Keele Observatory Annual Report 2016

Table of Contents

From the Director 2

Administrative report 2
Personnel 2
Finances 3

Infrastructure and equipment 3
Engineering work on the Thornton 4
Maintenance of the Grubb and its dome 5
Binoculars' enclosure 6

Research activities 6
Solar System observations 7
Publications 7

Outreach activities 7
BBC2's "Stargazing Live" 7
Mercury transit 7
Media activities 7
Public viewings 7
Schools and teachers 8
Community group visits 8
Adult Education sessions 8

From the Director

At long last, the 24" research telescope saw its renewed light, and we regained (some) control over the movement of the telescope and of the ST7 camera, after AWR installed the electronics `heart' and the `intelligent' handset (the `brain'). Although the system is still far from faultless, this is a major step in the right direction.

Unfortunately, our application for an Excellence award in Teaching and Supporting Learning was not successful; while our case was well received the major "flaw" they saw was that we did not make reference to Educational Science literature. Apparently it does not matter what you do, but who you quote.

Our regular activities continued unabated, from the free weekly sessions to the arranged visits and Stargazing Live, to this year's special occasion of Mercury's transit across the Sun – showcasing how extra-solar planets can be found.

I wish to profusely thank all of the Observatory Support Team's volunteers, without whom the observatory would not be able to function. Onwards and upwards!

Jacco van Loon

Administrative report

Personnel

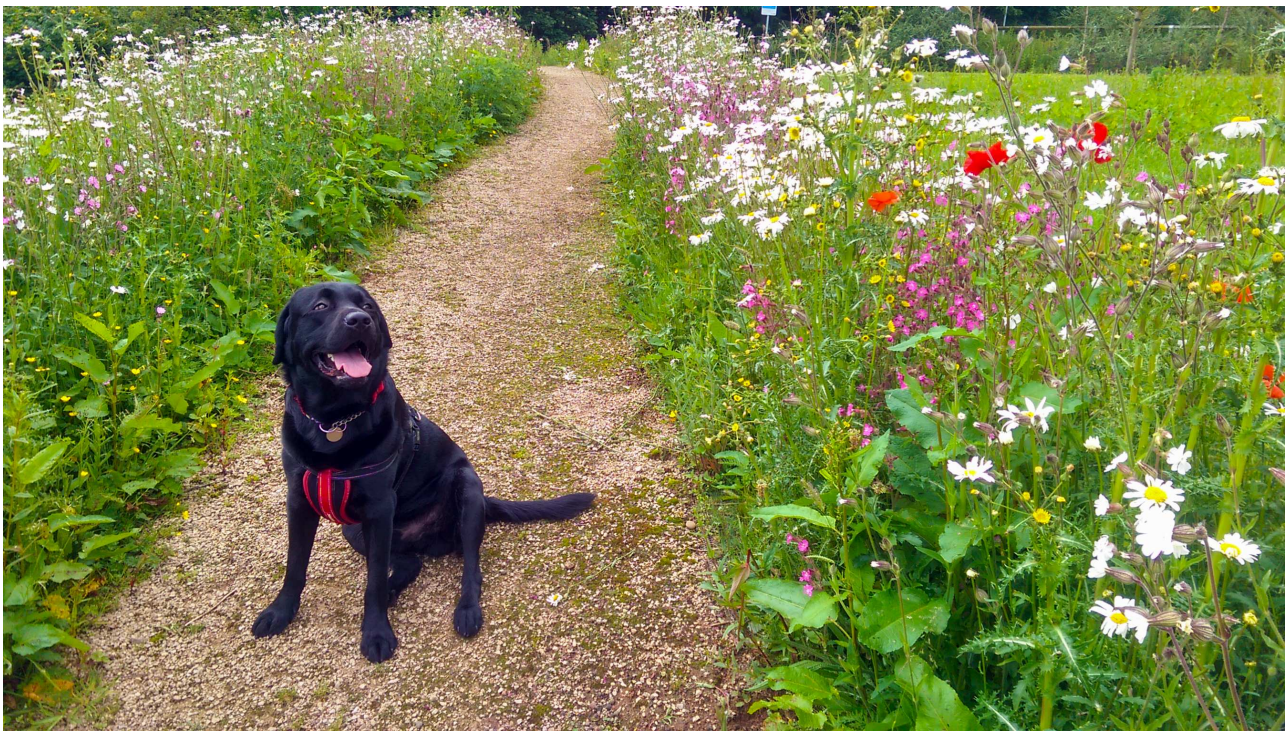
Keele Observatory is operated and maintained through a unique partnership between the Astrophysics Centre in the School of Chemical and Physical Sciences at Keele University, and a core group of skilled and dedicated volunteers: the Observatory Support Team ("The Crew"). Former director, and founder 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 2016 the Crew was composed of Dr. James Albinson, Alan Bagnall, Dave Caisley, Stephen Doody, Ian Johnson, Keith Heron, Paul Klimczak, St.John Robinson, Matthew Stretch, John Webb, with Andrew Shepherd joining us enthusiastically, along with several affiliate members.

