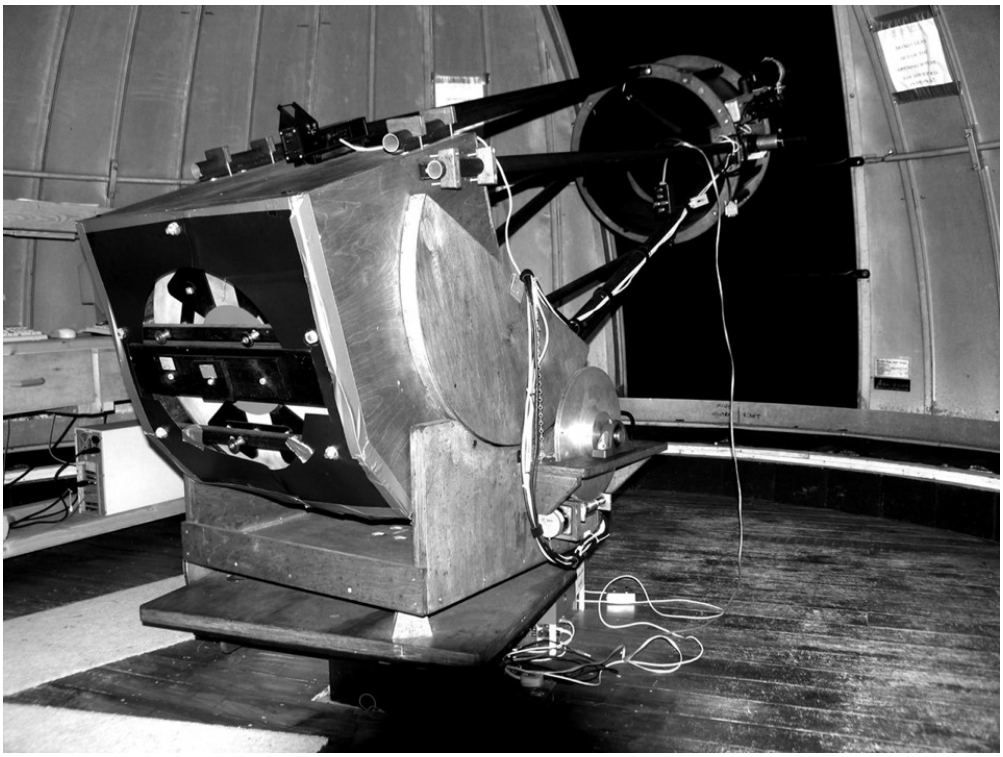
Breckland Astronomical Society

Affiliated to the British Astronomical Association and the Federation of Astronomical Societies

EXTRA TERRESTRIAL

Newsletter June 2021



Registered Charity no, 1044478

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Copy is always needed for this newsletter. Articles with an astronomical theme are welcome but anything of likely interest to the membership will be considered. Text or Word documents preferred but handwritten submissions also welcome.

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Mick Ladner is visitor organiser. **visitors@brecklandastro.org.uk**

Chairman's Notes June 2021

The weather has been a bit rainy but a few clear nights have been available to observers and imagers during the new moon period in May. The waxing crescent moon orbits up at a steep angle to the western horizon prior to solstice and rises late when a waning gibbous phase. The opposite happens after solstice, shifting the 'dark fortnight' so that the waxing crescent sets earlier becoming less of a problem for deep-sky astronomers.

In early May DASH invited us to a meeting to discuss the latest Sizewell C lighting proposal. While in their area of Suffolk, it affects the Star Party site. Their Lighting Engineers, designers, and architects had listened to all concerns for such a delicate area for nature. Lighting temperature will be low, all will be fully shielded, all will be only if and as bright as necessary. Surface reflectivity was brought up by Jim at DASH and will also be considered. It is only a shame that their consideration does not apply to most private development, such as proposed industrial developments toward Snetterton. Lighting need not be polluting. This is why the country needs a new Light Pollution Law, and we must hope the APPG on Light Pollution, initiated by Sir Martin Rees, Astronomer Royal and an MP, makes changes to law.

I had the opportunity to chat to Stephen Bumfrey on Radio Norfolk on Thursday 13 May, a second recording after the first (and better) disappeared taken that morning. I attempted to describe the wonders of the universe, and managed to advertise the society.

