

Keele Observatory



Annual Report
2018

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The full Moon rising above a snow-dusted Keele Observatory on the 28th of February of 2018. Credit: Jacco van Loon.

From the Director

On the one hand we didn't have Stargazing Live anymore, and sessions got cancelled for a variety of reasons including Industrial Action. The 24" project progressed slowly. On the other hand, the first batch of Single Honours Astrophysics students did their laboratory work at the Observatory, and the support team is in transition. We are gearing up to a future in which we shall take a more responsible role in society. I thank everyone who has helped make the Observatory a success, and in particular congratulate Dr. James Albinson and StJohn Robinson on a sterling job to clean the 12" lens. I welcome anyone who wishes to join us with the same positive spirit.

Jacco van Loon

Administrative report

Personnel

Keele Observatory is operated and maintained through a unique partnership between 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 of their great contributions to the observatory.

In 2018 the Crew was composed of Alan Bagnall, Dave Caisley, Ian Johnson, Paul Klimczak, StJohn Robinson, Andrew Shepherd, Matthew Stretch and John Webb, along with a number of affiliate members. Dr. James Albinson and Stephen Doody have "retired", and StJohn Robinson joined them in that capacity at the end of the year (well, sort of). Behind the scenes, Chris Briggs oversees our presence on Facebook.

Undergraduate student Lucy Auger continued to be of great assistance at many of the public and arranged visits, but she is

spending this academic year abroad. While Kris Turner graduated, he is finishing the dome rotation project he had started. Sam Yarwood and Rachel Wallace also helped out. Postgraduate student Clara Pennock joined our team later in the year, as did Computer Sciences student Camilla Jones.



Figure 1 Lucy Auger photographing her favourite (celestial) object. Credit: Jacco van Loon.

Equality, Diversity and Inclusion

This report sees the introduction of a new standing item on Equality, Diversity and Inclusion. This is to ensure that we reflect on the equal opportunities that we aim to provide to people to support and use the observatory, and that we value the rich diversity of people and their contributions.

Our visitors represent a wide range in gender, ethnic and social background and life choices, and we aim our team to reflect that. We tweeted in support of the LGBT+ in STEM Day on the 4th of July. We also had a student borrow materials for an event about women in history and we took part in a cultural day about Islam (see the "Outreach Activities").

Sustainability

This report also introduces a new standing item on sustainability. This aims to ensure that we strive to minimize the impact the operation of the Observatory has on the environment. It will also flag issues that impact upon the Observatory, such as light pollution, and comment on the ecology of Observatory Hill (see Figures 2 and 3).



Figure 2 A newt visiting on the evening of 24th April.
Credit: Jacco van Loon.



Figure 3 Drops held up by moss on the wall of the Observatory's entrance porch, 27th of March of 2018.
Credit: Jacco van Loon.

We participated again in WWF's 'Earth Hour', which saw 55 people either visit the Observatory or our telescope at Union Square (Figure 4) under dark but overcast skies, to raise awareness of light pollution and energy waste. We were also consulted by Estates on the light pollution from the developments behind Home Farm, and the opportunity was taken to raise the issue of heat emanating from the rooftops – energy waste but also degrading conditions for astronomical observation (turbulence).

And we obtained a recycling bin.



Figure 4 Two spectators at 'Earth Hour', looking through the 10" Newtonian at pitch-black skies.
Credit: Jacco van Loon.

Finances

While the Keele Observatory building is part of the School of Chemical and Physical Sciences, the Observatory does not have a budget of its own and in order to operate more autonomously and efficiently it needs to generate its own funds. The total income and total expenditure in 2018 were a little below previous year's figures, but again they resulted in an overall positive balance.

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 Higher Horizons scheme) and from Adult Education sessions (renamed "Astronomy Club"). Donations were quite a bit higher this year, and donations in kind continue to be received: a book, meteorites including a

piece of the Allende, and a 70mm refractor, all by former Observatory Director Prof. Emeritus Nye Evans; an 8" Newtonian on a pillar mount with accessories including a CCD camera – all in excellent condition – by Bronwen Montgomery; a 12" Dobsonian by Mike Walton – also in a superb condition. (Former students Josh Clorley collected his 10" Dobsonian and Ameerah Al-Sadooni took her 5" Newtonian home to Baghdad.)

