

# Keele Observatory Annual Report 2019





## Table of Contents

<b>From the Director.....</b>	<b>2</b>
<b>In Memoriam: Ron Maddison.....</b>	<b>2</b>
<b>Administrative report.....</b>	<b>4</b>
Personnel.....	4
Equality, Diversity and Inclusion .....	5
Sustainability .....	5
Finances .....	6
<b>Infrastructure and equipment .....</b>	<b>7</b>
Engineering work on the Thornton.....	8
Maintenance of the Grubb and its dome .....	9
<b>Research activities .....</b>	<b>9</b>
Undergraduate laboratory work.....	10
Publications .....	10
<b>Outreach activities .....</b>	<b>11</b>
Media activities .....	11
Public viewings .....	11
Schools and teachers .....	12
Community group visits.....	12
Adult Education sessions.....	12





## From the Director

This was a busy year that saw a growing optimism for the future, until the sad news arrived at the very end of the year that the founder and long-time Director of the Observatory, Dr. Ronald C. Maddison had died. This Annual Report is dedicated to his memory, which lives forth in all that is the Observatory and everything that it makes possible. We therefore devote the start of this report to some reminiscences.

*Jacco van Loon*

## In Memoriam: Ron Maddison

*(Written by Professor emeritus Nye Evans, pictures supplied by Margaret Maddison)*

It is with great sadness that we learned of Dr Ron Maddison passing on 29 December 2019, a few days short of his 85<sup>th</sup> birthday.

Ron, the founding father of Astronomy at Keele, was born on 1 January 1935 to John William and Violet Alsbury Maddison. His interest in astronomy was kindled during the black-out in war-time Birmingham, and there were early experiments in building telescopes. During his childhood he had encouragement from, amongst others, the then Astronomer Royal, Sir Harold Spencer Jones. The latter had visited Birmingham to give a talk on recent astronomical discoveries and the young Ron – clutching his treasured copy of Spencer Jones' "General Astronomy" – asked the Astronomer Royal if he would sign it. Not only did he sign it but he took the time to offer career advice on how to become an astronomer.

Ron gained his first degree (1953 – 1957) and PhD at Keele; no doubt the fact that the latter was in experimental electron physics and not in Astronomy will come as a surprise to many! But in those days