Images

We have had some spectactularly deep images of galaxies rolling in this May. I managed to capture the Antennae galaxies, low in the South this year, with the tidal tails of stars flung out into empty space just visible. M108 and M97 and a spectacular deep image of M106 and satellite galaxies was captured by Malcolm. Mick also captured this galaxy in incredible depth, a best for his set up so far. I also went for the same galaxy on the 20". All of us managed to resolve very distant background galaxies, such as a line of galaxies of 19th-20th magnitude, and a 20th magnitude quasar. The nights have been good in the overhead skies. Neil Wilson has joined us on facebook and had a both incredibly sharp and deep image of M51, the Whirlpool galaxy, a favourite at this time of year. I prefer the rarer southerly galaxies, such as M104, the Sombrero, as captured by Mick.

In the Sky

A bright meteor was seen burning up and breaking into pieces on Wednesday 12th.

Venus and Mercury have been followed and photographed. Venus is very low all this year, but Mercury was quite visible once dark enough.

Nova Cas flared again and Chris Bailey managed a spectrum of it, with his new BK7 wedge on the SA100 spectrograph. There was Fe II (iron ion) lines in the spectrum as well as some Helium still. It was vaguely visible from the observatory field at 5.6 magnitude, but blurred in with the star 4 Cas and M52 as an averted vision patch of light. It is just beyond 4 Cas going away from the main W.

There is a (very) partial Solar Eclipse on the morning of Thursday June 10, conveniently timed from 10 am – 12:30. While we're not running an event as some of us have job commitments, this is something to look out for and watch wherever you are.

WARNING do NOT look at the sun through binoculars or a telescope. Only with a specifically safe filter that securely fits over the FRONT of a telescope, can it be viewed directly. The simpler way is to project the sun, but this can also be fraught with danger, eg. the finder scope can easily shine into the eyes, any other scopes attached should be capped or removed, and the beam must be carefully steered. If you have eclipse glasses in good condition with no pinholes they will also enable direct viewing.

At the observatory:

May 23 A tidy up and clear out session where we look at how we can store some of the new stock, and what is needed. A spring clean is really needed. We also needed the allotmenteers to chop the hedge earlier in spring, but that will have to wait until winter, as some whitethroats were heard singing in the hedges, perhaps nesting nearby. The hedge to the South of the observatory also is poking up above the south horizon. The elder will be out soon. Ahem, sorry I digress… this isn't a bird and tree club.

Tuesdays: The observatory is open for 30 outside and 6 inside, but we must be vigilant with protecting each other and have done a risk assessment for operating at the observatory. Outside is mostly fine, inside requires ventilation and caution still.

Friday May 28 – open evening. We have had some interest so far. June and July are too light, but the last Friday in August looks good for a next public open night, all being well with regard to movement.

Meetings in the Hall

We have news that the Recreation Centre Hall can hold 40 people, so we can run talks (we don't usually get over 40). I am thinking we should include those that have joined us on Zoom and Google Meet over the last year or so, and will try to set up a device to stream from the back of the hall. The next talk in the hall is Andy Jones, our dedicated treasurer and membership secretary, and will be (in person or not) followed by the AGM. I will get the documents out to members in due course.

Star Party at Haw Wood reminders of the dates are Mon 1 Nov - Sat 6 Nov – Mon 8 Nov and Thu 21 Apr (2022)- Sat 23 Apr – Thu 28 Apr

We would like help with finding speakers and are looking for the right person to volunteer as a committee member to make 6 of us – this improves our decisions and discussions.

Don't forget Hingham road is due to be closed from mid June-August, and Church Street (the road to Breckland Lodge/Hargham) is closed at the moment, due to the roundabout installation.

