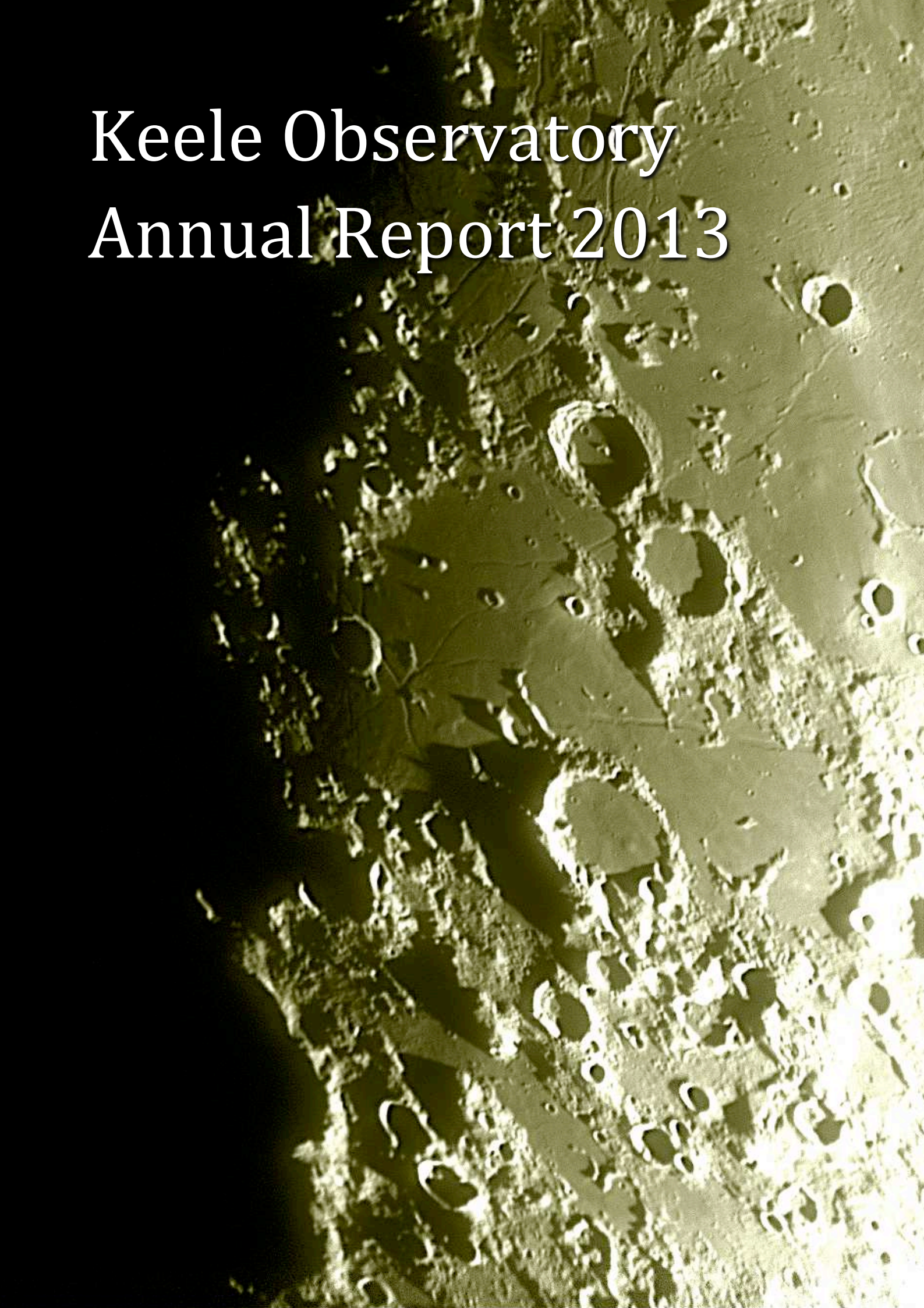


# Keele Observatory Annual Report 2013





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## From the Director

We have enjoyed a busy 2013, with large numbers of visitors, new types of activities, and healthy finances. It is becoming an increasingly professional facility in the way it operates and what it offers.