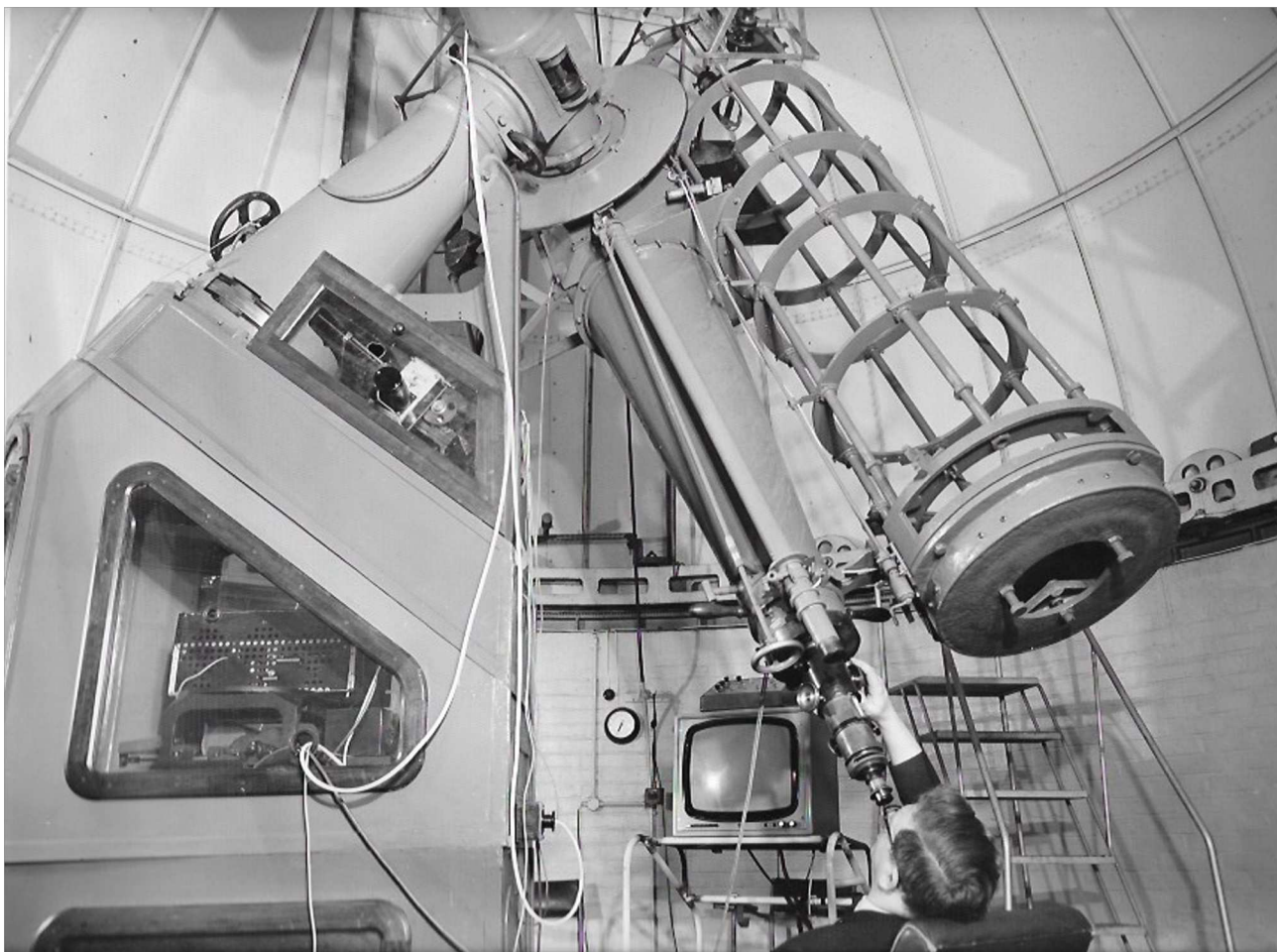


Figure 1 Ron Maddison at the helm of the 12" Oxford refractor, looking out into space and at new opportunities.



postgraduate opportunities in Astronomy and Astrophysics were very few and far between. He was appointed a lecturer, and subsequently a Senior Lecturer, in the Department of Physics at Keele, where he remained until he moved to the USA in 1991 to take up the position of Director of the Observatory at the Astronaut Memorial Planetarium and Observatory in Cocoa, Florida.

The unexpected availability of the Oxford Grubb refractor around 1960 led to the establishment of Keele Observatory, for which Ron was the driving force. Not only did he persuade the then head of Physics, Professor David Ingram, that having an observatory on campus would be a Good Thing, but also that the Department should pay for it. This was an enduring talent of Ron's – coming up with a bright idea and then persuading someone else that they might like to pay for it! Legendary are the tales of the establishment of the Keele Observatory, from the churning up of the beautifully manicured lawns at South Parks Road in Oxford by the heavy goods vehicles that would transport the dome to Keele, to the encounter of the Registrar's suede shoes with cow pats that led to the construction of a path up Observatory Hill. Once up and running the Observatory became a distinctive feature of the Keele landscape, in all senses of the word. In my early years at Keele the Observatory was open every clear night, staffed by postgraduate students and demonstrators. In order to announce that the Observatory was open for business, a small red light was lit at the top of the dome, and visible from most of campus. Many were the comments by mischievous students about the Observatory being Keele's "Red light district".

Keele was very active in Adult Education and with the Workers' Education Association. Evening and weekend courses on Astronomy were offered on campus and in the surrounding district, as far afield as Burton-on-Trent. Ron was actively involved with these, and an Adult Education course at Keele led