Undergraduate students Lucy Auger and Niamh O'Connor joined Kris Turner and PhD student Teo Močnik on the team.

An e-mailing list was set up for ease of communication. The list of keyholders was updated and extended.

Figure 1 Archie.



Finances

The Keele Observatory building is part of the School of Chemical and Physical Sciences. To finance the observatory's equipment we seek to generate a steady income, while offering our services to the public for free or a small donation. Major developments need special funding.

Income was generated by visits of community groups, schools (organized by ourselves or via our colleagues at the Hub or widening participation department) and from Adult Education sessions. Science Learning Centre workshops for teachers, and a special session for medical students added to the totals. Donations mostly arise from sales of the Keele Observatory's History booklet, and appreciation of telescope surgeries.

In addition, £204 were gained by favourable accounting, £20 were found outside the observatory, accommodation for AWR visits were paid for by the School, printer cartridges and a computer for the 24" control room were provided by the Astrophysics Centre, and our bids to the School equipment and software budget were successful to purchase an upgrade to The Sky X software and a seeing monitor.

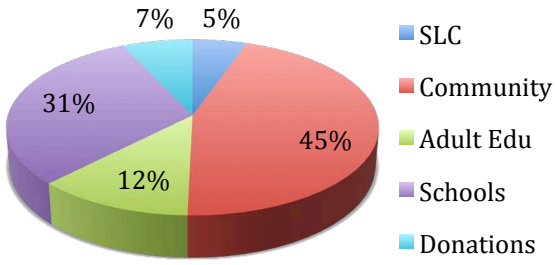


Table 1 Financial account for 2016.

1. Balance brought forward	£5198
Income	
Science Learning Centre	£80
School activities	£454
Medical students session	£250
Community group visits	£666
Adult Education	£178
Donations	£103
2. Total income	£1731
Expenditure	
General maintenance	£213
New acquisitions	£65
Development of the 24"	£377
Printing Annual Report 2015	£79
3. Total expenditure	£734
4. Unspent, ringfenced	£979
5. *Windfall*	£224
Surplus (items 1+2–3+5; exclude 4)	£6419

Table 2 Budget for 2017.

1. Balance brought forward	£6419
Income	
Hospitality	£1200
Donations	£100
2. Total income	£1300
Expenditure	
General maintenance	£400
24" upgrade project	£500
Acquisition of equipment	£200
Printing Annual Report 2016	£80
3. Total expenditure	£1180
4. Ringfenced for solar telescope	£979
Surplus (items 1 + 2 – 3; exclude 4)	£6539

Based on the most recent accounts and budget for 2016, we set a budget for 2017. We foresee some further expenses related to commissioning an upgraded 24", and allow for some additional purchases and contingency.

Infrastructure and equipment

With contributions by Dr. James Albinson

Various enhancements were made to the observatory (Fig. 2) and its functions. To celebrate International Women's Day we framed a picture of Jocelyn Bell-Burnell, honorary doctor at Keele University, and

Figure 2 The Keele Observatory site, seen towards the East, with the binoculars' enclosure to the right.

we displayed a framed map of the building at the entrance. New signage boards were bought, for our own exclusive use. Paul Blurton donated another batch of books, and Graham Preece – technical team leader at Staffordshire University – donated a 3D print of Mars. We thank both.

