Keele Observatory Annual Report

2023

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Figure 1 (From left to right:) Camilla Jones, Jacco van Loon and George Abraham at Cannock Chase.

From the Director

It is with immense sadness that our hopes and prayers were crushed when St.John Robinson succumbed to a woefully unfair illness, after having been such an enduring feat of engineering prowess. We've lost a legendary custodian of the observatory.

Poignantly, this happened just when we were celebrating the life and works of the Observatory's founder, Ron Maddison, whose ashes were reunited with the fertile soils of Observatory Hill.

Figure 2 Memorial to Ron Maddison, January 2023.

Autumn brought the fall of another leave from our heritage tree, Keith Heron, and the year ended with more concerning news which thankfully (miracles happen) the new year brought to a happier ending.

While the good olde 24" telescope is going from strength to strength – two steps forward despite one step back, but inching towards full and reliable use – recovering the purchased 20" telescope is becoming less likely and 2024 will be `make or break' as to whether the University is willing and able to challenge Orion Optics.

In so many ways, 2023 has been a trying and unjust year, but we choose to focus on the positives and assume that the future is yet unknown. The world will go on without us, but we can join it for a ride.

Jacco van Loon

Administrative report

Personnel

The Keele Observatory is operated and maintained through a partnership of the School of Chemical and Physical Sciences and a group of volunteers and students.

In 2023 the team composition was: James Albinson, Alan Bagnall, Dave Caisley, Ian Johnson, Paul Klimczak, Richard and son Patrick Oppenheimer, the late St.John Robinson, Matthew Stretch and John Webb, with Honorary Member Stephen Doody still actively involved from a distance.

Natascha Dury returned with a vengeance before returning home. Dan Pearson proved the greatest new asset, while George Abraham, Ava Harris, Reuben Stott, Jamie Ramsey, Cas Redfern, Thomas Hale, Ben Cahill and Martha Heap (from Philosophy) made occasional appearances.

Equality, Diversity and Inclusion

We embrace diversity and inclusion, and actively promote these values and seek to embed them into our culture. We welcome new members onto our team, especially to improve the representation balance.

Figure 3 Women & Girls in Science Day 2023 poster (design: Jacco van Loon).

We organised a fourth edition of a multi-disciplinary event celebrating United Nations International Women and Girls in Science Day, on the 11th of February, for the first time in a venue on the High Street of Newcastle-under-Lyme in collaboration with the Appetite local Arts charity.

Aside from continuing working with the local Higher Horizons team to reach underprivileged schools and children (including the National Saturday Club), we consolidated links with an Islamic school in Cobridge, had return visits by schools who cater for pupils with specific educational needs, and welcomed all-women groups.

James Albinson made the insightful suggestion to use the tabletop Meade ETX telescope for wheelchair bound visitors.

We more actively and prominently used the noticeboard in the entrance hall to promote things like Black history Month and Trans Awareness Week.

We have seen an increase in people who had "bought" a star and would like to spot it through our telescope. Usually this is in commemoration of a beloved family member, and if done well it can create positive links between humans and the Universe. But commercialisation and appropriation of celestial objects raises ethical questions around exploitation and neocolonialism, and we do not support it.

Sustainability

Being aware of the fragility of life on a planet in space, we are conscious of the broader aspects of sustainable operation of an observatory, from nourishing a team to reducing its carbon footprint.

The Nurture project is one to stay, maintaining the wildflower meadow in front of the Observatory. While the trees may hinder our views, we cherish the nature that surrounds us.

For the second time we ran a Dark Skies event for Girlguiding and Scouts at Cannock Chase. While Beaudesette isn't the darkest of sites, raising awareness of light pollution and the value of seeing stars is an important way to empower young people to shape their own destiny.

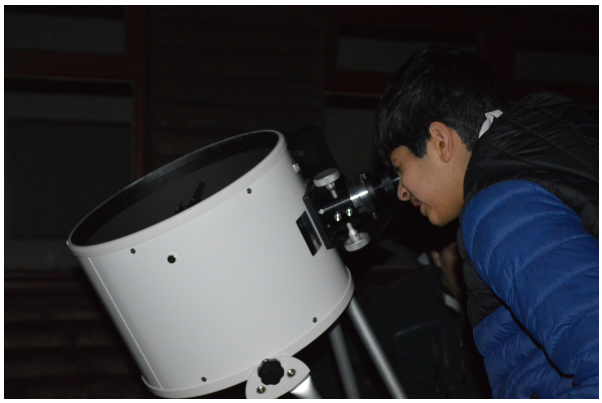

Figure 4 Looking into space at Cannock Chase.