I must report some sad news too. Glyn Haslam, the local radio astronomer famous for the 408 MHz survey of 1982 passed away. He had become a regular visitor of our Observatory, and we often discussed his and our plans to build radio telescopes for public outreach. His sudden departure came as a shock and is a great loss. The director attended his funeral in Wistaston near Crewe.

While there is progress, AWR are yet to deliver the upgraded control system of the 24" research telescope, and hence this facility has been idle for another year.

On the other hand we have acquired the 6" H $\alpha$  Solar telescope, at last, as well as a CCD equipped spectrometre – for use on the 12" or 10" telescopes. These are very welcome additions to what we can offer both visitors and Keele students. There is even scientific potential for use of the spectrometre, for instance in the case of transients (e.g., novae), or monitoring emission-line stars and Mira variables.

The eagerly awaited arrivals of the comets PANSTARRS and ISON turned out to be disappointing for observers on Earth, having to make do with spectacular videos from the SOHO and STEREO satellites. Our observing campaigns did raise interest and attention, and were fun for all who partook.

No doubt, 2014 will be another year full of business, work and enjoyment at an observatory we can all be proud of. I would like to end by taking the opportunity to thank the many volunteers, students and staff who have contributed to this year's activities – be it in the workshop or during outreach events – and Susan Albinson for proofreading this document. Without you there would not be a Keele Observatory.

*Jacco van Loon*

## Administrative report

### Personnel

Keele Observatory is operated and maintained by a unique partnership between the Astrophysics Group in the School of Physical and Geographical Sciences at Keele University, and a group of skilled and enthusiastic volunteers: the Observatory Support Team a.k.a "The Observatory Crew". At the start of 2013 the Crew comprised James Albinson, Alan Bagnall, Dave Caisley, Ed Doody, Stephen Doody, Nicholas Haselgrave, Keith Heron, Paul Klimczak, Alan Mason, St. John Robinson, Matthew Stretch and John Webb, with an advisory role by former Director and founder of Keele Observatory, Ron Maddison. We also thank Carol Davies for her help in the first half of the year.

After a (very) lengthy bureaucratic process, a number among the most active members of the Support Team have finally been granted the newly introduced status of "Keele University Associate".

Three students joined us in 2013: Lian Bryant, who has proven to be both talented, reliable and indispensable in all of the observatory's activities; Rebecca Olubi who has set up and run the Twitter account (@KeeleObs); and David McGhee who has diligently represented us on Facebook.

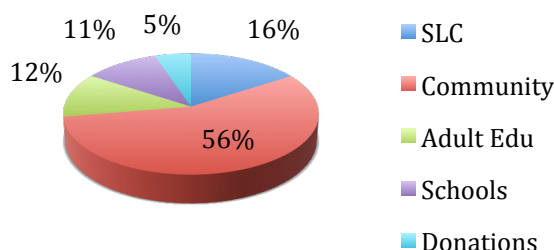
### Finances

The Keele Observatory building is part of the School of Physical and Geographical Sciences, and the directorate of Estates are called upon to service and maintain it. The observatory's equipment needs regular attention, carrying expenses with it. Therefore we seek to generate a steady income, while offering our services to the public for free or for a small donation. Major developments need special funding.

Income was generated by visits of community groups, Science Learning Centre workshops, and Adult Education sessions. KeeleLink has stopped paying for our services, but we hosted a good number of visits by schools ourselves. Donations included sales of the Keele Observatory's



History booklet, appreciation of telescope surgeries et cetera. Donations in kind included posters and booklets from the European Southern Observatory.



**Table 1 Financial account for 2013.**

<i>1. Balance brought forward</i>	£2132
<b>Income</b>	
Science Learning Centre	£240
School activities	£161
Community group visits	£855
Adult Education	£180
Donations	£78
Royal Astronomical Society	£1000
Keele Key Fund	£5000
STFC Small Award	£4000
<i>2. Total income</i>	£11514
<b>Expenditure</b>	
General maintenance	£200
Printing Annual Report 2012	£72
Solar telescope investment	£9021
<i>3. Total expenditure</i>	£9293
<i>4. Unspent, ringfenced</i>	£979
<i>Surplus (items 1 + 2 - 3 - 4)</i>	£3051

Not included in the account are two one-off contributions for specific cases: the School of Physical and Geographical Sciences paid for a visit by AWR to finalise specifications for the 24" upgrade (£100), as well as an Elliott Instruments CCDSPEC spectrograph plus an Atik 314E detector (£1625) following a successful bid by the observatory director.