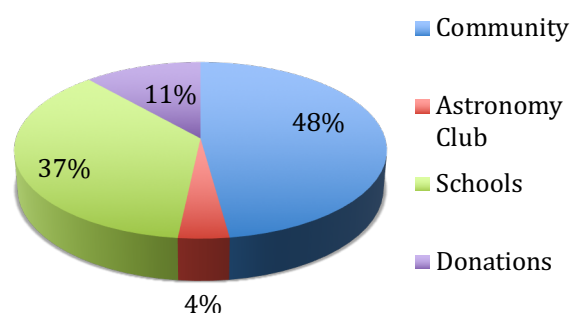


Table 1 Financial account for 2018.

1. Balance brought forward	£7378
Income	
School activities	£528
Community group visits	£688
Astronomy Club	£56
Donations	£167
2. Total income	£1438
Expenditure	
General maintenance	£147
Development of the 24"	£507
Printing Annual Report 2017	£55
3. Total expenditure	£709
4. Unspent, ringfenced	£979
Surplus (items 1+2-3; exclude 4)	£8108

Based on the most recent accounts and budget for 2018, we set a budget for 2019, aiming for (only) a slight surplus. Spending associated with the 24" upgrade project should diminish, as the system is in its final commissioning phase. The biggest unknown is how much we may need to spend to accommodate new equipment.

Table 2 Budget for 2019.

1. Balance brought forward	£8108
Income	
Hospitality	£1000
Donations	£100
2. Total income	£1100
Expenditure	
General maintenance	£300
24" upgrade project	£400
Acquisition of equipment	£300
Printing Annual Report 2018	£60
3. Total expenditure	£1060
4. Ringfenced for solar telescope	£979
Surplus (items 1 + 2 - 3; exclude 4)	£8148

Infrastructure and equipment

With contributions by StJohn Robinson

A Myford ML7 lathe was obtained from the Physics department and restored for use. The 10" Meade was removed from the binoculars' enclosure because the tracking had ceased working (subsequently fixed).

Engineering work on the Thornton

During Spring and early Summer the new focus platform (described in the 2017 Annual Report) was installed on the 24" reflector (Figure 5). It carries the new QSI 583wsg CCD, FLI CL1-10 filter wheel and the existing Wynne corrector.



Figure 5 QSI camera and filterwheel on the focus platform at the 24" reflector. Credit: StJohn Robinson.

The imaging train is secured by quick release fixings and can be installed and removed from the focus platform very easily. A stepper motor drives the belt, allowing variable speed focusing to be controlled from the AWR drive box. The filters have yet to be inserted, as initial commissioning is still ongoing; filter selection and imaging sequencing is controlled by the Sky X Professional software camera add-on application.

Whilst initial collimation of the new focus platform has been carried out it now requires an on-sky observing run to obtain focused star images to characterize the optical alignment and apply any corrective adjustments if required.

Due to reliability issues with the self-powered USB cables, our software specialists suggested that a Lindy four-port USB-over-Ethernet hub be obtained, which has since been installed on top of the 24" truss box (Figure 6). Providing connectivity for the QSI camera and filter wheel, it has spare capacity for additional USB devices. New power supplies and cabling have also been installed.



Figure 6 USB-over-Ethernet hub replacing unreliable self-powered USB cables. Credit: StJohn Robinson.

Final testing and commissioning of the system is still hampered by software issues with the AWR Intelligent Handset. This pertains to both telescope and focus control and is only slowly being resolved.



Figure 7 Mercury tilt switches installed on the side of the 24" truss (top), seen inside the box (middle), with an indicator unit in the control room (bottom, below the AWR electronics rack). Credit: StJohn Robinson.

A pair of mercury tilt switches was installed by our electronics experts on the side of the 24" truss (Figure 7) to prevent the telescope from violating pointing limits set in the Sky X planetarium. On a number of occasions, and as yet unexplained, the



Figure 8 The 24" found pointing in a very odd angle.
Credit: StJohn Robinson.

AWR drive box lost control over the telescope, leading to runaway motion beyond these limits (Figure 8). If triggered, the tilt switches now cut the power off instantly and alert the operator with a red LED. The operator can manually reposition the telescope, reinstate power, and then resume normal operations.

Keele finalist Kris Turner continued to develop the 'Star Chaser' project, which will interface with the Sky X to slave the motion of the dome to that of the telescope. Currently, dome motion is manual. During testing, one of the original relays that control the operation and direction of dome rotation burnt out. A decision was taken to replace the existing control circuit with a new one using solid state relays, designed, manufactured and installed by our electronics experts (Figure 9).