Finances

The Observatory has been taken through a rigorous audit and some changes have been agreed to its financial management, moving away from a system of trust and efficiency, to one that is more bureaucratic, restrictive, costly but more compliant with University procedures. This has already had an impact – we have stopped buying Rachel Ignotofsky postcards of women scientists to inspire girls to take up science, and we have not made various repairs or improvements. All our income now enters the School's account, which is reset at the end of a financial year. We receive fantastic help from Monica Heaney in the School but will have to plea for every expenditure.

Table 1 Financial account for 2023.

1. Balance brought forward	£7987
Income	
School activities	£374
Community group events	£785
Donations	£212
2. Total income	£1371
Expenditure	
12" dome control upgrade	£288
24" dome control upgrade	£78
24" recoating	£100
Printing annual reports	£131
Taxi for Allan Chapman	£500
Miscellaneous	£32
3. Total expenditure	£1128
Surplus (items 1 + 2 – 3)	£8229

Table 2 Budget for 2024.

1. Balance brought forward	£8229
Income	
Hospitality	£1000
Donations	£100
2. Total income	£1100
Expenditure	
17" Hindle resurrection	£1000
General maintenance	£100
3. Total expenditure	£1100
Surplus (items 1 + 2 – 3)	£8229

Despite a significant allocation and indeed expenditure for Ron Maddison's memorial, we made a healthy surplus. The balance of income shifted from last year to community visits rather than schools; the total was fairly similar and as high as ever. This was despite various events delivered free of charge. A few visits did not happen due to snow, lack of capacity at their end or inability to come to a mutual agreement.

We would have had to call on our reserves to finance the recoating of the 24" primary mirror (£594) if it wasn't for the fact that Galvoptics never responded to our repeated reminders regarding payment.

We also benefitted from donations, notably by the Maddison family (Browning 6" reflector, books including a visitor book with Princess Margaret's signature, a small iron-nickel meteorite and some important paperwork regarding the history of the Observatory), the 10" Watson reflector from the BAA via the late St.John Robinson along with a large collection of magazines and books, more books by Mrs. Wood, a portable laptop projector with HDMI cable by AVS, the replacement of the 12" dome entrance door by Estates to comply with fire safety standards (but requiring some modifications to allow the dome to rotate without clipping the door's self-closure mechanism) and refurbishment of the old gent's toilet into a kitchenette and the old ladies' toilet into a storage cabinet paid for by the School (to the tune of ~£10k).

The budget for 2024 is set based on a conservative estimate of income, more restraint on expenditure but an allocation to resurrect the 17" Hindle into operation.

Infrastructure and equipment

As mentioned, we now have a kitchenette, greatly improving safety and comfort, and a more appropriate storage cabinet.

There have been a lot of changes to the IT infrastructure, though, some of which have upset the weather station data feed for display on the website. Barry Smalley and IT Service have worked to reestablish that link, at least at the time.