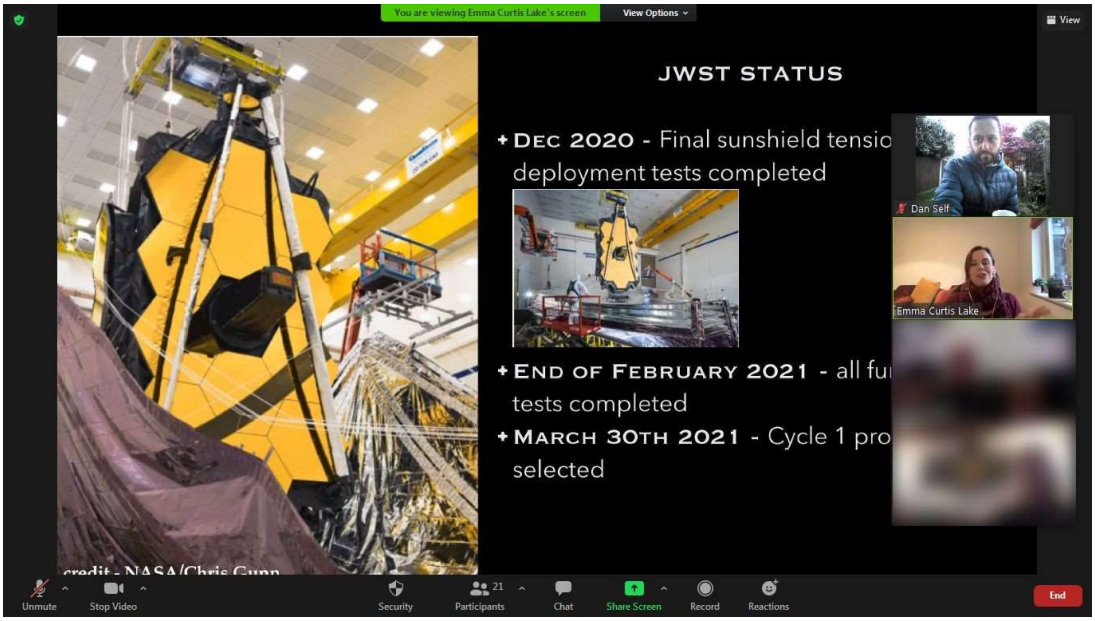
Talks

It was a great talk on the Friday in May via Zoom. We move over to Google Meet next month for Russell Parry (swapped June/July) the author of The Appley Bridge Meteorite.

The URL (webpage) to go to is https://meet.google.com/aay-cemh-nbh

Dr Emma Curtis Lake told us all about the James Webb Space Telescope, to be launched in October and ready to go late 2022. She was super keen to talk to us all and researches very early epoch galaxy formation (the mysterious bit, we can barely see.

Firstly it was nice to hear Emma had offered to give us a talk. It is pleasing to hear from someone who works full time in astronomy and Emma certainly didn't let us down with her extensive knowledge. I had many questions of course and the talk made me appreciate the difficult and careful work Emma does with regard to analysis of ancient galaxies from limited data.



The James Webb is a showpiece and is worth knowing about its importance, we learned about things such as its final tests, its journey through the Panama canal, and the colossal size. Once deployed at the Lagrangian point, the fine multiple shields unfold and stretch and separate into 5 layers. The mirror unfolds from three pieces and it has steerable mirror segments. It can see well into the infra-red and reaches the red end of the visible spectrum. I think many of our members thought the detail about the spectral bands was the point where we really learned about its purpose and capability, so well done Emma for describing that well and not glossing over it.

The talk was a little shorter than we usually have, she packed a lot in to that time. And that's why we had plenty of time to bombard her with questions! Emma was very happy to give full and detailed answers to all of them. For instance, there are not many O type (hot) stars in our galaxy. The JWST is cooled to 7K in places by liquid Helium, which is amazingly due to last at least 10 years. The cooling is essential for the infra-red capabilities – this is the source of our ‘dark current’ for astro imagers. It will have many other uses, such as exoplanet studies, a huge ‘light’ grasp, and a slightly better resolution than Hubble. And don’t worry… it will produce pretty pictures like Hubble!

Events

JUNE 20th We are celebrating International SUNday on Sunday morning June the 20th where we will meet from 10 am at the observatory on Father's Day to observe the Sun safely. This is a public event, so please publicise. We will have the marquee up in case of poor weather and want to remain outside where possible to stay safe, but still have access to the indoor facilities when needed.

Dan Self

Astro Dairy

June 2021

2nd June	Last Quarter Moon
	Europa's shadow will pass across Jupiter 0150GMT
5th June	Io and Ganymede's shadows visible on Jupiter 00:30 GMT
6th June	Asteroid 3 (Juno reaches opposition Mag 10.1
9th June	1% crescent Moon rises on NE horizon
10th June	New Moon
	Annular Solar Eclipse. (1042 UTC.)
11th June	Mercury Inferior Conjunction
12th June	Conjunction Venus and Moon 0.7 Degrees
13th June	Topocentric conjunction Mars and Moon (1.9 Degrees)
14th June	Neptune Western Quadrature.
18th June	1st Quarter Moon. 2 Clair obscure effects, "Eyes of Clavius" visible after 2000GMT and "Plato's hook" occurs at 2200GMT
21st June	Summer Solstice.
24th June	Full Moon.
	Shadows of Io and Callisto visible on Jupiter 0500GMT
27th June	Peak of June Bootids Meteor Shower
	Peak of Tau Cetids Meteor Shower.