Based on the accounts for 2012 and 2013 and budget for 2013, we set a budget for 2014. We foresee purchasing display

cabinets, postponed from previous rounds. It is possible that fairly major expenditure will be experienced to service the 12" or repair the Lunt solar telescope (see below).

**Table 2 Budget for 2014.**

<i>1. Balance brought forward</i>	£3051
<b>Income</b>	
Hospitality	£1000
Donations	£200
<i>2. Total income</i>	£1200
<b>Expenditure</b>	
General maintenance	£300
Acquisition of equipment	£800
Printing Annual Report 2014	£80
<i>3. Total expenditure</i>	£1180
<i>4. Ringfenced for solar telescope</i>	£979
<i>Surplus (items 1 + 2 - 3; exclude 4)</i>	£3071

## Infrastructure and equipment

*With contributions by St. John Robinson*

The building and infrastructure have been maintained as usual, installing spotlights for the whiteboards and mind-your-head signs at the binoculars' enclosure. The Meade LX200 keypad was replaced, and Steve brought in his 14" (36cm) f/5 Dobsonian. There were also significant IT upgrades: the installation of WiFi and upgrade of a few machines to the Windows 7 operating system (with help from Andy Grant from Keele IT Services appreciated). Also, the cloud sensor has been linked live to the Observatory's webpage.

## The Keele Observatory workshop

One of the support team members was granted on loan the use of a Dore Westbury milling machine, and later in the year was gifted a brand new Myford Super 7 lathe. Along with another drill press and smaller milling machine these were duly installed. Their use has greatly facilitated progress and is duly acknowledged here.

### Engineering work on the Thornton

It has been a very busy year in engineering terms, preparing for the upgrade by AWR to the command control and pointing system. As part of the solution, both the RA and Dec stepper motors are to be replaced with light compact modern ones. The original RA drive stepper motor used a high quality lab chain and two sprocket gears to drive the worm, whilst the new design specifies an inline Oldham type coupling that has a hard plastic sliding component that will allow for any slight misalignment between the stepper motor and the worm shaft.

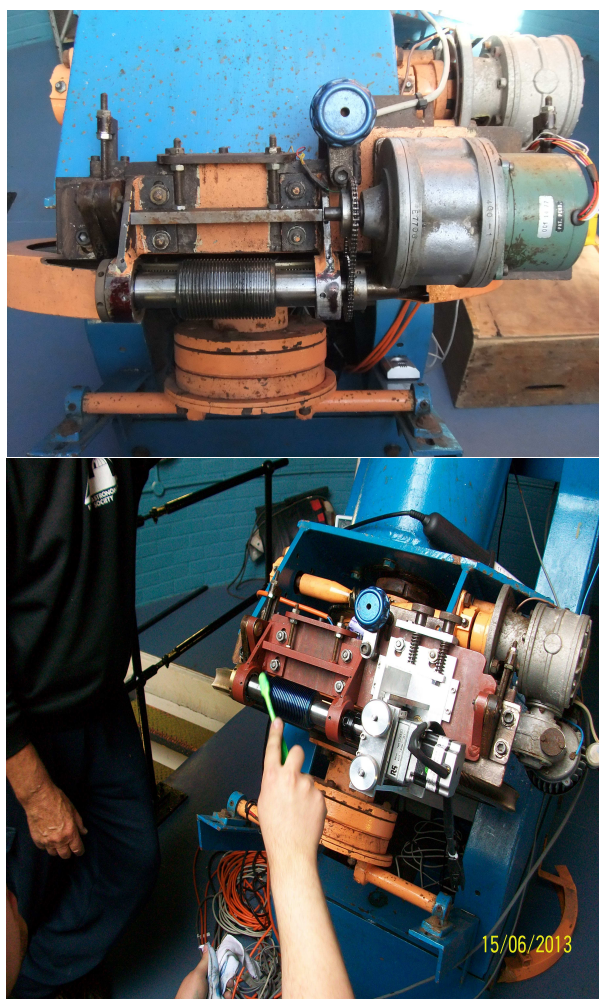


Figure 1 24" Thornton telescope RA worm assembly before (top) and after (below) refurbishment.