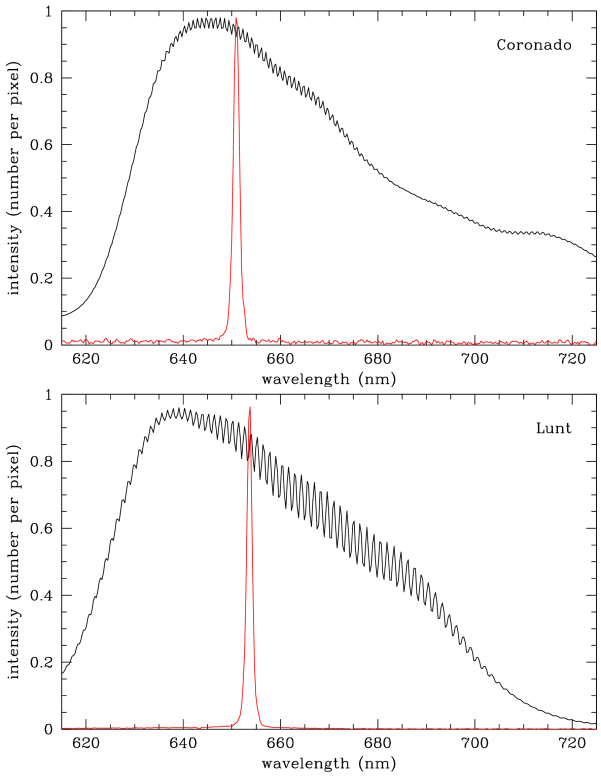

Figure 5 Throughput spectra of the étalon (in black) and with the order sorting filter in (in red), measured for Coronado (top) and Lunt (bottom), respectively.

We serviced the CCD spectrograph, cleaning the slit of grid and securing the slit view mirror in place. As part of the student lab, we then used it to measure the solar telescopes' étalons and order sorting filters (figure 5) – they look quite similar despite the difference in engineering; the Lunt produces somewhat stronger fringes and its blocking filter seems a tad narrower.

The lab also proved useful in determining properties of the ATIK-11002 camera: it has a high bias level and significant dark current, and on the 12” refractor offers a 20’ x 30’ view. The filter wheel needs its filter positions confirmed or remapped.

We had a couple of small items gone walkies: a smiley bouncy ball and blue-tac Earth – which we replaced from spares – and a little compass. The latter was found among the pages of the Apollo Remastered book, by which time James Albinson had already furnished a modern replacement.

We also threw away stuff, in a never-ending attempt to keep the place tidy (helped by the refurbishment). A lathe and drawing board were removed from the workshop, and in the 24” control room old computers were identified for disposal and the printer was discarded.

Engineering work on the Thornton

Figure 6 The Orion Nebula (M42) imaged with the 24" reflector through LRGB filters by Paul Klimczak on 14 February 2023, processed by Steve Doody.

Paul Klimczak demonstrated the potential of the 24” reflector. Figure 6 shows the result of a large number of short exposures in the Luminance filter (170 two-second and 162 ten-second) and 20 two-second images in each of the red, green and blue filters. These were then pre-processed (weighted stacks, image alignment) and post-processed (dynamic background extraction, blurring, denoising, intensity

Figure 7 Paul Klimczak servicing the FLI filter wheel.

scale stretch and balance) by Steve Doody using PixInsight. A final version once bias and flatfield calibrations had been obtained and applied can be seen on the front cover of this year’s report. The short exposures helped against the brightest stars creating diffraction and CCD saturation artefacts,

but focus can be improved and with more exposure time in colour and narrow-band filters (as the FLI filter wheel has now been commissioned) an even more stunning picture is waiting to be made.