JOHN'S NEWS BITS
June 2021

NASA and ESA scientists have carried out a week long disaster planning exercise on the likelihood of an asteroid hit and concluded that a catastrophe is currently unavoidable! There is no technology on Earth that would stop a massive asteroid wiping out a continent or worse. A fictional asteroid spotted 35 million miles away would hit Earth in six months, the scenario was carried out at a Planetary Defence conference by the United Nations. Not to worry, it may never happens until it does. The conclusion was that we must develop a rapid response spacecraft with a nuclear device to veer it off its course.

Musk has finally done it! His SN15 Starship soared 6.2 miles on May 5th in a high altitude test followed by a successful landing. A must view on 'youtube' or 'spaceflight now'.

The JWST underwent final tests before shipping to the landing site to go on an Ariane 5 rocket. The 6.6 metre segmented gold mirror was deployed unfolding in a simulated test mimicking zero gravity. The launch date is due for October 31st 2021. However, latest news is that it could be delayed to November due to earlier scheduled launches of the Eutelsat Quantum and Star One D2 holding things up..

The mystery of Venus's rotation and has finally been solved. The dense clouds surrounding Venus has made it difficult to identify the length of its day and its inclination but new research by scientists at the university of California LA published a paper in Nature Astronomy that established fundamental facts about the planet. It's day is 243.0226 earth days and has an inclination of 2.6392 degrees compared to Earth's 23 degrees. The core is 3,500km across but not sure if it is liquid or solid. The data was obtained by bouncing radar off its surface over a 15 year period.

NASA's OSIRIS-Rex spacecraft fired up its engines on May 10th leaving asteroid Bennu for its 2.5 year long return to Earth along with rock samples of the asteroid's regolith..Due for arrival on Sept. 24th 2023 after orbiting the Sun twice..

NASA's Perseverance rover has deployed its robotic arm on the floor of the Jezera crater and is using the WATSON camera to take images of rocks.. The rocks will be examined to see if they are igneous (volcanic origin) or sedimentary caused by water. The latter would be the best for looking for biosignatures.

The Mars lander and rover of China's Tianwen-1 space mission landed on Utopia Planitia on Saturday may 15..The probe entered Martian atmosphere on Feb. 10 collecting data before releasing the lander and rover.
Quite a first for China as the last attempt 10 years ago failed as the Russian rocket blew up.

The controversy for measurement of the Hubble constant takes another turn.
So far two methods give slightly different values. One uses the CMB (cosmic background radiation) the other Type 1a supernovae.
Now astronomers at Stanford university are proposing a new method using FRBs (fast radio bursts). Early data obtained shows the constant closer to the CRB version but much too early yet to draw conclusions. Reported on ScienceNews.

Jeff Bezos Blue Origin 'New Shepard' crewed space vehicle is ready for bookings for the July 20 flight., Go to www.blueorigin.com for tickets, price to be announced. It will take up to six passengers 340,000 feet to the edge of space viewing through 6 panoramic windows. Warning: read the small pint very very carefully before applying. One seat will be auctioned off.

Reported on phys.org news, scientists in Darmstadt and Heidelberg have found stars in the dwarf galaxy Fornax with the highest content of the element Europium.
They have named these 'Europium stars' and have the highest content of the element ever observed.. these stars may provide an insight into the origin of heavy elements in the universe. Europium is used in control rods in nuclear reactors as they absorb neutrons, also in super-conducting alloys. Most important of all they are used for printing euro bank notes, they glow red under UV so hard to forge!!

Some amazing images from the Chandra X-ray telescope can be found on the Harvard centre for astrophysics site:
www.cfa.harvard.edu/resources/image-gallery

Interesting report in the Guardian, the US Defence Department is due to deliver in June the official report on UFOs. Also stems from a report on CB's 60 minutes that tackled the issue of the US government's reluctance to acknowledge UFO's existence. Barack Obama admitted that footage and records do exist. Interesting..