A barlow lens was bought for the periscope project for the 12", but this is more likely to be of general use. Additional purchases included a 40-m cable reel for the portable telescopes, and the workshop door handle was repaired.

The most valuable addition to our fleet of telescopes came in the form of a generous donation by Mr. R.S. Pope, who parted with an exquisite 8" (Meade) Schmidt–Cassegrain telescope fitted with a white-light solar filter – the `Pope Scope'.

Once again, a major effort on PATT testing all our mains electrical devices was undertaken by Ian Johnson, Paul Klimczak and Alan Bagnall, for which many thanks are due.

Sadly, the model of Neptune, amidst the bluebells, got vandalized.

Engineering work on the Thornton

The 24" CCD control PC failed and was replaced, and an upgraded version of The Sky X software – including add-ons – was purchased and installed. The latest version of the NOMAD catalogue was obtained, with many thanks to Norbert Zacharias of the US Naval Observatory. A second serial port card was added to the ccd24/control PC to connect to the AWR control box.

In March a project was started to automate the rotation of the dome, in sync with the telescope. Spring loaded jockey arms with plastic wheels connected to encoders were manufactured in-house, and fitted to the dome. A hole was drilled in the telescope platform floor to feed cables into the control room; this was done by Estates, who also commissioned an asbestos check. In anticipation of the automated control, a push button manual control of the dome rotation from downstairs was enabled in May/June.

A new focus platform was starting to be constructed, to enable use of the FLI filterwheel with 2" filters, and the QSI 583 camera. Matthew Stretch did most of the engineering, with Ray Rutter sourcing the

age-hardened aluminium. The SBIG ST7 camera was serviced and its connections rechecked. Thermistors were fitted to the mirror cell and the focus platform.

AWR finally supplied the new 24" control system. It was, however, found to be wholly unfit for purpose. Various small items were supplied by AWR in the first months, which were subsequently fitted by the Observatory Support Team. To allow for the periodic error correction, a brass top hat on the worm wheel was fabricated by St.John Robinson, an opto-coupler from AWR was installed, and Matthew Stretch finally realigned the worm.

AWR first visited in May (5th-8th). The visit proved to be abortive; none of the control equipment worked. A dead stepper motor on the RA axis was replaced; a replacement stepper motor and gearbox on the focus platform were sent up and fitted.

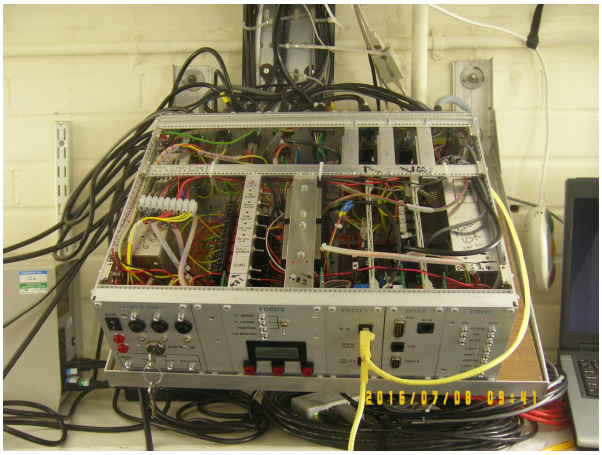


Figure 3 AWR control box for the Thornton reflector.

A further visit in July (6th-9th) provided an electronics control box (Fig. 3) that partially worked. The system would track, with manually set track rates. The system would slew on the induction motors, but only from the intelligent handset (IH2) – not the small handsets. The DecTangent arm was not programmed; hence it would run off the end of the threaded section with no software stops. Recovery was manual, and complicated. Therefore there could be no automated slew to target. The encoders ran at half their designed resolution. The focus motor control was entirely manual, with erratic behaviour. Some runaway conditions (unrepeatable) were found, necessitating manual emergency stops. Eventually a very careful approach enabled focus to be found. The supplied power supply to the electro-magnetic safety brake and track/slew clutches was inadequate. It was replaced by the old linear 24V PSU. The wiring in the control box – the RS232 serial connection – was modified to allow connection from The Sky X to the IH2.

AWR were unable to make much progress for the rest of the year, with promised software fixes only arriving after Year's End and a Skype conference on December 14th only enabling limited tests.