To fabricate a new motor support platform for the RA drive, the worm table platform was removed, measured and drawn up; this was done because the worm table had been modified from the original design. To minimise input-to-output shaft

misalignment, an X-Y type platform was produced. With the new stepper motor specification, the shape and size could be laid out on the drawing and a mock up of the new motor support platform produced in cardboard. Hence the mark-up, cutting and machining of the aluminium plate could be achieved with some certainty that when assembled it would be right. This work was carried out offsite by the support team in a home workshop using a lathe, drill press and hand tools. The opportunity was taken to clean the phosphor bronze RA driving gear, and strip and clean the worm table, re-lubricating during re-assembly (Figure 1). The worm table platform with the new X-Y drive motor table was then reinstalled, and the worm was realigned with the driving gear using engineer's blue to check for proper contact.

The new Dec stepper motor needed fitting to the tangent arm frame. This entailed removing and stripping the frame and repositioning the stepper motor and tangent arm drive rod. The new motor shaft was shorter and of different diameter, hence it was necessary to turn a new collar to connect the motor shaft to the tangent arm drive rod. During this operation it was noticed that the tangent arm yoke was out of alignment with the tangent arm. To cure this a hard plastic angled spacer was made, for which the milling operations were carried out in the observatory workshop.



Figure 2 24" Thornton telescope Dec modification with the new gear transmission improving accuracy.



To support the AWR solution for increased pointing accuracy the RA and Dec encoders have had their gear ratios increased to improve angular resolution. The Dec axis had the original 28 toothed wheel substituted by a 10 toothed wheel (Figure 2); the RA axis had the original 60 toothed wheel substituted by a 29 toothed wheel. Hence the encoder can be driven directly, thus eliminating the original intermediate idler gear. To ensure shaft alignment a new support bracket was machined, including milling work on the encoder stack carrier.

As part of the provision of the new primary mirror the supplier had also provided new covers. Unfortunately these proved to be inadequate even after some rework; the support team has instead devised a new solution (Figure 3). The position of the original internal mirror cover hexagon ring was raised so that it was approximately flush with the top of the lower truss mirror cell mounting point. Each of the two covers had two sections (flaps) cut and reattached with hinges such that when partially raised they could be folded back to allow the covers to stand upright. These were then secured using the original magnets and some small ceramic ones taken from a stripped PC hard drive. When closed the mirror covers are restrained in a horizontal position by using two strips of child seat belt webbing. Draught excluder has been fixed to the base ring to provide a good seal.



Figure 3 New 24" Thornton mirror covers.



Figure 4 New 24" Thornton mirror fan assembly.

We also installed a fan tray on the underside of the primary mirror cell, using three 12 V fans sourced from redundant PCs (Figure 4). The fan tray was mounted on rubber grommets either side of the securing bolts to minimise any vibrations. Having a constant airflow should reduce both cool-down time and condensation on the primary mirror surface. Reduction of the boundary layer effect at the surface of the primary ought to improve the images.

The AWR solution implements a zero position on the focus platform. To this aim an infrared sensor was fitted to the moving part and an aluminium finger was positioned on the fixed base to interrupt the sensor beam, providing the index point.



Figure 5 24" Thornton telescope control room before (left) and after (right) removal of the electronics rack.

To carry the AWR control system electronics rack, an angled 19" support tray was fitted above the control desk. A new overhead cable tray was installed to carry the new control and data cable runs from



the AWR control box to the telescope. The redundant telescope control systems and cable runs were removed (Figure 5), with some components retained for display or future use on other instruments.

### Maintenance of the Grubb and its dome



**Figure 6** 12" Grubb refractor after removal of the 17" Hindle reflector (top, with St. John Robinson), and the rest of the team, with the Hindle (bottom, from left to right: Paul Klimczak, Stephen Doody, James Albinson, Matthew Stretch, Nick Haselgrave and Lian Bryant).

The 17" Hindle reflector, which had been carried by the 12" refractor since the 1960s for Dr. Ron Maddison's experiments with Pye TV cameras, was removed and stored during the Autumn, along with the excess

counterweights and the astrograph camera supports (Figure 6). The reasons include relieving considerable weight from the 12" refractor, making it easier to operate, the limited use of the Hindle, and the fact that the Hindle had never been a part of the original ("Oxford") configuration.



