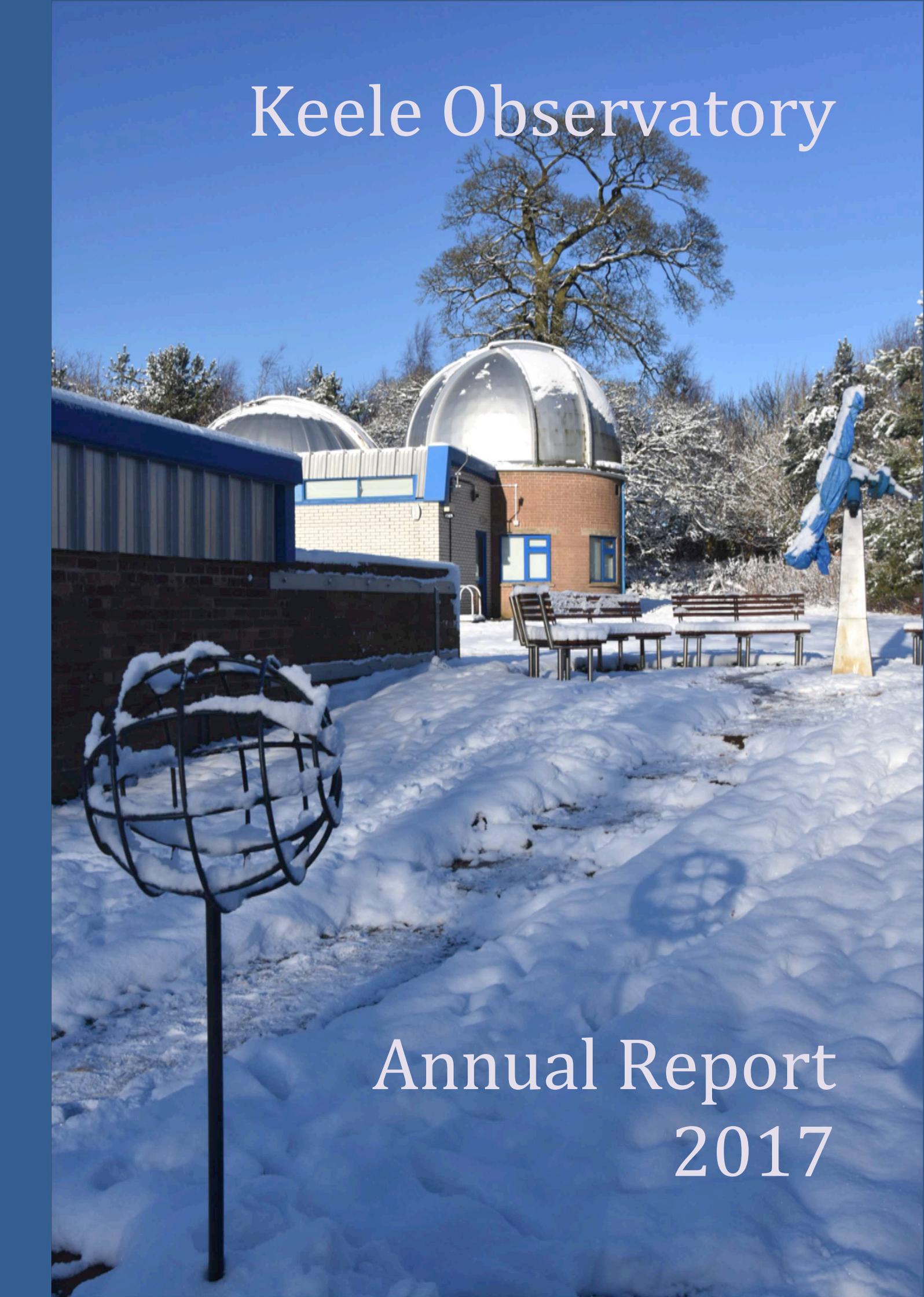


Keele Observatory



Annual Report
2017

Table of Contents

From the Director	2
Administrative report	2
Personnel	2
Finances	2
Infrastructure and equipment.....	3
Engineering work on the Thornton	4
Maintenance of the Grubb and its dome.....	6
Binoculars' enclosure.....	6
Research activities	7
Solar System observations	7
Publications.....	7
Outreach activities.....	7
BBC2's "Stargazing Live"	7
Media activities.....	8
Public viewings.....	8
Schools and teachers.....	8
Community group visits	8
Adult Education sessions	8



Observatory Hill as seen by a drone during 'International SUNDAY' on 18th of June 2017. Credit: Duncan Richardson.