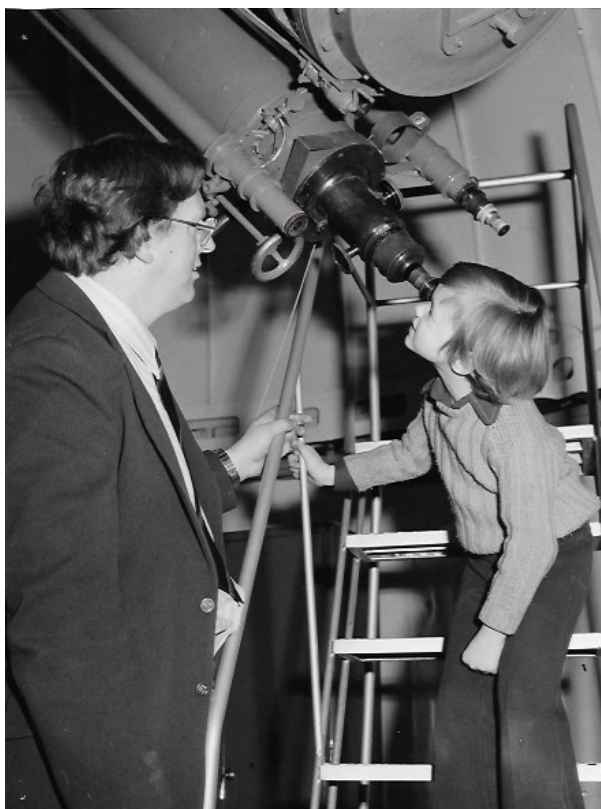
indirectly to the extension to the Observatory in the 1970s: a participant in one of the classes worked for local engineering company William Boulton. With this contact, Ron persuaded Boulton's to contribute to the construction of an extension to the Observatory, and Frank Thornton to contribute the optics for a 0.6m (24 inch for those who prefer telescope sizes in imperial units) reflecting telescope for which Boulton engineered the telescope framework. Ron's "The First Fifty Years of the Keele Observatory" gives an excellent account of the early years.



Figure 2 Ron had an eye for detail and precision.

Keele's founders had the vision that all students should encounter science, social science and humanities in their undergraduate studies, and the famous Keele "Foundation Year" – the first year of a 4-year degree – exposed students to a whole spectrum of ideas, from the Big Bang to Plato. The first four lectures of the "FY" covered our place in the Universe, and Ron was the first lecturer that students would encounter in their lives at Keele. In this culture Ron initiated the 1-year Astronomy Subsidiary course, which instantly became a big hit in Keele's multicultural ethos. Few universities in the UK offered an Astronomy course that was accessible to all students, irrespective of their academic inclinations. When I met some of Keele's "golden" alumni after the 2010

refurbishment of the Observatory, many of them remembered how much they enjoyed and still appreciate Ron's Astronomy lectures, even though they had studied humanities at Keele; the impact of his lectures lasted a lifetime. Although the FY, as originally conceived, has long since gone, the "Astro Subsid" lives on in two very popular electives.



**Figure 3** Ron was passionate about sharing curiosity and the wonders of the Heavens with others.

Another of Ron's passions, and as with astronomy one he acquired at an early age, was steam engines. This culminated in his acquisition of a traction engine, which was often seen parked on the Physics Department car park at week-ends, with Ron – dressed in overalls and covered in oil, coal dust and grease, and with an incongruous black beret perched on his head – pouring over some intransigent component of the engine that would not co-operate.

Ron had a life-long friendship with the late Patrick Moore, and was a frequent guest on the BBC's "Sky at Night". He enjoyed chasing solar eclipses, and visiting volcanoes in his Land Rover; this, like the

traction engine, was frequently seen on the Physics car park with the bonnet open, and the upper half of Ron's body immersed in the bowels of the Land Rover's engine, bits of which were strewn on the car park.

On a personal note, I owe Ron a great deal. It was he, along with David Ingram, who appointed me to the (then) Physics Department at Keele. As I found my feet in the early days, Ron was a constant and immense source of encouragement, and provided me with every opportunity to develop as a member of the academic staff. I last met him in 2012 when he visited Keele on the occasion of the Observatory's 50<sup>th</sup> anniversary, and it gave us the chance to catch up.

His legacy to Astronomy and Astrophysics at Keele cannot be overstated. Ron is survived by his wife Margaret and his two children (Christopher and Julia) from an earlier marriage. Sadly Christopher passed away not long after his father.

## Administrative report

### Personnel

For a long time now, 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 (a.k.a. "The Crew"), with temporary membership of students.