**Figure 7** The refurbished 12" objective shroud and blind assembly, with Steve Doody in the background.

A new dew control system was fitted, comprising two heater rings behind the front lens. Keele University electricians installed the cabling and rheostat to control the voltage to the heater elements, with the electrical circuit being protected by an RCD breaker. A probe was fitted behind the rear element of the lens in order to monitor the temperature, with the display placed in the pillar. The original aluminium shroud was thin and frail. A new shroud was cut, with the top edge hand shaped; hand rolled into a cylinder, it was sprayed with self-etching primer and matt black. The new shroud is held in place by large jubilee clips. The wooden box that supports the objective moving blind was refurbished with brass screws replacing the corroded steel ones (Figure 7). The Bowden cable to operate the blind was wire brushed on the outside and wiped over with an oily rag as an "anti rust treatment". It required new supports.





Figure 8 Inspection of the dome shutter rollers (top centre); St. John Robinson (top left); Jacco van Loon (top right); Lian Bryant and the 12" Grubb still carrying the Hindle reflector (bottom left) and a South-East view (bottom right).

As one of the dome doors seemed to always get caught behind something, only to start opening after an almighty bang, some of the crew – including the director – took advantage of a dry Autumn day to climb up the outside of the dome to inspect the condition of the rollers (Figure 8). One of these turned out to be far out of alignment. Repair is foreseen for 2014.

### The Solar Telescope Project

We finally managed to acquire a Lunt 6" H $\alpha$  refractor (Figure 9), with funds from the Keele Key Fund, Science and Technology Facilities Council, and Royal Astronomical Society. Received in late Summer, it was used at the North West Astronomy Science Festival in Runcorn but developed a fault.

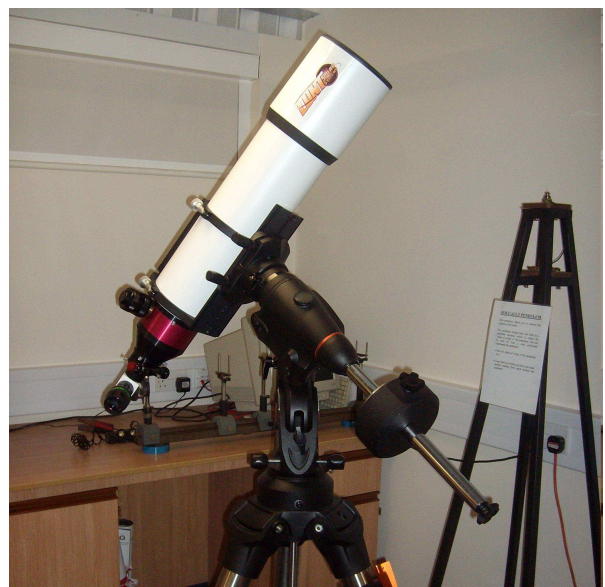


Figure 9 The new Lunt 6" solar telescope on its Celestron C-GEM mount (picture by Dave Caisley).



