2	1,927,000	1,859,241
Net operating costs for the year		(1,509,050)	(597,787)
Balance at 31 March 2018		8,109,936	7,691,986

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 10th December 2018.