We finally bade farewell to our comfortable but unwieldy and 'injured' observer's chair (Figure 10), in a continued effort to maintain – or enhance – safe and comfortable working conditions and a more professional and modern look.



Figure 9 24" dome control circuitry before (top) and after (bottom) remedial work was carried out by our in-house electrical experts. Credit: StJohn Robinson.



Figure 10 Retired 24" telescope operator chair.
Credit: Jacco van Loon.

Maintenance of the Grubb and its dome

In mid-December it was noticed that one of the 12" dome drive power rail supports was badly bent and twisted, snapping two of the three plastic rail supports. The bent and twisted bracket was heated up and straightened. However, the now straight vertical length of the bracket fouled the fixed ring gear. Close examination shows that the ring gear track is slightly proud of the vertical face of the rotating dome ring. All of the other brackets have a slight step in them to clear the ring track. Two aluminium plates and two longer bolts have since allowed the reinstallation of the bracket. In the process, one of the two glued plastic power track supports parted company (it was anticipated that this might occur) and the second one is suspected to eventually meet the same fate.

On a more positive note, after much procrastination and abandoned intent the delicate operation to clean the 144-yr old 12" objective lens was carried out. This had been long overdue since the last such treatment more than half a century ago (see KOP2 – "The First Fifty Years of Keele

Observatory", Maddison). With invaluable advice from Dr. Ron Maddison, the A-team comprising Dr. James Albinson and StJohn Robinson performed the critical tasks of cleaning the dome, setting up the materials, supporting the telescope, removing the lens, cleaning the two glass elements with diluted detergent, and reassembling it onto the telescope tube (see Figure 11, overleaf). The result is sublime, but we hope that a repeat will not be due for another 50 years.

Research activities

Steve Doody's guest visitor Gillian Wright demonstrated what can be accomplished even with a simple digital SLR camera, in her picture of the Orion Nebula (Figure 12), and Lucy Auger took one of the best Moon pictures ever with a phone (Figure 13).

Undergraduate laboratory work

Enduring a few frosty evenings, the first six Single Honours Physics with Astrophysics students enjoyed a new laboratory course to introduce them to the operation of our telescopes and instruments. Despite some technical setbacks and lack of experience, a picture and a spectrum of the Moon were obtained at the 12" refractor (Figures 14 and 15, respectively) and a spectrum was taken of Betelgeuse with the 8" SCT (Figure 16), all with the ATIK-314 camera. It was clear that acquisition on the slit of stellar or faint sources would be very challenging and require a significantly larger-aperture telescope with accurate tracking. Imaging would benefit from a larger format CCD.

Publications

In 2018 we published 30 copies of the eighth annual report:

"Keele Observatory Annual Report 2017", J.Th. van Loon (ed.). KOP 9

We presented a poster at the European Week of Astronomy and Space Science in Liverpool (Figure 17), attended by over 2000 astronomers from all over the world.



Figure 11 The cleaning operation of the 12" refractor objective lens.
Credit: StJohn Robinson (except bottom left, by Jacco van Loon).

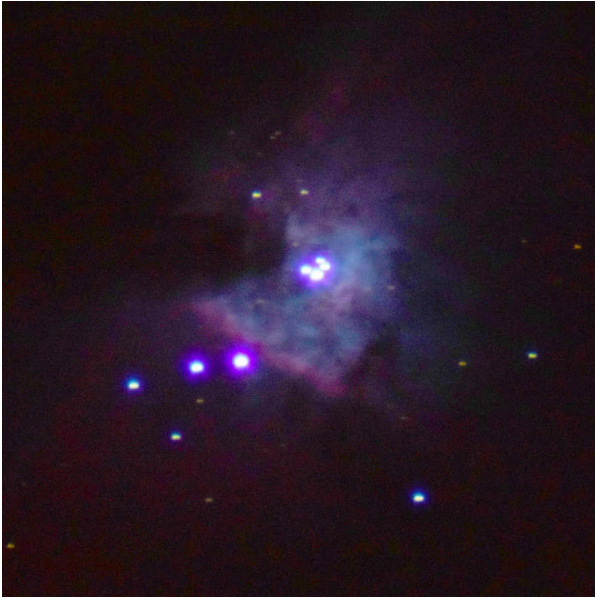


Figure 12 The Orion Nebula photographed with a Nikon DSLR at the 12" refractor on 12 February 2018. Credit: Gillian Wright.