In 2019 the core Crew comprised Alan Bagnall, Dave Caisley, Ian Johnson, Paul Klimczak and Andrew Shepherd, with James Albinson, Stephen Doody, StJohn Robinson, Matthew Stretch and John Webb still affiliated too. Richard Oppenheimer and his son Patrick joined, and quickly became part of the core team.

Undergraduate student Camilla Jones (Computer Science) was joined by Daniel Abbott (Astrophysics + Chemistry) and Jordan Richmond (Astrophysics + Education). PhD student Nikki Miller made some appearances also, as did Lucy Auger.





Figure 4 Two new, alien members of the team.

### Equality, Diversity and Inclusion

We organized a multi-disciplinary event for the United Nations International Women and Girls in Science Day, which takes place every year on 11<sup>th</sup> February. It attracted about 80 visitors to the Observatory. We thank in particular Yolanda Gómez Gálvez from Life Sciences for their contributions. BBC Radio Stoke covered our event, and it was included in the events listing of the International Astronomical Union.



Figure 5 Mark Pullinger's daughter showing her souvenir from Women and Girls in Science Day.

We tweeted in support of the 2<sup>nd</sup> annual LGBT+ in STEM Day, and Camilla Jones promoted Ada Lovelace Day.

We responded to a survey for John Rowland's Accessible Telescope Project. Wheelchair access remains challenging, but at high elevation views can be had through the 12" refractor, and the two Dobsonians may offer views at lower elevation.

### Sustainability

We deeply care for the environment, both dark skies and the natural ecology around the Observatory. We are always delighted to spot wildlife, such as a fox passing by in the evening twilight in early Autumn.



Figure 6 Wildlife at the observatory.





Figure 7 Trees hugging the 12" dome

Unfortunately, we could not garner the interest from the Students Union and Keele Postgraduate Association for WWF's 'Earth Hour'. We decided not to go ahead with it, but the Observatory Director gave an interview on BBC Radio Stoke about light pollution and wrote an article for The Conversation on the topic (and whether it could attract the attention from aliens).

Ongoing tension between our needs and those of the natural world, concerns trees. They tend to grow, up and towards the Observatory. Especially where it involves a protected oak tree. We had our 12" dome rid of the jungle, and the tree line to the West culled... how long may it last.

### 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. This is made more difficult with the Observatory's "T" account on the University's system being



reset at the end of each financial year. We do keep track of our (virtually) rolling T account assets in our registers below.

For the first time since 2010, the total expenditure in 2019 exceeded the total income. This was due to the failure of the electro-magnetic brake of the 24" telescope, and precisely the reason why over the years we had built up credit.

Income was generated by visits of community groups and schools, from the Astronomy Club and from donations. Our participation in Stoking Curiosity and an Observatory event for Physicist of the Year were funded by the University and are included in community and school visits, respectively.

Our own Dave Caisley donated an inflatable Jupiter ball and James Albinson lots of books, magazines and a small Moon globe. Geoffrey Lake donated a 13.1" f4.5 Coulter Odyssey Dobsonian reflector which has already seen good use.

Dr. Steve Wye from the Physics department printed 3D models of the Apollo capsule and lander. Our School outreach fund allowed us to purchase 500

of the highly popular Rachel Ignotofsky postcards of women scientists and a small acrylic display case. More substantially, we were successful in obtaining funding from our School for a wide-field CCD camera plus filter wheel and filters (£5641) and a 20" telescope from Orion Optics (£43 205), plus two laptops to operate cameras.

**Table 1 Financial account for 2019.**

1. Balance brought forward	£8108
<b>Income</b>	
School activities	£542
Community group visits	£524
Astronomy Club	£164
Donations	£91
2. Total income	£1321
<b>Expenditure</b>	
General maintenance	£95
Development of the 24"	£1390
Printing Annual Report 2018	£55
3. Total expenditure	£1540
4. Unspent, ringfenced	£979
Surplus (items 1+2-3; exclude 4)	£7889

**Table 2 Budget for 2020.**

1. Balance brought forward	£7889
<b>Income</b>	
Hospitality	£1000
Donations	£100
2. Total income	£1100
<b>Expenditure</b>	
General maintenance	£100
Installation of 20" telescope	£800
Printing Annual Report 2019	£60
3. Total expenditure	£960
Surplus (items 1 + 2 - 3)	£8029

Based on the most recent accounts and budget for 2019, we set a budget for 2020, aiming for (only) a slight surplus. We

anticipate some costs associated with the installation of the new 20" telescope. The need to ringfence money for the Lunt solar telescope is no longer justified, so we have removed that from the accounting.