John Gionis

THE THOMPSON 30-INCH REFLECTOR AT HERSTMONCEUX

Gerald North

The East Gate barrier rises and I drive my car forwards onto the great estate that surrounds Herstmonceux Castle. Emerging through a tunnel of thickly planted trees and bushes my destination begins to come into view on the rising ground to my right. It is not the castle but a complex of six domes, with buildings connecting the back row of three domes, that is my destination. The Sun has set, the now darkening sky is deep blue and clear of clouds, and my anticipation of the pleasures to come mounts on that evening back in the 1980s. A couple of minutes later my car is parked around the back of the easternmost of the two blocks that connects the rear domes and I am letting myself in through the great doors.

Alone in the building, my footfalls echo as I walk further eastwards along the corridor until I get to the plate store. Retrieving my box of cut Kodak IIa-O plates, I then walk back along the corridor, and then further westwards, through the cylindrical area above which is Dome B, and onwards until I come to the staircase of the western block. Up the stairs I go, turning right onto a long gallery extending westwards, then passing a door labelled ‘Dome A Darkroom’ and walking towards the end of the gallery. Having just past a door to my right (the observer’s rest-room), I open the door facing me and step out into the evening air and onto the short walkway that connects to Dome A and its balcony.

In front of me is the door to Dome A. Opening it, all is dark inside the dome, so I step in, reach forward, and open the door of the little wall-mounted cupboard just in front of me. ‘Clunk!’, I’ve pulled the shiny handle and a quiet buzzing starts up and lights come on. I am in a small vestibule, not much more than a metre square. Facing me is the door to the mezzanine level. I will be going in there shortly. But for now I turn left

and start to climb the narrow staircase that curves around the inside wall of the dome. As I continue to climb the stairs up to observing floor, I can never resist turning my head to look at the several tons of light-green painted telescope that begins to come into view. The telescope is bathed in the light of the several strip-lamps brightly shining from the similarly-coloured painted interior of the great dome and the softer lights glowing from their flush fittings in the polished wooden-clad walls below. Stepping up onto the observation floor my first job is to cross to the desk, put down the box of plates, and use the telephone to let the security staff in the castle lobby know that I am on-site. “Hi Martin - it’s Gerald North in Dome A…”.

BEGINNINGS

Between January 1985 and March 1990 I enjoyed the enormous privilege and pleasure of being a Guest Observer at the RGO. I carried out many projects and observational tasks in my time at Herstmonceux, using a range of equipment, but lunar research which involved taking spectra of sunlight reflected from the Moon’s surface using the Thompson 30-inch (0.76 m) reflector featured often in what I did there.

At the time this telescope was configured to feed celestial light into a high-dispersion spectrograph - an instrument built external to the telescope and the parts of which spanned all three stories of the building. However, that configuration and use is very far from how that telescope started out…

CONJOINED TWIN

The Thompson telescope(s) resulted from a financial gift to the RGO from Sir Henry Thompson (1820 - 1904), a surgeon and an amateur astronomer. Back in 1896 when it was built and for the next half-century, the Thompson 30-inch reflector occupied the same German-style equatorial mounting as the Thompson 26-inch (0.66 m) refractor. The optical tube assemblies of these were situated at either ends of the declination shaft. You could say that one telescope acted as the counterweight to the other!