Figure 13 Portion of the Moon photographed with a phone held at the 12" refractor. Credit: Lucy Auger.



Figure 14 Detail of the Moon imaged with the ATIK-314 at the 12" refractor by the laboratory students.

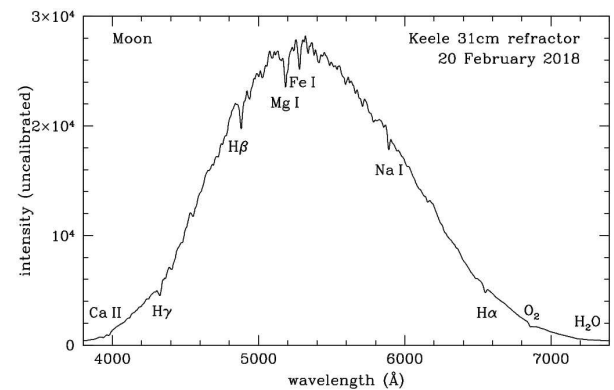


Figure 15 Spectrum of the Moon, obtained at the 12" refractor by the laboratory students.

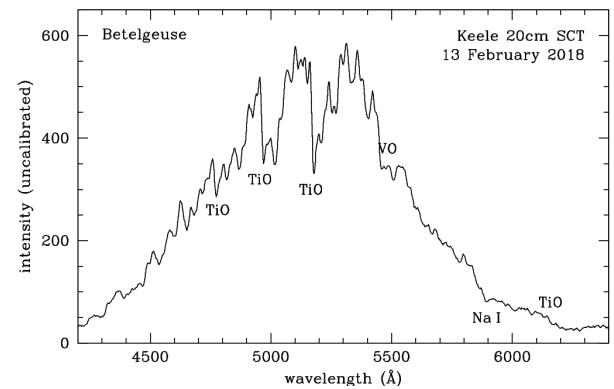


Figure 16 Spectrum of red supergiant Betelgeuse, obtained at the 8" SCT by the laboratory students.

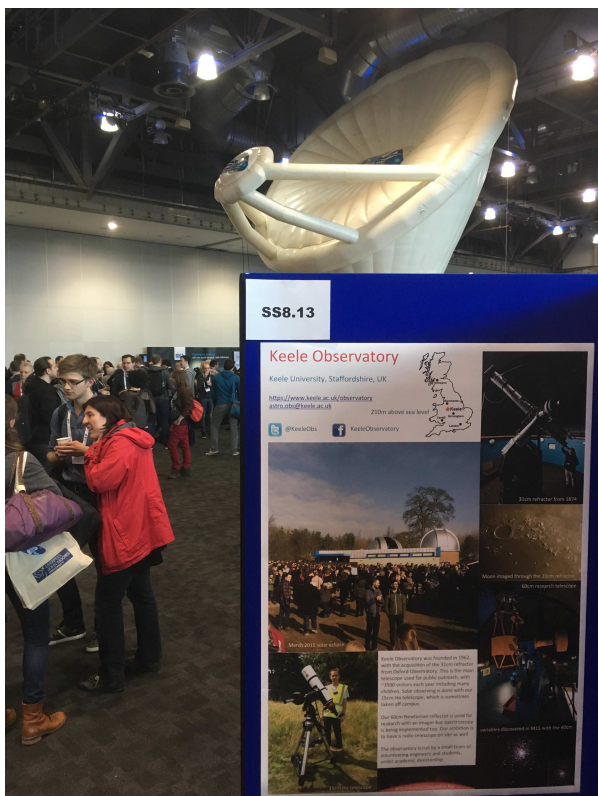


Figure 17 Keele Observatory poster presented at the European Week of Astronomy and Space Science. Credit: Jacco van Loon.

Outreach activities

We welcomed over 3400 visitors. This is no less than typical, despite 'Stargazing Live' having terminated. We did participate in 'Earth Hour' again – which always depends on staff availability and campus support. We also joined forces again with the North Staffordshire Astronomical Society to take part in International SUNDAY – once again blessed with good weather and about 60 participants (see photo collage at the end).

We also ran an event for the Islamic Society, which attracted 35 visitors.