From the Director

In some ways this year was pretty much a year as any other. The Observatory played host to thousands of visitors, young and old, thanks to the dedication, enthusiasm and skills of its team of engineers, outreach ambassadors and students. We enjoyed plenty of (positive!) media visibility.

Then again, every year is different. From an unexpected telescope donation or power surge, to rallying behind Stoke-on-Trent's bid to become 'City of Culture', there was always something to attend to.



Figure 1 We actively supported the bid by Stoke-on-Trent for the status of 'City of Culture' in 2021.

While the 24" upgrade project did not come to a final conclusion as yet, a greater understanding of the system was gained and further preparations for the new camera were conducted, and we are all justifiably optimistic about next year.

I would like to thank everyone for contributing their time and energy, and for their trust and patience in this endeavour. "Onwards and upwards!"

Jacco van Loon

Administrative report

Personnel

Keele Observatory is operated and maintained through a unique partnership between the Astrophysics Centre in the School of Chemical and Physical Sciences at Keele University, and a core group of skilled and dedicated volunteers: the Observatory Support Team ("The Crew"). Former director, and founder of the observatory, Dr. Ron Maddison, and Lian Bryant are lifetime honorary members of the team, in recognition for their great contributions to the observatory.

In 2017 the Crew was composed of Alan Bagnall, Dave Caisley, Ian Johnson, Paul Klimczak, St. John Robinson, Andrew Shepherd, Matthew Stretch and John Webb, along with a number of affiliate members. Dr. James Albinson and Stephen Doody assumed a less prominent role this year, but they remain highly valued associates. Electrical engineers Ian Knight and Kassim Al-Muflehi had expressed an interest in joining our team, as did Chris Briggs who will oversee our social media presence.

Undergraduate students Lucy Auger (whose assistance has been invaluable) and Kris Turner (who has been working on a technical project) along with PhD student Teo Močnik were joined by undergraduate students Abdulkarim Moallim and Rachel Wallace. Duke of Edinburgh Awardee Rohini Krishnadas also joined our team.

Finances

The Keele Observatory building is part of the School of Chemical and Physical Sciences. We successfully applied to be allowed to purchase some new furniture (bookcases, desks) for the 24" control room and the 'library'. The School also provided a replacement hydrogen bulb. As the Observatory does not have a budget of its own, in order to operate more autonomously and efficiently it needs to generate its own funds.

Income was generated by visits of community groups, schools – organized by us or via colleagues at the Hub or widening

participation department (funded by the Science Learning Centre or, more often, the Higher Horizons scheme) and from Adult Education sessions. Donations remain disappointingly low and few and far between, and mostly arise from sales of Keele Observatory's History booklet and appreciation of telescope surgeries.

Both the total income and the total expenditure in 2017 were very similar to previous year's figures, though more was spent on the 24" telescope this year.

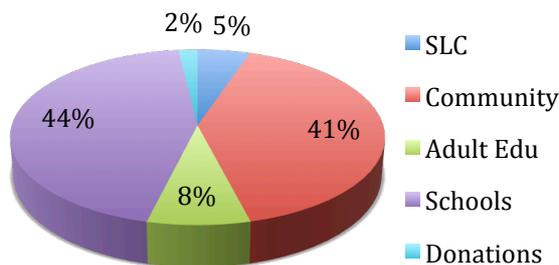


Table 1 Financial account for 2017.

1. Balance brought forward	£6419
Income	
Science Learning Centre	£90
School activities	£771
Community group visits	£711
Adult Education	£136
Donations	£33
2. Total income	£1741
Expenditure	
General maintenance	£153
Development of the 24"	£554
Printing Annual Report 2016	£75
3. Total expenditure	£782
4. Unspent, ringfenced	£979
Surplus (items 1+2-3; exclude 4)	£7378

Based on the most recent accounts and budget for 2017, we set a budget for 2018, slightly increased both in terms of income and expenditure. We foresee some further expenses related to commissioning an upgraded 24", and allow for some additional purchases and contingency.

Table 2 Budget for 2018.