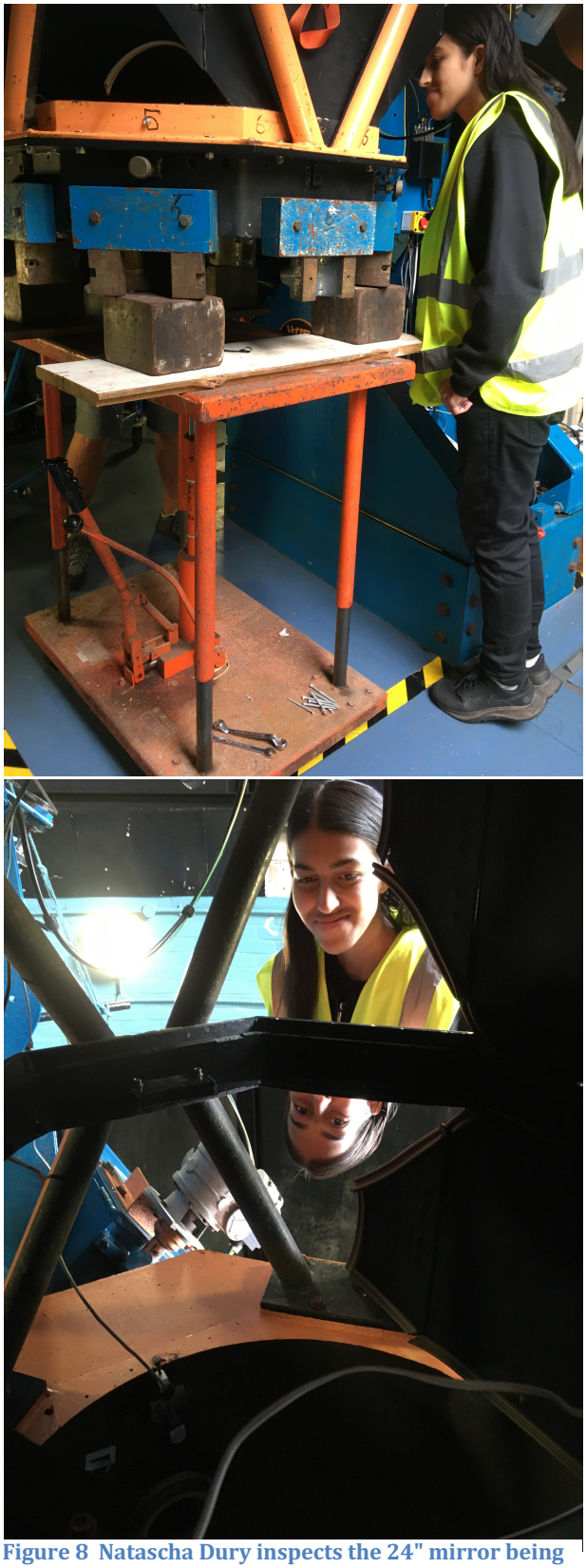

Figure 8 Natascha Dury inspects the 24" mirror being reinstalled after having been recoated by Galvoptics.

It gave us good reason to have the primary mirror recoated. It did look very degraded indeed and we weren't terribly upset when Orion Optics announced that, after all, they were unable to recoat it. On a journey to (and in) Basildon, Essex, it went and back again after a month or two with a shiny aluminium coat protected by a silica layer. Galvoptics did a sterling job!

However, progress is still marred by events. While the dome motor finally was returned after a bearing failure, a lightning storm in Summer caused a factory reset and it took a considerable effort to restore the settings and regain reliable control. It is critical to have accurate records of these settings in case something similar happens.

Maintenance of the Grubb and its dome

The 12" refractor's dome control project was ready for installation. However, since it involves connecting up to high voltage power we decided that Estates needed to get involved. This considerably delayed matters. The "dead spots" also returned.

The replaced door initially had an overhead closing system which would be clipped (and destroyed) by the dome and this had to be removed. A door handle had to be added so the door could be closed and opened without having to use the key.

The interior of the dome is in need of a lick of paint, colour yet to be decided.

Research activities

Figure 9 Moon halo on 25 November (Ian Johnson).

Figure 10 The Green Comet on 25 January imaged with a Nikon DSLR and an 8" SCT (Jacco van Loon).

Plenty of celestial spectacle was witnessed in 2023. Ian Johnson recorded a splendid halo surrounding the Moon, and the Green Comet was a binoculars object at the start of the year. Venus stole the show in Spring.

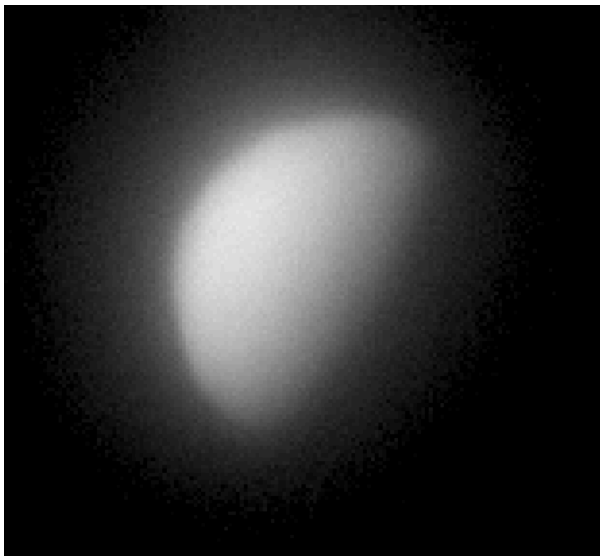

Figure 11 Venus on 9 May through the 12" refractor (Jacco van Loon).