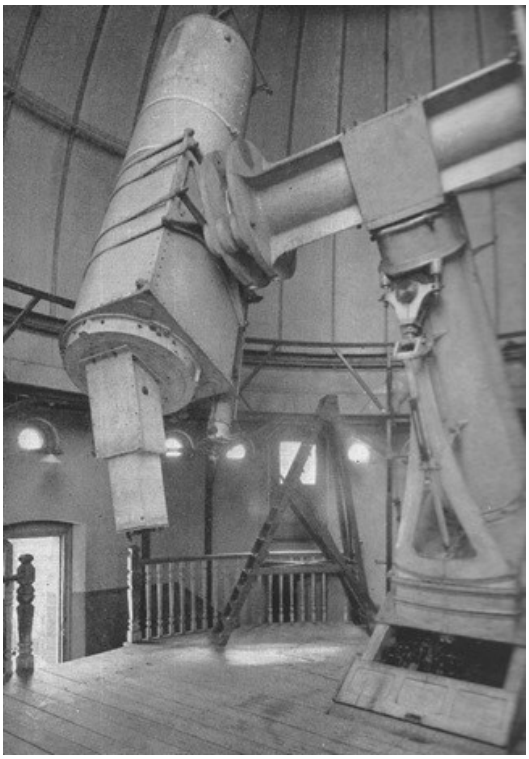


Figure 1 shows The 30-inch reflector as it was in its early years at Greenwich, the optical tube of the refractor being just out of shot. I have no further information about this poor-quality photograph but what appears to me to be in all likelihood a low-dispersion spectrograph is visible attached to the Cassegrain focus. The primary mirror is perforated so the reflector was presumably intended for optional use as a Cassegrain from the outset. Dr Henry C. King in his 1955 book *The History of the Telescope* states that the primary mirror was made by Dr Andrew Ainslie Common (1841 - 1903) but the rest of the telescope was manufactured by Sir Howard Grubb.

Originally this telescope was intended to be a general photographic instrument and so would mostly have been used in a Newtonian configuration. An internet source quotes the focal length of the primary as ‘11 feet 5 inches’ and that gives it a focal ratio of f/4.6. I have no information on the original effective focal ratio at the Cassegrain focus.

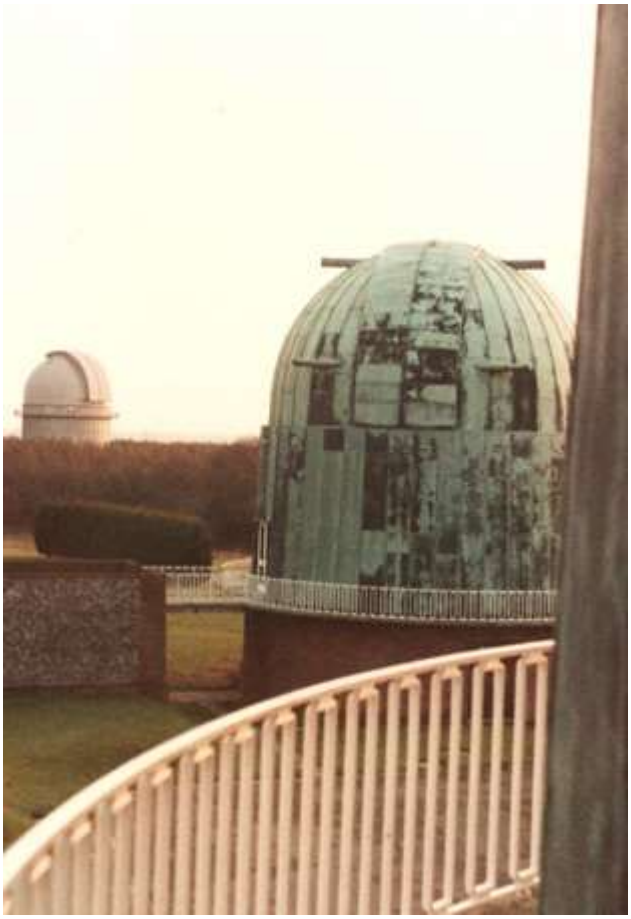
The Thompson reflector was extensively used to photograph comets, asteroids and planetary satellites. In the course of that work Philibert

Jacques Melotte (1880 - 1961) discovered the eighth moon of Jupiter, Pasiphae, with this telescope in 1908.

Just before the Second World War plans were initiated to relocate the observatory and its largest telescopes to somewhere that afforded better conditions than London. The War intervened and it was not until 1946 that the Admiralty chose the castle and its associated 380 acres of Sussex countryside at Herstmonceux. Setting up the new observatory was a very slow and drawn-out process and it took until the late 1950s before the main telescopes were up-and-running in their new home.

In the interim the 'Thompson twins' were split. The refractor remained on the equatorial mount, with a conventional counterweight added in place the reflector. Former Grub-Parsons employee Len Clucas has told me that he remembers seeing the Thompson refractor being worked on at the Newcastle factory.

Meanwhile a new fork equatorial mounting was built for the 30-inch reflector by Cox, Hargreaves and Thomson and this telescope (the Thompson reflector) was eventually erected in the 26 feet (8 metre) diameter Dome A at Herstmonceux. It became operational in 1952. Figure 2 shows a fairly early view of dome A, the copper sheets cladding the dome having only just begun to acquire their much lighter green patina. These first three photographs are by courtesy of the RGO (as are the diagrams presented later on as Figures 6 and 7) but the rest of them presented in this article were taken by me in the during the 1980s.