## Research activities

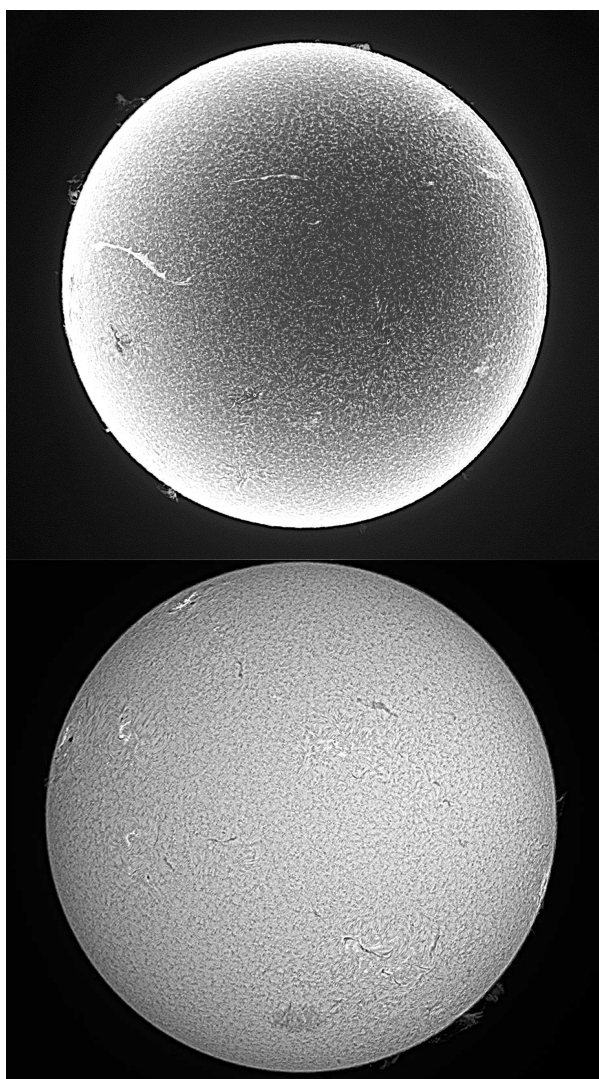


Figure 10 Sun on 17 Feb (top) and 11 May (bottom), through a 4" Coronado solar telescope (Steve Doody).

### Solar System observations

Stephen Doody, using a Lumenera camera, continued to capture the spectacular Sun through the Coronado 4cm solar telescope (Figure 10), and Saturn (Figure 11) and the Moon (Figure 12) through the 12" Grubb.



Figure 11 Saturn imaged on 28 April through the 12" Grubb (Steve Doody).

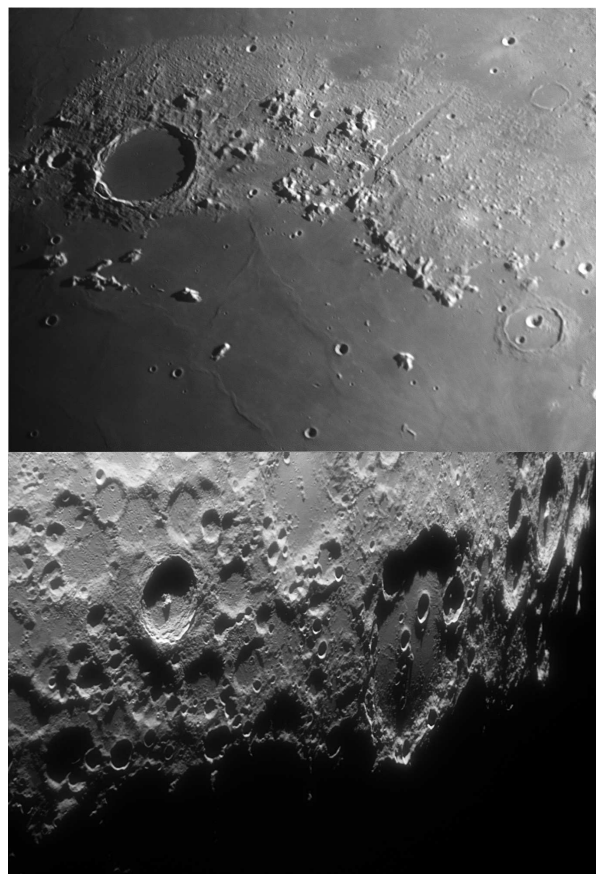


Figure 12 The Moon imaged through the 12" Grubb: Plato, Alpine Valley, Mare Imbrium (top) and Tycho (bottom left), Clavius (bottom right). (Steve Doody.)

### Publications

In 2013 we published

"Keele Observatory Annual Report 2012", J.Th. van Loon (ed.). KOP 4

(the third annual report, in 30 copies).

Also, note 33 on operating the 12" refractor was updated, and a new note 34 contains the observatory's coordinates.

A start was made with an inventory of the historical maps and atlases, with a view to making this information available and restoring and displaying some of them.

### Outreach activities

#### BBC2's "Stargazing Live"

Keele Observatory took part in the third edition of BBC2's "Stargazing Live", on the 8<sup>th</sup> to 10<sup>th</sup> of January. Over 500 people visited us, despite the poor weather. The Stardome was set up in the Sustainability



Hub. A large number of Observatory Crew, students and staff helped out, identifiable by their hi-vis vests (Figure 13).

The Keele events were covered as usual by The Sentinel newspaper, and BBC Radio Stoke. We were informed of 1273 unique viewers of our events on the BBC site "Things To Do" during 7-14 January.