## Infrastructure and equipment

We continue to improve our Observatory as a modern professional facility for public outreach, training and research. Paul Klimczak coordinated a "Big Clear-out", 20 comfy but clumsy chairs being among the victims. We got better, acrylic display stands, furnished the new 13" Dobsonian with a make-shift finder scope, and found a mains power supply for the Lunt solar scope. Following a School Health & Safety inspection we improved the ladders and made the 24" counterweight more visible; it remains a significant effort to keep up with statutory PAT testing of electrical equipment, of which we have plenty.



**Figure 8 Finder scope for the new 13" Dobsonian.**

We were fortunate to receive a new wide-field ATIK-11002 camera with 7-filter wheel including RGB broad- and H $\alpha$ , [O III] and [S II] narrow-band filters and L-band ("clear") filter, and two laptops to operate various cameras. This enhances the use of our telescope arsenal for education and, eventually, scientific measurements.

We also bought a 20" f6.8 optimised Dall-Kirkham telescope from Orion Optics, on a Paramount ME2 and pillar, to provide





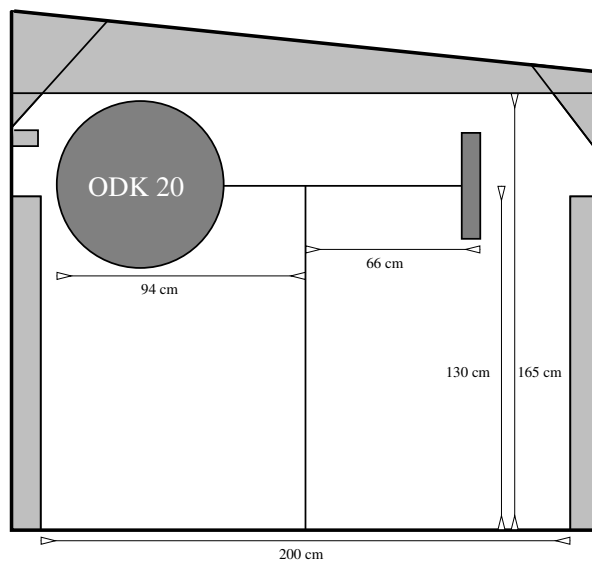
**Figure 9** The new ATIK-11002 camera (top) and loaded filter wheel (bottom).

light gathering power and accurate control for spectroscopy work. The telescope will be situated in the roll-off shed, and we have therefore removed the binoculars from it. The mounting frame and chair were not considered worth keeping but the 6" historical binoculars are stored safely with intention of future re-instating.

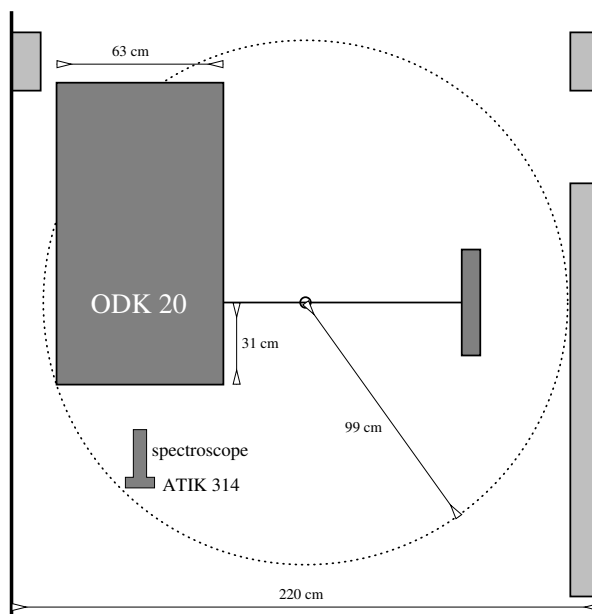


**Figure 10** 20" Optimised Dall-Kirkham telescope at European Southern Observatory's Cerro Paranal site.

View from North to South:



View from above:



**Figure 11** Technical drawings of the 20" telescope in the roll-off shed, made by the Observatory Director.

Unfortunately, the Observatory remains vulnerable to vandalism and petty theft. A small 3D-printed fluorescent ball and miniature solar system fell victim of the latter, whilst the observing pier for the 8" refractor is a prime target for "fun" – an attempt to protect it with a bicycle cover hasn't lasted very long, though this was due mainly to blustery weather.