That said, Monday 29th August and Wednesday 31st August saw the first in-focus images from the 24" in many years (see under "research activities"). The old mirror was in place. On Wednesday 14th September the old mirror was replaced by the new mirror, which measures exactly 60cm in diameter – a fraction smaller but without the Cassegrain access bore. Focus was found 38mm inwards from the old position. Also, the track clutch was wedged, to improve response times. The finder was centred with the main telescope, and the misalignment of the mount in azimuth and polar altitude was quantified.

Maintenance of the Grubb and its dome

The 12" did not receive much attention, nor did it need any – although the cleaning of its front lens is a standing item that will become increasingly urgent.

Figure 4 A glimpse into `The Cave', in front of the 12".

Figure 4 offers a rare glimpse into the depths of the cavity in front of the pillar, where once weights fell.

Attempts to align the 5” refractor petered out in the face of more urgent tasks. Improvements in the alignment of the finder scope with the 12” did not prove to be of a lasting nature; this hampers the location of faint targets.

Binoculars’ enclosure

A new battery was bought for the chair supporting the 6” binoculars. However, an electrical fault occurred at the binoculars’ enclosure, tripping the systems in the main observatory building and requiring the enclosure to be isolated and to remain out of action for the rest of the year. The fault was attributed to the power cable, running from the electrical cupboard in the main building to the binoculars’ enclosure. The 10” Meade was meanwhile brought indoors as it could no longer be used from within the binoculars’ enclosure.

Research activities

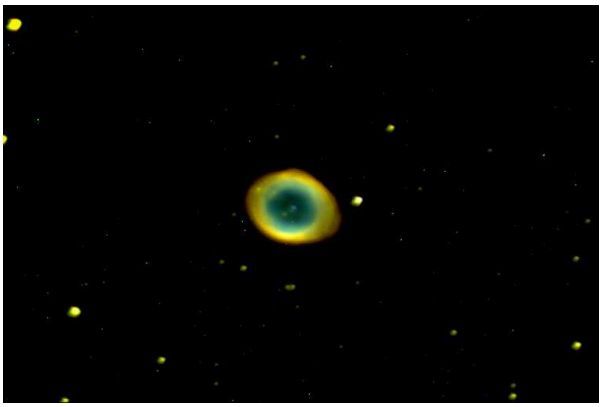


Figure 5 Messier 57 with the ST7 camera on the 24" Thornton reflector, late August. Credit: Steve Doody.

First “relight” in focus was obtained late in August, on ε Lyræ and other stellar fields, showing some misalignment of the optics. A colour composite image was obtained of M57 (Fig. 5). This was with the old mirror.

Further observations of transiting exo-planet systems were made during the Autumn, with the new mirror in place. The ingress of the transit by WASP-58b (Fig. 6) was measured by Ben Clark, Oliver Turner and Teo Močnik on October 10th. More transit measurements were attempted of WASP-10b, -33b, -150b, -155b and -156b, by the three PhD students mentioned, Dr. James Albinson, St.John Robinson, Andrew Shepherd and Lucy Auger.

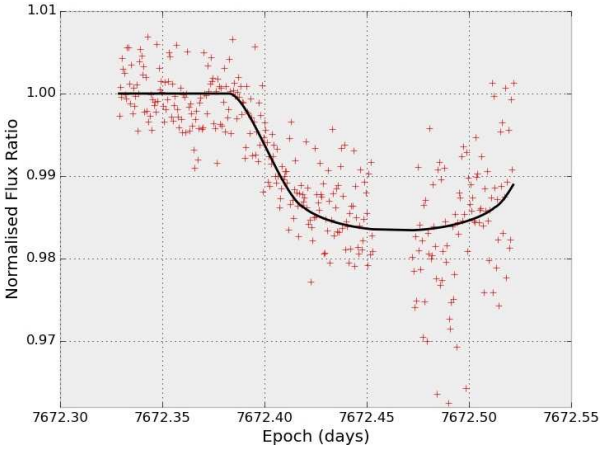


Figure 6 Ingress of the transit of exo-planet WASP-58b, with the 24" Thornton reflector on October 10th. Credit: Ben Clark, Oliver Turner and Teo Močnik.