Undergraduate laboratory work

As already mentioned before, the Year One laboratory in observational astronomy not only trains undergraduate students to use our equipment to observe astronomical phenomena, but it also provides us with an opportunity to do tests and calibrations.

The Moon was imaged again though obtaining the best focus is time consuming. Likewise, while the Great Red Spot and some structure in its southern equatorial belt were visible on Jupiter, allowing us to see it rotate, much better images ought to be possible with optimal focus and `lucky imaging' techniques. Tracking with the 12" refractor is inaccurate for more than ten seconds; this remains to be investigated.

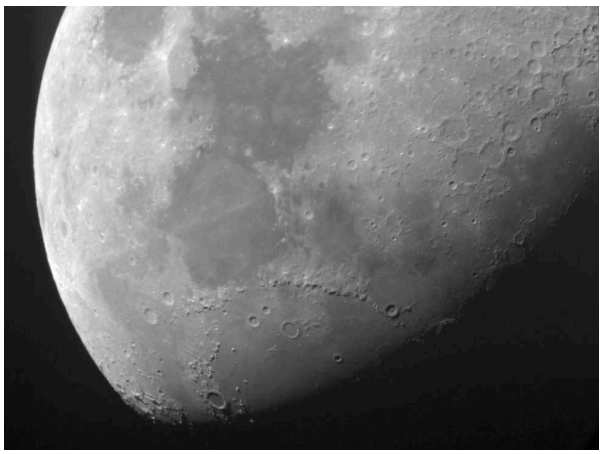

Figure 12 Moon with ATIK-11002 and 12" refractor (0.01 s exposure).

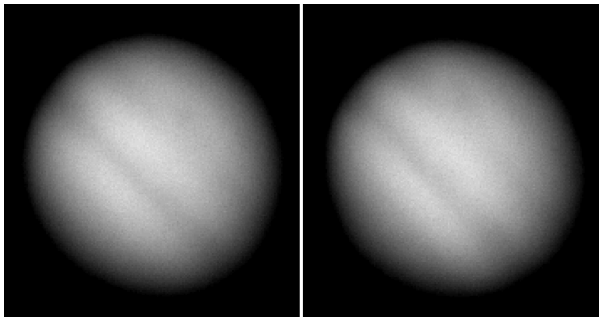

Figure 13 Jupiter on 23 January with ATIK-314 and 12" refractor (0.05 s exposure), half an hour apart.

Spectroscopy is more forgiving of focus perfection and seeing conditions. This made it possible to obtain a spectrum of Jupiter (and Betelgeuse) through the 10" Newtonian on the C-GEM mount, and of the Orion Nebula and a few famous bright stars through the 8" SCT.

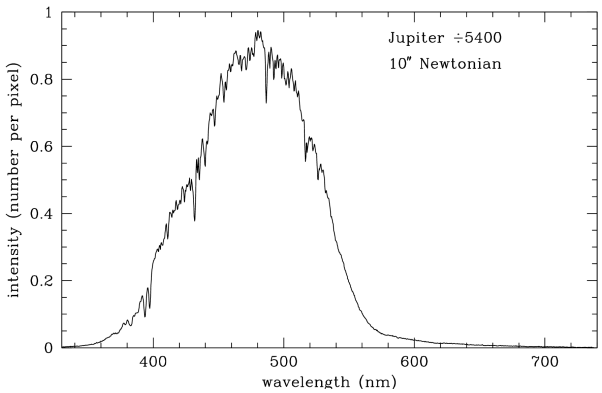

Figure 14 Spectrum of Jupiter with 10" Newtonian (100 s exposure).