1. Balance brought forward	£7378
Income	
Hospitality	£1300
Donations	£100
2. Total income	£1400
Expenditure	
General maintenance	£400
24" upgrade project	£600
Acquisition of equipment	£200
Printing Annual Report 2017	£80
3. Total expenditure	£1280
4. Ringfenced for solar telescope	£979
Surplus (items 1 + 2 - 3; exclude 4)	£7498

Infrastructure and equipment

With contributions by StJohn Robinson



Figure 2 The 'Lucascope' 10" Newtonian reflector; student volunteer Sam Yarwood in the background.

Besides the aforementioned new furniture for the 24" control room (a bookcase, a

desk and a storage cabinet) and 'library' (two book cases and a magazine display cabinet) that replaced and augmented some of the aging furniture, along with new office chairs for the control room and lecture room, we acquired a 10" Newtonian reflector (make: Orion Optics) generously donated by Peter Lucas – the 'Lucascope' – which we adapted to be able to mount on the C-GEM mount that normally carries the 6" Lunt solar telescope (see figure 2).

With regard to the exterior, it was a relief to see Neptune restored to its former glory. Running along it, 'Observatory Walk', across Observatory Hill, had meanwhile been fitted with light bollards to guide pedestrians on their commute to and from the new car park on the other side of the Sustainability Hub. While advice had been sought from us, and we have been granted the ability to dim the lights, they do leak more light than we had been promised initially. Unfortunately we cannot win the battle against the expansion of the campus – the extensive car park at the bottom of 'Observatory Walk' has made way for the construction of a new hall of residence. While the project stalled, it is unlikely that additional light pollution can be avoided.

Other campus events which affected operation included a concert organized at the Student Union, participants of which had parked their cars blocking access to and from 'Observatory Walk' while we had our own cars parked on Observatory Hill and had been entertaining guests. Security could not get hold of the car owners and while a complaint was filed with the Students' Union no response was received. We have since reported it to the School's Safety Committee. Another event concerned a power spike near the end of a particularly busy visit, causing power loss. The 12" dome had to be closed manually, for which Stephen Doody kindly came in early (the weather was fair that night).

Stephen Doody and James Albinson stood down from active duty this year, and their expertise, dedication and friendship will be sorely missed.

Engineering work on the Thornton

The decision was taken to fabricate a new focus platform to support the QSI CCD camera, FLI CL-1-10 filter wheel and Wynne Corrector. Whilst similar in design and construction to the one currently in service, it has a number of significant differences. The QSI offers a larger field of view, which should facilitate testing the AWR Intelligent Drive System.

To facilitate any future exchange of instruments, the focus platform design criteria called for a flat surface to mount the instrument on and a quick but secure method of mounting and removal. This implies that the threaded rods that support the moving part of the focus platform would need to travel inwards towards the light path of the telescope, but not impinge into it. Once the limits of focus travel for our instruments have been determined the rods will be trimmed to size.

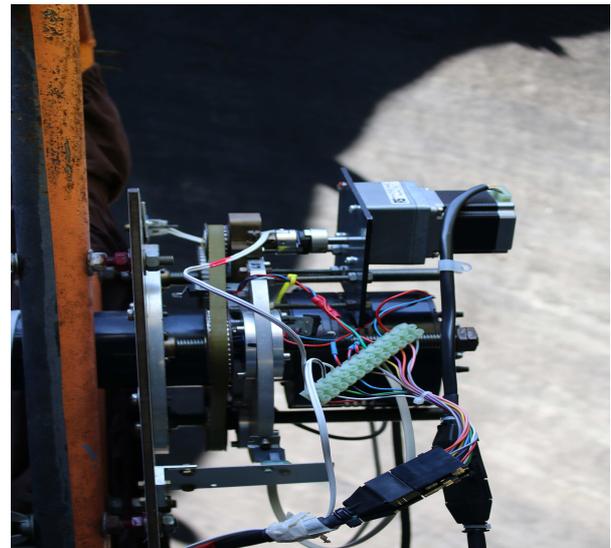


Figure 3 Current ST7 imaging train on the 24".

The above image (figure 3) of the currently in service focus platform shows how the threaded rods project outwards through the moving plate of the focus platform beyond the current SBIG ST7 XME CCD camera; it therefore restricts the instruments that can be mounted in between the threaded rods, and it is also a cumbersome task to dismount the imaging train, due to the method used to couple the components together.