**Figure 13** Part of the Stargazing Live team, from left to right: Joana Oliveira, Jacco van Loon, Keith Heron, Paul Klimczak, Ed Doody, James Albinson and St. John Robinson (the picture was taken by Deepak Mahtani).

### Earth Hour

For the first time, on Saturday 23<sup>rd</sup> March Keele University took part in the World Wildlife Foundation's "Earth Hour". This major global event is participated in by institutions and many private groups and individuals to raise awareness of climate change and energy sustainability. Led by our Observatory, lights were switched off across the campus. Keele's Postgraduate Association hosted a candle-lit dinner. The Observatory itself opened its doors, candle-lit as well, and we had a presence at Union Square in the centre of campus with the 5" century refractor on the Celestron C-GEM mount. The weather did not play ball, with snow and ice keeping most people at bay – still, some 30 people visited us.

### Comets PANSTARRS and ISON

Comet ISON was expected to become the brightest comet in a century, easily visible with the naked eye in late November and early December due to its close proximity to the Sun. As a warm-up act, the comet PANSTARRS would become a naked-eye object in March. Hence we gave it plenty of

publicity – BBC Midlands Today did a live feature during a visit by Brine Leas school on the 13<sup>th</sup> of March. But the comet was spotted by very few of us, low above the tree line and with the aid of binoculars.



**Figure 14** On the look out for comet ISON in morning twilight. Lian Bryant on the right is using binoculars.

We organized two campaigns to view comet ISON, at the crack of dawn on the consecutive clear Saturday mornings of the 23<sup>rd</sup> and 30<sup>th</sup> November (Figure 14). A combined 30 or so people failed to see the comet, but they got some lovely views of the Moon and of Jupiter (Figure 15). BBC Radio Stoke featured our second campaign.



**Figure 15** The twilight Moon seen high above the 12" Grubb refractor carrying the 17" Hindle reflector.

### Public viewings

Some 1120 people visited the Observatory this year for its free Tuesday evening and Saturday afternoon public viewings.

### Schools and teachers

The Science Learning Centre organized four teacher sessions, while KeeleLink organized visits by the SmallPeice Trust, a school, and a Space Conference. Seven more school visits and three visits by the Keele Day Nursery were arranged directly with the Observatory. All these events reached 540 learners and 80 teachers. We are now validated as an approved Learning Destination for the Children's University.

Open and Visit Days for prospective students, induction for Ph.D. students, and a group of Japanese students amounted to 330 people. We entertained five work experience students: James Dempster, Helen Shubotham, Thomas Ratcliffe and Sam Pemberton, and Molly Ramsden.

### Community group visits

Community Day drew over 120 visitors to the observatory, and 650 people of all ages visited on many other specially arranged occasions including two "Health Walks".

John Webb represented us at the "Museums at Night" event at Englesea

Brook Methodist church, Jacco van Loon went to a Café Scientifique at Westwood College in Leek, and a team of Lian Bryant, Maša Lakićević, Joana Oliveira and Jacco van Loon took the Lunt Solar Telescope to the North West Astronomy Festival in Runcorn reaching some 100 people. Former director Nye Evans took the 4.5" Hunter to Wales for a star party attended by 90 people under brilliant dark skies.

### Adult Education sessions

Once again the observatory played host to the "Keele Astrophysics Discussion Group" where we swapped our views on the latest discoveries in astronomy and astrophysics, including observing if the weather permits. Paul Klimczak leads these sessions.

This year there were 9 meetings, attended by an average of 12 visitors. At the final meeting of the year, Keele Ph.D. student Deepak Mahtani presented a talk on his research to an audience of 19.