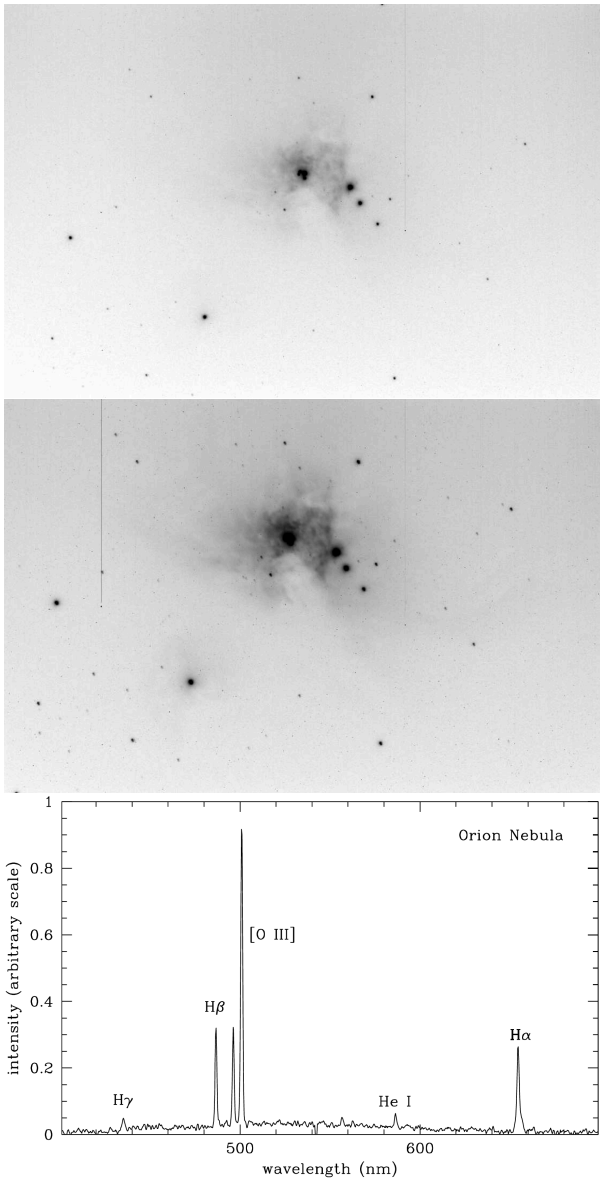

Figure 15 Orion Nebula images with the ATIK-11002 and 12" refractor (top: 10 s; below: 30 s) and nebular spectrum with ATIK-314 and 8" SCT (120 s exposure).

The Sun was imaged with the 4cm Coronado Hα telescope but, again, a single exposure never reaches its full potential.

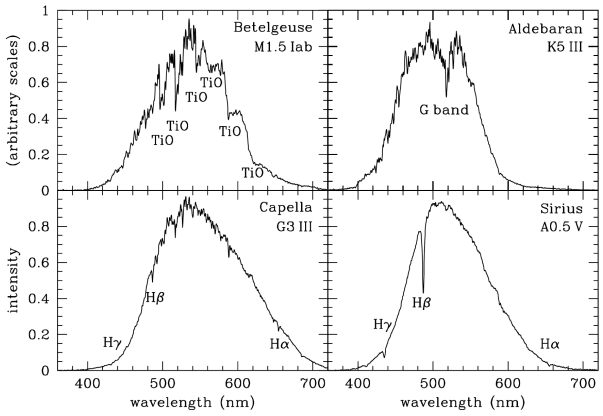

Figure 16 Spectra with 8" SCT of Betelgeuse (60 s), Aldebaran (60 s), Capella (20 s) and Sirius (10 s).

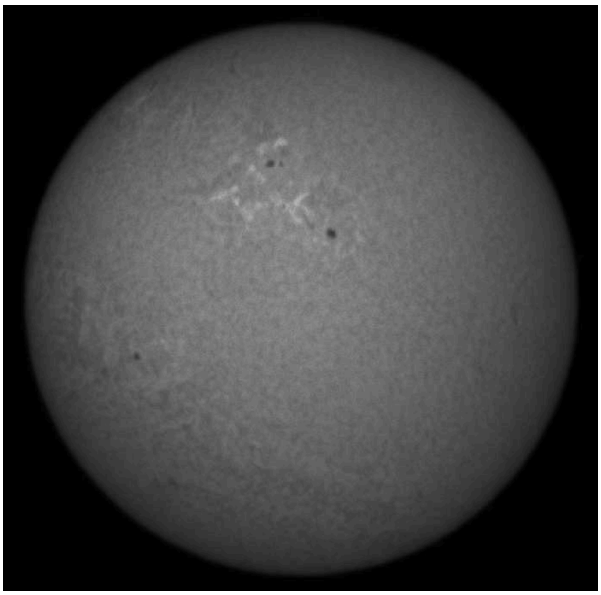

Figure 17 Sun on 23 March with the Coronado solar telescope (0.01 s exposure).