### Engineering work on the Thornton

AWR's Alan Buckman visited us to solve the focus problems on the 24" telescope, and faults with the declination encoder information and sense of direction. When,





**Figure 12** The 8" refractor pier is an easy target for jokes or worse... the awkward shape makes it difficult to adequately protect.

after his departure, we had a chance to test it on sky it was worse. This meant that the progress made in 2018 was largely undone.

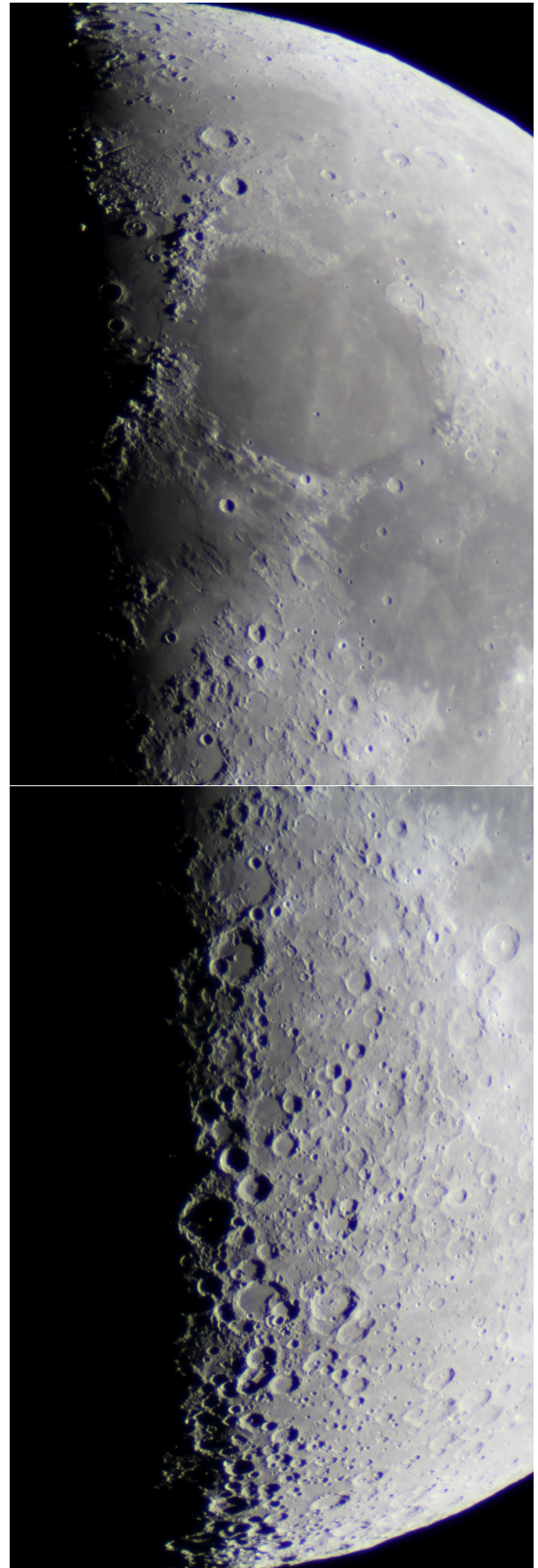
Further problems arose with the UPS failing (Richard Oppenheimer kindly donated a spare one he happened to have), the electro-magnetic clutch brake failing (which we replaced, at significant cost), and the dome tripping power.

### **Maintenance of the Grubb and its dome**

The 12" refractor is Keele Observatory's single most important item, making its protecting dome the most critical part of the Observatory building.

While the telescope is in a good state (with minor improvements possible in future), the dome control is at risk of failing and needs to be replaced before it does so. We have started this project under leadership of Alan Bagnall and we are confident it will result in safe and reliant operation. A separate issue is the structural integrity of both the dome and power rail, the latter showing signs of "dead spots" that require manual remediation.