Stephen Doody commenced with the marking up and initial machining of individual parts using a Myford Super 7 lathe currently located in our workshop; we gratefully acknowledge the use of this machine provided by Dr. James Albinson.



Figure 4 One of six bearing housing plates on the Myford lathe, being 'clocked' prior to machining to accept a self aligning bearing.

Further machining was done by Matthew Stretch using a Bridgeport milling machine; we gratefully acknowledge the use of the workshop facilities at Super Marine in Hanley Staffordshire. Additional fabrication and machining of small parts and initial assembly was carried out in StJohn Robinson's workshop (figure 5).



Figure 5 StJohn Robinson's Dore Westbury milling machine, being used to slot the base plate.

Figure 6 shows a nearly finished product. Whilst the filter wheel orientation remains fixed with respect to the focus platform, the QSI CCD camera when attached can be rotated to zero the CCD camera roll angle.



Figure 6 FLI CL-1-10 filter wheel, showing the brass QSI adapter coupling, mounted and secured by use of quick release turn buckles to the new focus platform. The stepper motor and gear head used to drive the three toothed timing pulley wheels are mounted on the fixed focus platform base plate.

A 2" focuser can be fitted in place of the CCD imaging train. It can be used to carry an eyepiece, digital SLR camera or a small spectroscope, and used as an aid in initial collimation of the optical system or for general viewing of the night sky. We also have the provision to fit a 4x5 plate holder for wet photography (see figure 7). By unscrewing the body of the film holder the focuser can be screwed into place.



Figure 7 Photographic plate holder attached to the new focus platform, with to its right the focuser which can be used in its stead.

We purchased CCDinspector software to help collimate the instrument in real-time.

In early November AWR returned with code updates for the Intelligent Drive System. During the visit a number of pre-existing software problems were resolved; an unexpected issue with the tangent arm driving mechanism prevented full travel to test the soft and hard micro switch stops that protect the tangent arm driving rod from damage; this is being rectified. A major problem occurred when a resistor and a damaged chip within the AWR Drive Box failed. The resistor was replaced on site, but the damaged chip required the Drive Box to be returned to AWR for repair, halting further testing of the code updates.

Maintenance of the Grubb and its dome

The 12" Grubb dome drive, after the earlier reported power failure in February then suffered a mechanical failure in March when the power coupling rubber spider expired (figure 8). It had twisted one of the two V Drive belts a full 180° – it was thus engaging the large driven wheel upside down whilst engaging the driver wheel the right way up, giving itself away by making unusual noises. The spider was replaced.

The graphics card in the computer in the 12" pillar died and was upgraded.



Figure 8 The power coupling to drive the 12" dome relies on a rubber spider – it failed but was replaced.

Binoculars' enclosure

The power was restored to the roll-off shed after a fatal cable failure. This meant that it could be used again for viewing with the binoculars and for work by students with the 10" Meade and spectrograph in 2018.



Figure 9 The 6" binoculars and 10" Meade in the foreground, and 8" refractor in the background.



Figure 10 The 24" seen from the roof near the 12" dome, with student Sam Yarwood. Credit: Jonny Williams.

Research activities

While this year was quiet on the research and recorded observational front, as earlier reported engineering preparations have continued so stay tuned for what's to come!

Solar System observations

The Moon and Sun were imaged by Kassim Al-Muflehi (figure 11) and Teo Močnik (figure 12), respectively. There appears to be some reluctance to use the Lunt 6" solar telescope, both for viewing and imaging. This may call for more training in the use of the telescope and in imaging with it.



Figure 11 The Moon imaged by Kassim al-Muflehi through the 12" Grubb, on the 3rd of December 2017.



Figure 12 The Sun imaged by Teo Močnik through the 8" Meade with a neutral density solar filter on the 2nd of September 2017.

Publications

In 2017 we published 30 copies of the seventh annual report:

"Keele Observatory Annual Report 2016", J.Th. van Loon (ed.). KOP 8

The front cover of the 2015 Annual Report was chosen as the front cover of the first edition (April 2017) of 'The Know', a new quarterly magazine for Keele people.

Norman Butler contacted us and said he would feature Keele's binoculars in his book 'The History of Binoscopes', to be published in early 2018 by Springer.

We took part in a survey by the Science Education Department of the Museum of Astronomy and Related Sciences in Rio de Janeiro, facilitated by the International Astronomical Union. It aims to identify institutions around the world that use historically valuable telescopes in public sky observation activities.