Originally the telescope tube was orientated in its new mounting with the flat face of the rear section (seen attached to the declination axis in Figure 1) facing downwards and the 6-inch acquisition and guide refractor (partially visible in Figure 1) moved to the top. Pathé newsreel footage exists online of this telescope in the late 1950s and early 1960s, along with others at the Herstmonceux site. You might care to use your search engine to locate: SPUTNIK II FROM HERSTMONCEAUX - British Pathé (Note the extra 'A' - this is the spelling used in the title).

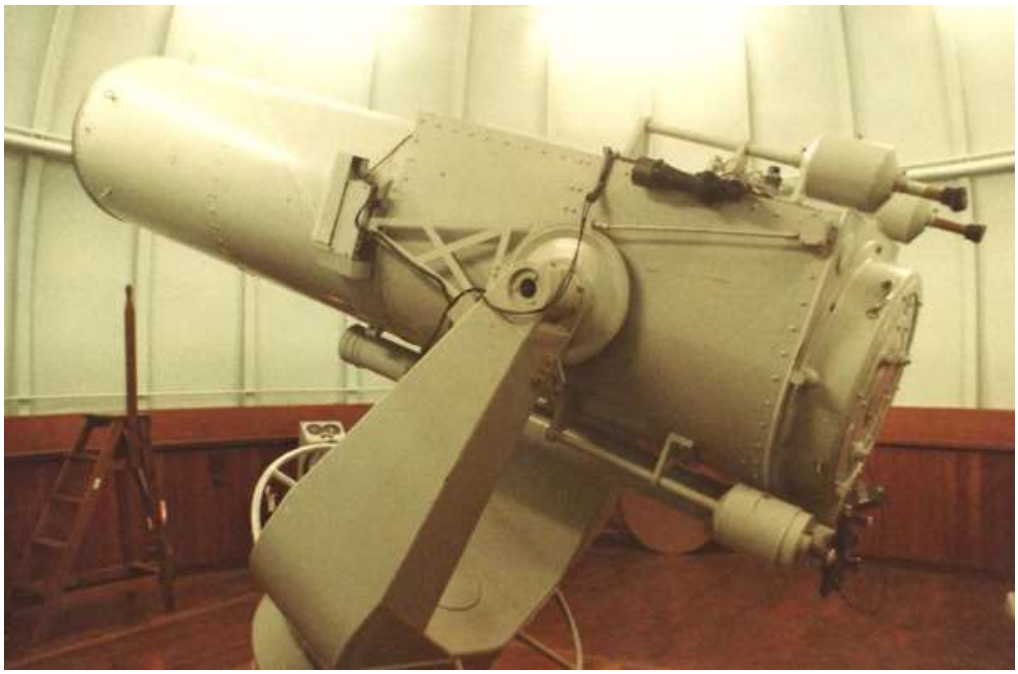
The Thompson refractor was erected in the 34 feet (10 metre) diameter Dome E. Figure 3 is a photograph of Dome E that I took from the balcony of Dome A at sunset on January 25th 1985. Much further into the background you can also see the (by then unused) original dome of the Isaac Newton Telescope. RGO optical coatings expert David Jackson had told me that the figure on the Thompson's primary mirror (and secondary mirror?) was re-worked by the famous telescope builder George Hole at some time in, or about, 1960.

This was not the first time the mirror's figure was re-touched. In the December 1950 issue of *Popular Astronomy (Vol. LVIII No.10)* is an article by the Astronomer Royal of the time, Sir Harold Spencer Jones titled *The New Royal Greenwich Observatory at Herstmonceux*. In it the he writes: 'The 30-inch reflector will be provided with a separate

mounting and dome; the mirror, which was slightly astigmatic, has been refigured by Mr F. W. Hargreaves'. This article can be found online – see link at the bottom.