Publications

In 2023 we published the following annual reports, 20 copies each except for the 2019 Ron Maddison memorial issue (50 copies):

"Keele Observatory Annual Report 2019", J.Th. van Loon (ed.). KOP 11

"Keele Observatory Annual Report 2020/1", J.Th. van Loon (ed.). KOP 12

"Keele Observatory Annual Report 2022", J.Th. van Loon (ed.). KOP 13

There are ideas around the publication of more historical and technical details of some of the more interesting telescopes.

Outreach activities

We expanded our reach to 3900 people, 2600 of whom visited the Observatory.

On the 22nd of January we held a memorial event in celebration of the late Ron Maddison. About 30 people including his widow Margaret and son attended a private session. A commemorative plaque and photo were unveiled in the entrance hall, Ron's ashes were laid to rest on the meadow, and speeches were given by the University Chaplain Stephanie Couvela,

Ron's niece, Jonty Powis, Professors Nye Evans and Watson Fuller, and Observatory Director. This was followed by a wonderful public lecture by Allan Chapman, who we were lucky to receive after recent illness. We had hoped for a larger audience than the 25 who enjoyed it, some half of those who had reserved tickets didn't show up. Somewhat independent from this, but in a way related, we collaborated with Alan Scott to identify eclectic space imagery on Patrick Moore's slides from his 1991 Ron Maddison lecture.

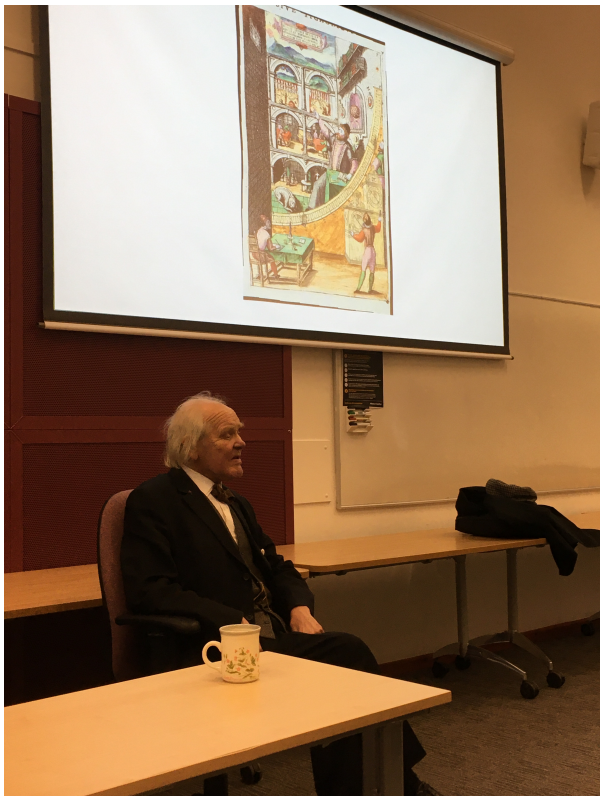

Figure 18 Allan Chapman explaining how astronomy was funded through the ages (much of it about beer).

Figure 19 Maddison Jr and a much later descendant at the helm of Ron's prized acquisition.

Figure 20 United Nations International Women and Girls in Science Day at Newcastle Common.

For the fourth time we organised Women and Girls in Science Day, on the 11th of February, but for the first time in Newcastle-under-Lyme in the Newcastle Common venue of Arts charity Appetite. Working with visual artists and scientists from across the Faculty of Natural Sciences this was a fantastic collaboration and went down well with the public – nearly 200.

Mere days later we were at Cannock Chase for a Dark Skies activity for 80 Girl Guides (and other scouts) in collaboration with CPRE countryside promotion. In May we offered views of the Sun, Moon and Venus through an 8" SCT from the rooftop

of Hanley's YMCA for Pint of Science. And in June we were at Bunbury's Village Fête among a thousand visitors but little Sun.