Outreach activities

We welcomed over 3100 visitors. This is slightly down from recent years, in part because 'Stargazing Live' did not attract the same levels of attention as previously. We also gave 'Earth Hour' a miss again, due to unavailability of staff – especially with 'Stargazing Live' following immediately.

BBC2's "Stargazing Live"

Keele Observatory took part in the seventh edition of BBC2's "Stargazing Live. BBC had made some odd choices – scheduling it in Summer time when skies are still bright at times when young children might make it, and putting Saturn into the limelight when it could not be viewed in the evening. Also, the Observatory Director was abroad and the connection between BBC Radio Stoke and the little town in the hills outside of Rome was appalling. But Ian tweeted in abundance, the North Staffordshire Astronomical Society were out in force, The Sentinel covered it, and in spite of the poor weather 300 visitors were entertained.

Media activities

Apart from the usual coverage of 'Stargazing Live', Keele Observatory appeared in a number of media and promotional broadcasts. It featured in the 'Sunday Politics Show' on BBC Midlands (figure 13), and was advertised during the 'Ask the Expert' chat show with the Observatory Director on BBC Radio Stoke. We also featured in two promotional videos for Keele University, another one of a virtual tour of the Observatory – view at <http://youtube.be/LsuQehqiQcg> – and a farewell to the Cassini mission.



Figure 13 BBC Midlands' Gary filming Emma Thomas for the 'Sunday Politics Show'.

We also supported Stoke City's bid for City of Culture, with video clips and lending them binoculars and giving away booklets when the committee visited.

Public viewings

Near to 800 people visited the Observatory this year on its free Tuesday evenings and Saturday afternoons' public viewings.

Schools and teachers

We hosted no fewer than 18 visits by schools. In this way, and including a teachers training event, we reached 760 learners and over 60 teachers.

The Lunt solar telescope was taken to Stoke-on-Trent 6th Form College for the Science Festival with about 80 learners.

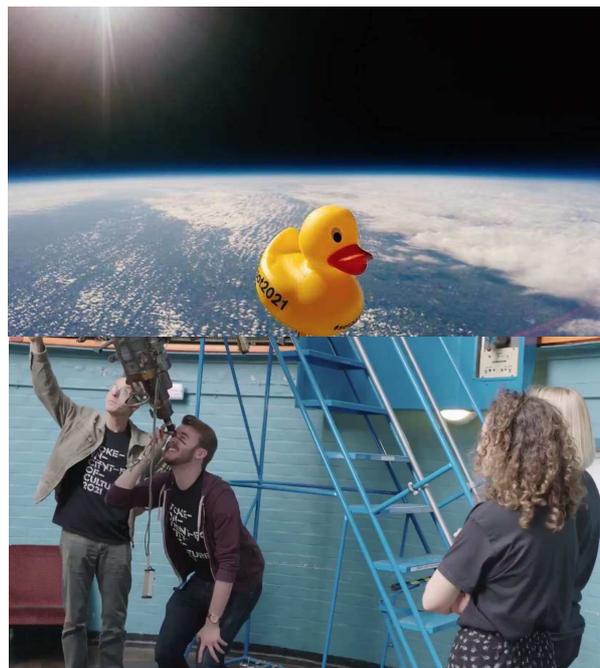


Figure 14 Stoke-on-Trent's stratospheric duck at an altitude of 20 miles (top) and Down-to-Earth Student Unionists looking up (bottom).

Open Days for prospective students, and visits by international students and by Keele Astrophysics students, amounted to another 300 visitors of the observatory.

Community group visits

Family Fun Day saw 60 people visiting, a Sun-blissed International SUNDAY (in collaboration with the North Staffordshire Astronomical Society) another 65, and a further 70 people enjoyed views of the Moon after a brass-band performance of Holst's 'Planets' in Lindsay Studios.

We hosted 27 specially arranged visits by societies and (mainly) scouting groups, of 170 adults and 400 children.

Adult Education sessions

The observatory continued to play host to the 'Keele Astrophysics Discussion Group', led by Paul Klimczak. The group met eight times – once a month except for a Summer break; a December session got cancelled due to heavy snow. Attendance numbers this year fluctuated between 7–10.

The aim of the group is to increase the volume and diversity of attendance, but to continue by way of member-suggested topics to discuss. It maintains a Facebook page: KeeleAstrophysicsDiscussionGroup