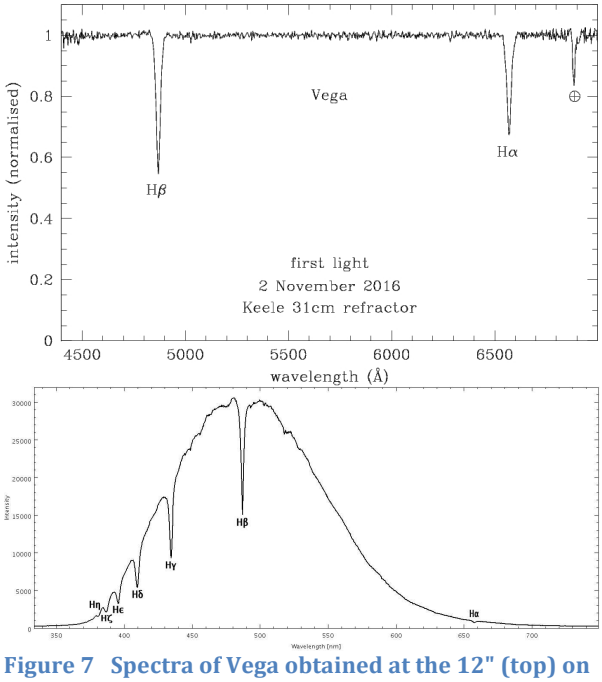


Figure 7 Spectra of Vega obtained at the 12" (top) on November 2nd and the 8” (bottom) on November 25th. Credit: Jacco van Loon (top) & Teo Močnik (bottom).

The CCD-equipped spectrograph was finally commissioned in November. It was used on Vega, first on the 12” Grubb (Fig. 7, top) and subsequently on the new 8” Meade (Fig. 7, bottom). Probably the 10” Meade would offer the optimal focal station for the instrument, for its ease of operation and decent aperture.

Solar System observations

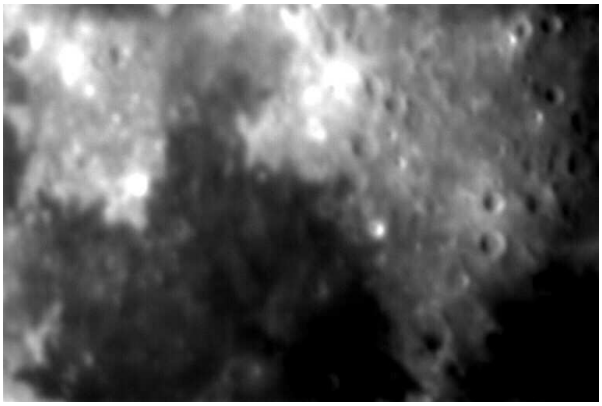


Figure 8 The Moon, seen in September through the 24" Thornton reflector (with its new mirror, but not in focus) and passing clouds. Credit: Jacco van Loon.

The Moon was imaged through the 24" Thornton reflector with its new mirror (Fig. 8). It proved to be quite challenging; use of passing clouds had to be made, as otherwise the images would saturate even in the shortest (milli-second) exposures. This also hampered efforts to obtain focus.

Figure 9 The new 8", kindly donated by Mr. Pope.

The Lunt 6" Hα telescope continued to offer spectacular views of the solar prominences and other solar atmospheric structures. The newly acquired 8" Meade with its white-light solar filter also proved its value (Fig. 9), even though sunspots are becoming an increasingly uncommon sight over the next few years.

Publications

In 2016 we published 33 copies of the sixth annual report:

"Keele Observatory Annual Report 2015", J.Th. van Loon (ed.). KOP 7

Outreach activities

BBC2's "Stargazing Live"

Keele Observatory took part in the sixth edition of BBC2's "Stargazing Live", which was moved back to January (12–14). As before, we opened the doors for one-hour lunchtime (possibly solar viewing) and three-hour evening sessions on each of the three days of the broadcast. A total of 310 people visited, more than half on the final, clear night (until it started snowing). The first two nights were rainy, but the Sun was visible on all three daytime occasions. We received coverage in The Sentinel and on BBC Radio Stoke (twice), as usual. The Facebook site maintained by David McGhee got 35,000 views and over 420 likes in 24 hours, probably largely due to the rather sad departure of David Bowie.