## **Research activities**



**Figure 13** Moon in the 12" refractor (Steve Doody).

Steve Doody obtained stunning images of the Moon at the 12" refractor. Sadly, for us, he has since migrated to the North-East coast, from where he has been sending us increasingly impressive deep-sky images.

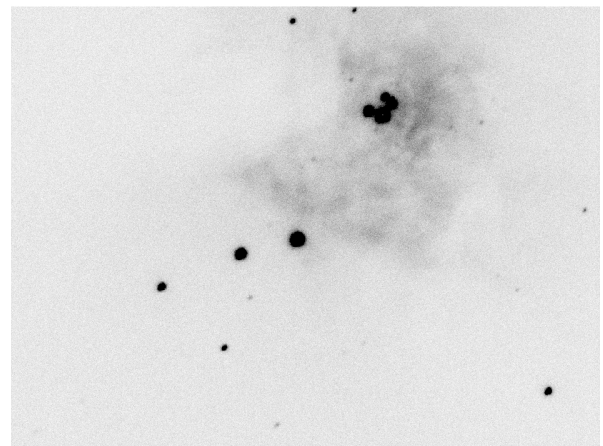
### Undergraduate laboratory work

The second year of undergraduate laboratory classes in observational astronomy were again a resounding success. Imaging and spectroscopy were done using the 12" refractor and the 8" and 10" Schmidt-Cassegrain telescopes. Images were obtained of the Moon, Mars, the Orion Nebula and the Sun with the ATIK-314.

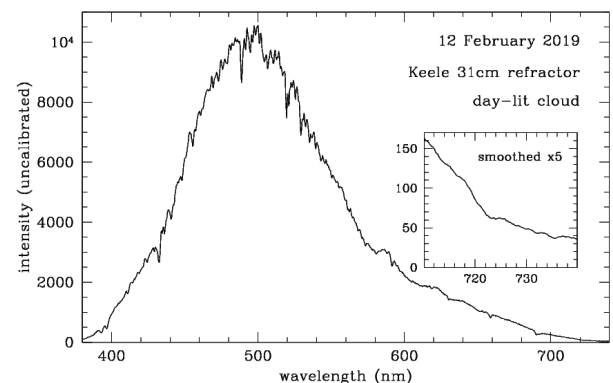


**Figure 14** Areas on the Moon, imaged through the 12" refractor with the ATIK-314 camera, during the undergraduate laboratory class.

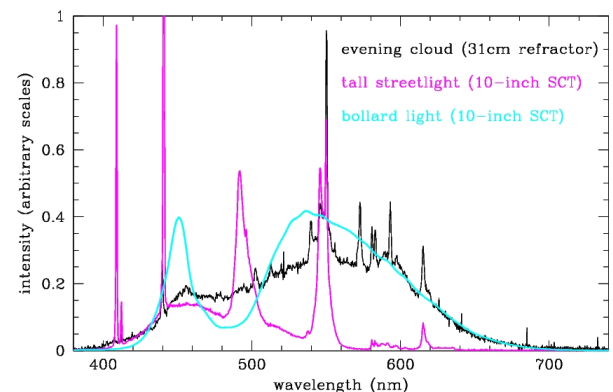
The weather was not always kind or dark, and these opportunities were taken to improve our understanding of the effect of the Earth's atmosphere and in particular artificial lighting. Different light sources produce different spectra, some of these are very local lamps but others may be more distant but light up the sky.



**Figure 15** Orion Nebula imaged through the 10" SCT with the ATIK-314 camera, and a mere 1 second exposure, during the undergraduate laboratory class.



**Figure 16** Spectrum of the Moon, which is essentially the Sun's spectrum but imprinted upon which we see absorption arising in the Earth's atmosphere, such as water vapour around a wavelength of 723 nm.



**Figure 17** Spectra of various artificial light sources.

### Publications

In 2019 we published 30 copies of the ninth annual report:

"Keele Observatory Annual Report 2018", J.Th. van Loon (ed.). KOP 10

Our observation of WASP 58b from 2016 was offered to The Sentinel but not used – an internet search returns pest control.