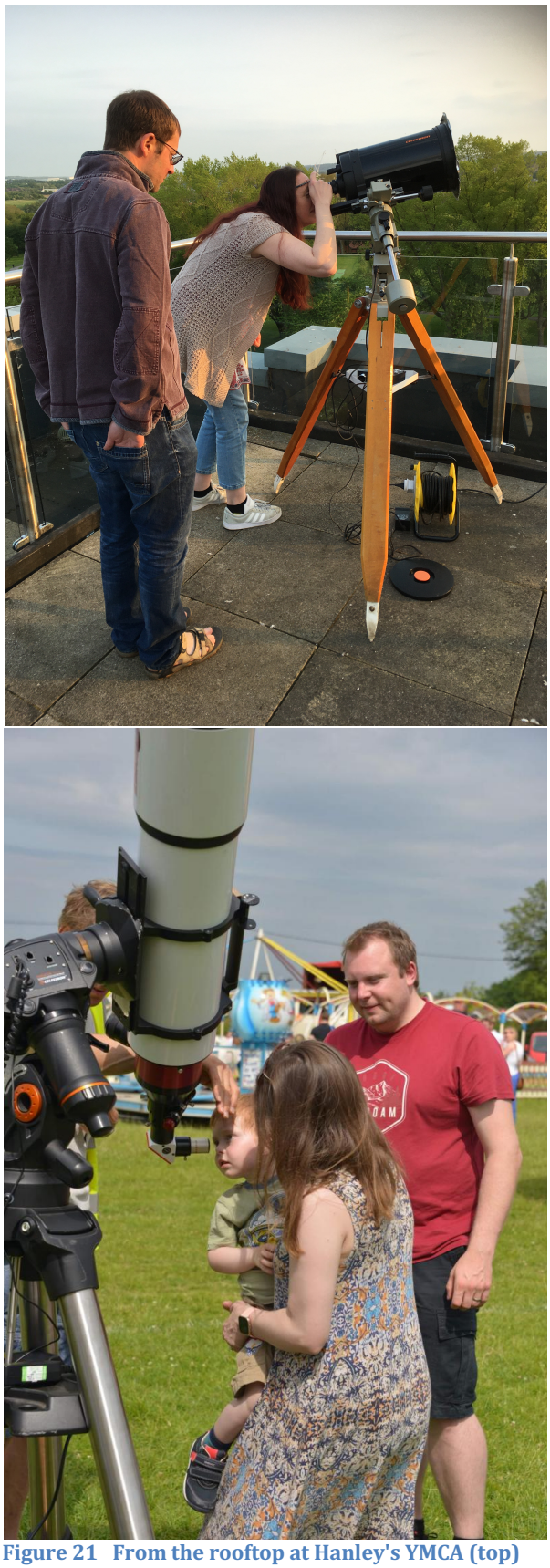

Figure 21 From the rooftop at Hanley's YMCA (top) to the fields of Bunbury's Village Fête (bottom).

Media activities

BBC Radio Stoke was our main outlet again, but we also welcomed back Shefali Oza, for a live interview for BBC Midlands Today. The Sentinel featured us, too.

We continued to sporadically tweet – this is now called `X' – for instance with regards to the Artemis crew, advocating for still better gender balance.

Public viewings

Over 1050 people visited the Observatory this year on its free Tuesday evenings' and (to a lesser extent) Saturday afternoons' public viewings. These are offered for free to ensure it is accessible to all.

Schools and teachers

We hosted 11 visits by schools and paid a return visit to an additional local school, reaching over 300 learners and about 35 teachers. This was a bit less than expected. To confirm our commitment to high quality experiences for young visitors we renewed our Children's University destination.

Open days for prospective students, some teaching activities, and sessions with students from the Astrofiz society and the Keele Postgraduate Association attracted well over 400 visitors, with in addition 60 alumni visiting us on Keele Day.

Community group visits

We entertained no less than 28 community groups on bespoke occasions – scouts of diverse plumage and age but also women's institute and policewomen. This resulted in interactions with nearly 500 children and 200 adults, and lots of positive feedback.

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Keele Observatory – https://www.keele.ac.uk/observatory

Front cover: LRGB composite of the Orion Nebula with the 24” reflector on 14 February 2023 (by courtesy of Paul Klimczak, the observer, and Stephen Doody, who processed the data)