Mercury transit

We had 100 visitors watching the transit of Mercury across the Sun, on May 9th (Fig. 10 overleaf). This rare event, blessed with fair weather, was covered twice on BBC Radio Stoke and for BBC Five.

Media activities

Besides the aforementioned coverage by the media, Keele Observatory got publicity in various other ways. Keele's Media and Communications department produced two videos: one on International Women's Day and one called "Keele In A Day". A team of Staffordshire University film studies under directorship of Daniel Haynes came to shoot for their project "Grounded – The Lives of Astronomers". And the StaffsLive website listed us as one of seven highlights of things to do in May.

Public viewings

Well over a thousand people visited the Observatory this year on its free Tuesday evenings and Saturday afternoons' public viewings.

Figure 10 Joana Oliveira and Teo Močnik spotting a sunspot (left/right) and Mercury's disc (middle) through the 12".

Schools and teachers

We hosted 15 visits by schools, including one for pupils with social communications challenges, and visited 2 schools, including one for autistic children. In this way, and including two teacher training events and a group of work experience students, we reached 540 learners and over 70 teachers.

Unfortunately, Sarah Broome from Barlaston First School, Stoke-on-Trent, never honoured the agreement regarding their visit, and with no response received from their Head Teacher this school has now been blacklisted – a first.

Open and Visit Days for prospective students, visits by international students and Keele Astrophysics students, and about 50 PhD students attending a course in bio reactors amounted to nearly 300 visitors.

Community group visits

Family Fun Day saw around 55 people visiting the observatory. We hosted 24 specially arranged visits by societies and scouting groups, of about 220 adults and 315 children.

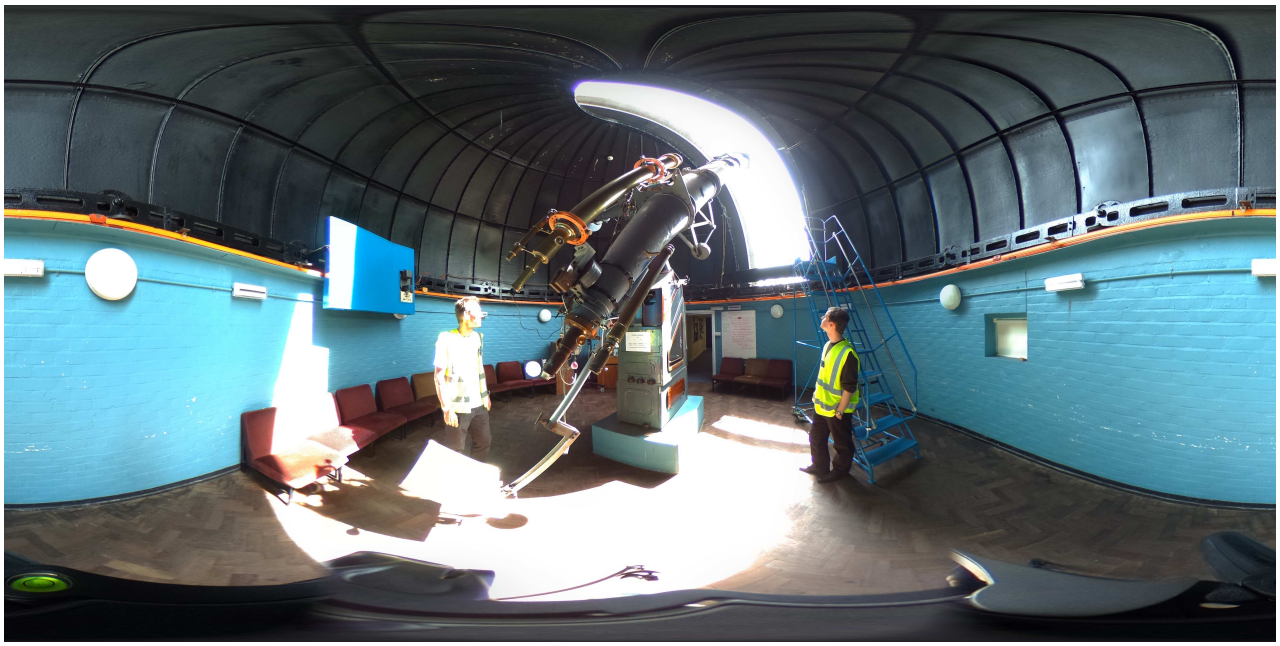
Adult Education sessions

The observatory continued to play host to the "Keele Astrophysics Discussion Group", led by Paul Klimczak and occasionally by Prof. Rob Jeffries. The group met ten times, once a month except for a Summer break. Numbers of attendees this year fluctuated between 6–11.