## Outreach activities

We welcomed at least 2530 visitors to the Observatory but also participated in three off-campus events, thus reaching about 3700 people in total.

We hosted two special events, the first one the United Nations International Women and Girls in Science Day, on the 11<sup>th</sup> of February from 4-8pm. We had participation from Life Sciences (brain tissue through a microscope), Geology (fossils) and various Physics experiments, and were lucky to see the Moon. At least 80 visitors enjoyed our first such event, which was covered by BBC Radio Stoke.

On the 11<sup>th</sup> of November around lunch time, Mercury transited the Sun. Despite the poor weather a few of the 25 visitors saw it. It also attracted media attention with on-site reporting by BBC Radio Stoke and coverage on Cross Rhythms radio and The Sentinel.



Figure 18 BBC Radio Stoke reporting on site during the Mercury transit.

## Media activities

Keele Observatory appeared on TRT World, France 24 and BBC News television and BBC Radio Stoke and Shropshire for various news items as well as events we hosted ourselves. We also accommodated a media student filming for their assignment.

We also participated in a couple of social media clips (on YouTube), and we are making sporadic, targeted use of our Twitter account: follow us on @KeeleObs

## Public viewings

Over 1000 people visited the Observatory this year on its free Tuesday evenings' and Saturday afternoons' public viewings. About one in every three sessions the weather was good enough for at least some celestial viewing. We made a special exhibition at the occasion of the 50<sup>th</sup> anniversary of the Apollo 11 Moon landing.



Figure 19 Moon through 12" refractor (Nikki Miller).

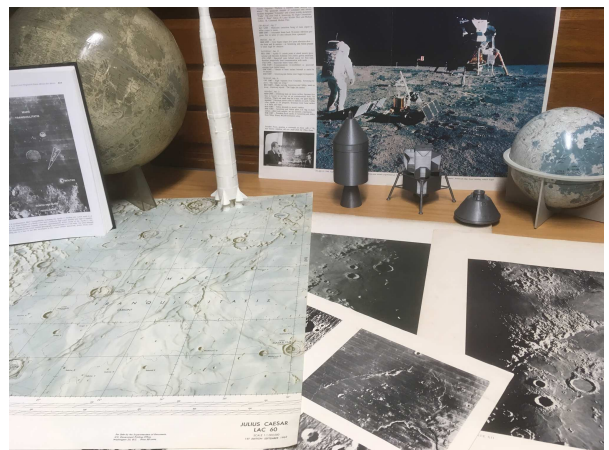


Figure 20 Apollo 11 exhibits for the occasion of the 50th anniversary of the Apollo 11 Moon landing.

Quoting one of the session reports: "A new student and her mum arrived [...] Apparently the Observatory was a major decider in her choosing Keele to do maths."





Figure 21 Steve Doody peering through the 12" refractor during a visit he hosted.

This proves that "soft untargeted outreach" can also result in returns the University is interested in.

### Schools and teachers

We hosted 8 visits by schools, reaching 410 learners and 33 teachers, and the School Physicist Of The Year (SPOTY) awards, with 80 attendees.

Open Days for prospective students, and visits by international students, Keele Physics or Astrophysics students and work experience students, attracted 400 visitors.



Figure 22 Children at Ellison Primary School study the Moon from all sides after having watched it first hand through the 13" Dobsonian telescope..

We took the new 13" Dobsonian telescope and various items to Ellison Primary School in Newcastle-under-Lyme for an evening under the stars, which was attended by about 100 including the Moon.

### Community group visits

We had 18 visits by societies and scouting groups, about 165 adults and 240 children.

We participated in two major events off campus: European Researchers' Night at The Potteries Museum, which saw about 1000 visitors, and Stoking Curiosity in Stoke City, where we only counted 50 visitors as the location was hidden from street view so few people knew about it.



Figure 23 At the European Researchers' Night (top) and the Stoking Curiosity festival (bottom).

### Adult Education sessions

The 'Astronomy Club' met ten times, with an average attendance of eight, to discuss astronomy or spaceflight related news in a friendly, informal atmosphere. It is led by Paul Klimczak and maintains a Facebook page: [KeeleAstrophysicsDiscussionGroup](#)