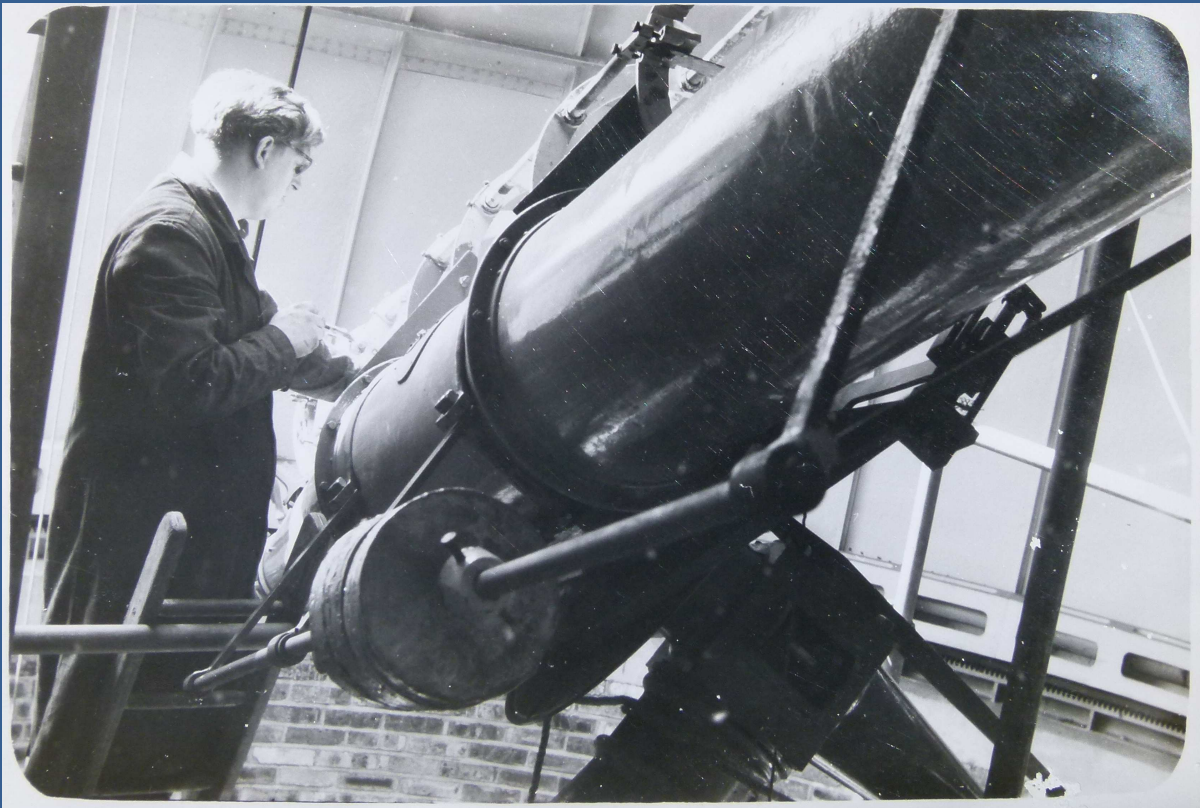
These meetings are free (a nominal donation to the upkeep of the observatory and its activities of £2 are welcomed) and open to the general public. You can find out meeting dates and times and what we are likely to be talking about at our Facebook page [KeeleAstrophysicsDiscussionGroup](#).





# Historical Supplement

The pictures below were supplied by Dr. Ron Maddison from his own personal archive.

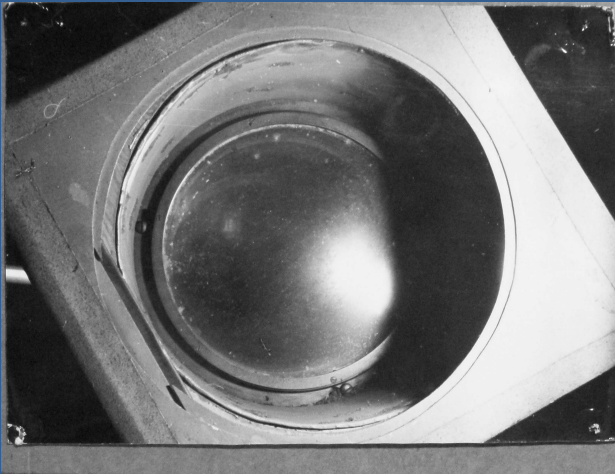


Dr. Ron Maddison up high at the 17" Hindle reflector atop the 12" Grubb refractor.



Dr. Ron Maddison underneath the 12" Grubb refractor carrying the 17" Hindle reflector.





The 12" Grubb lens and inspection by Dr. Ron Maddison and a young Nye Evans (bottom left), who would become the first Professor in Astrophysics at Keele and an Observatory Director.



Keele Observatory Publications 5

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Front cover: the Moon, image taken through the 12" refractor (credit: Stephen Doody)