The aim of the group is to try and increase attendances, and to continue in our vein of member-suggested topics to discuss. It maintains a Facebook page: KeeleAstrophysicsDiscussionGroup.

Figure 11 Paw prints in the snow at Stargazing Live.

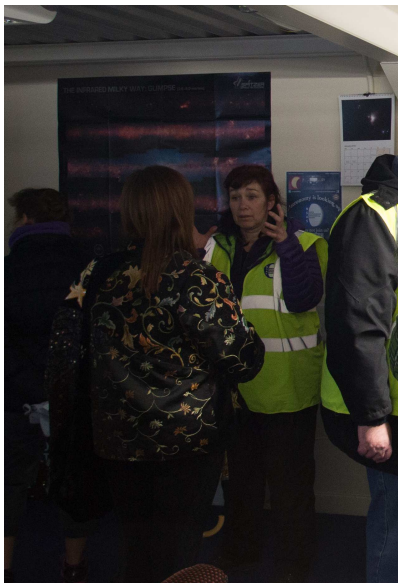
Following pages: impressions of Mercury's transit and BBC Two Stargazing Live.

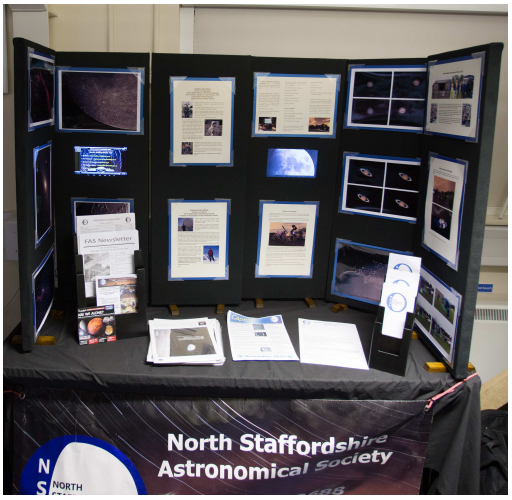


Mercury's transit on the 9th of May 2016. Top and centre-right credits: Paul Newton

Following pages: Stargazing Live. Credits (unless stated otherwise): Duncan Richardson

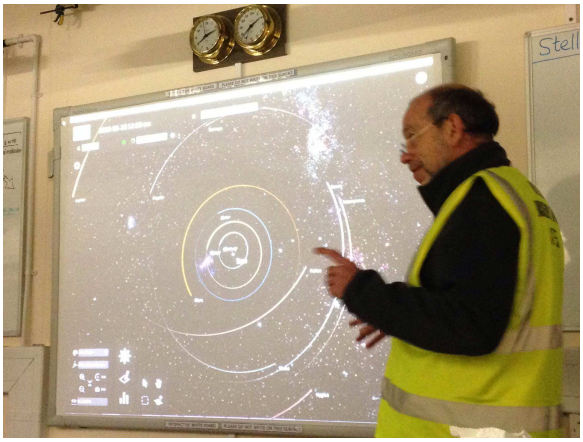

Stellarium

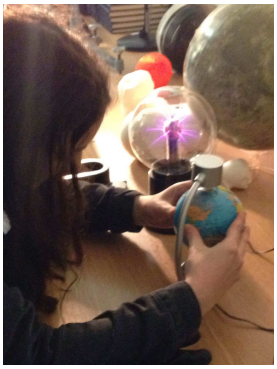



North Staffordshire
Astronomical Society

Top: Teo Močnik explaining…

Below (credits: Jacco van Loon): St.John, James, John, (bottom centre:) Dave & Paul.





Keele Observatory Publications 8

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Front cover: BBC2 Stargazing Live in front of Keele Observatory. Credit: Duncan Richardson