Final year (History/Media) student Rebecca Jones borrowed a small telescope, a few books, a picture and a Moon globe for an event based around the life and works of Caroline Herschel to celebrate the overt and hidden roles women have played in our history.

The Observatory was also promoted in talks given by the Observatory Director to astronomical societies in Manchester, in South Cheshire and in West Didsbury.

Media activities

Keele Observatory appeared on TRT World television and BBC Radio Stoke interviews about the "super blue blood Moon" (see below) and BBC News television about the calendar, broadcast at New Year's End.

We also participated in a number of social media clips, ranging from the Perseid meteors, through the launch of the Aeolus satellite, to the Mars Insight mission.

We're making sporadic use of our Twitter account: follow us on @KeeleObs



Figure 18 BBC Radio Stoke interviewing Observatory Director on 31 January 2018, about the "super blue blood Moon" Credit: Media & Communications team.

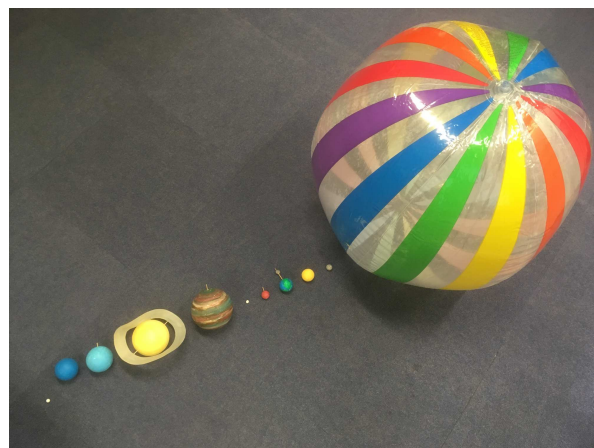


Figure 19 Solar System made from polystyrene and an inflatable ball. Credit: John Webb/Jacco van Loon.

Public viewings

Over 1000 people visited the Observatory this year on its free Tuesday evenings' and Saturday afternoons' public viewings.



Figure 20 Hosting visits by young (top) and youngish (bottom) people. Credit: Gillian Wright/Steve Doody.

Schools and teachers

We hosted 11 visits by schools, reaching 540 learners and over 50 teachers, and the School Physicist Of The Year (SPOTY) awards, with 80 attendees (Figure 21).

Open Days for prospective students, and visits by international students, Keele Physics or Astrophysics students and work experience students, attracted 500 visitors.



Figure 21 School Physicist Of The Year awards visit. Credit: a professional photographer/Scott Walker.

Community group visits

We had 24 visits by societies and scouting groups, about 150 adults and 340 children. Three visits by conference participants or departmental staff from elsewhere on the campus, added up to about 70 in total.

Adult Education sessions

The 'Keele Astrophysics Discussion Group', led by Paul Klimczak, was renamed to 'Astronomy Club', to give it a lighter image and appeal to a greater and more varied audience. The group only met four times, with an average attendance of seven, but there is every intention to blow new life into the Club. It maintains a Facebook page: [KeeleAstrophysicsDiscussionGroup](https://www.facebook.com/KeeleAstrophysicsDiscussionGroup)

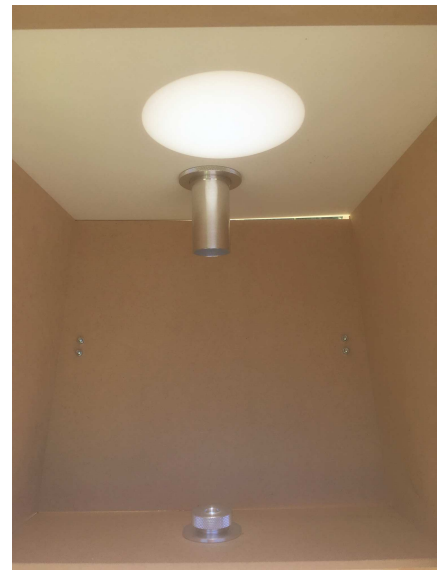


Figure 22 North Staffordshire Astronomical Society and Keele Observatory hosting International SUNDAY.

Credit: Duncan Richardson (NSAS, top two rows) and Jacco van Loon (Keele, bottom two rows).

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Front cover: upper tangent and sunvex Parry halo, 26th April 2018. Credit: Jacco van Loon