THE THOMPSON AT HERSTMONCEUX

The Thompson reflector's role as a general photographic telescope continued until 1963 when some very extensive modifications were made, to accommodate the operation of spectrograph that was installed in the building. The telescope's tube was turned over and then refitted in the forks, so the 6-inch acquisition and guide refractor was underneath (and remained unused from then on!) and the flat face of the rear section of the telescope tube then faced upwards (see Figure 4). Doors were fitted in this flat section (see Figure 5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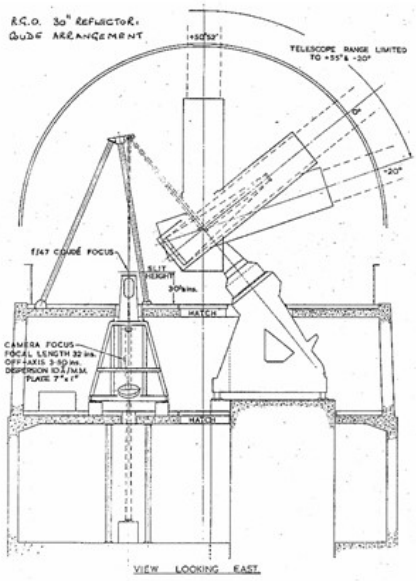
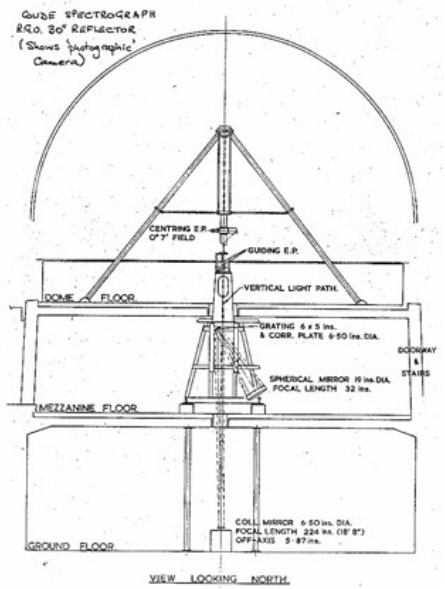

R.G.O. 30" REFLECTOR.
COUDE ARRANGEMENT
+55°59'
TELESCOPE RANGE LIMITED TO +55° & -20°
-20°
f/47 COUDÉ FOCUS
SLIT HEIGHT
30'ins.
HATCH
CAMERA FOCUS
FOCAL LENGTH 32 ins.
OFF-AXIS 3·50 ins.
DISPERSION 10 Å/MM.
PLATE 7"x 1"
HATCH
VIEW LOOKING EAST.


COUDE SPECTROGRAPH
R.G.O. 30" REFLECTOR
(Shows 'photographic' Camera)
CENTRING E.P.
0°7' FIELD
GUIDING E.P.
VERTICAL LIGHT PATH.
DOME FLOOR
GRATING 6 x 5 ins.
& CORR. PLATE 6·50 ins. DIA.
DOORWAY & STAIRS
SPHERICAL MIRROR 19 ins. DIA.
FOCAL LENGTH 32 ins.
MEZZANINE FLOOR
COLL. MIRROR 6·50 ins. DIA.
FOCAL LENGTH 224 ins. (18' 8")
OFF-AXIS 5·87 ins.
GROUND FLOOR
VIEW LOOKING NORTH.

Presumably a new convex secondary mirror was made, it being positioned to produce a much less steep convergence of the rays after reflection than before. I reckon that moving the existing secondary mirror towards the primary by the amount required would then have caused it to effectively stop the telescope down to a smaller effective aperture unless the secondary's diameter was overly large to start with. It strikes me as most likely that a new secondary mirror of similar diameter to the original but reduced radius of curvature (greater convexity) would have been substituted in a similar position to the original one. However, I cannot find any evidence in the literature to support my supposition of a replacement secondary mirror.

In this new configuration the light would no longer emerge to focus at the Cassegrain (or indeed Newtonian) position but would instead be diverted by another flat mirror - the tertiary mirror - and would exit the telescope tube through the open doors. Figure 6 shows the light path of this new arrangement. I believe that the configuration of the telescope has not been changed since I last used it but I don't know anything about the current state of the spectrograph.

The tertiary mirror is fitted inside the telescope tube on a mount slung between the tube's declination bearings that is geared to alter its tilt-angle by half any change in declination of the tube. In that way the beam of celestial light can be maintained pointing in a direction upwards along the celestial polar axis no matter where the telescope is pointed. However light does begin to be lost through vignetting of the rays for declinations outside the range +55° to -20°, so this defines the nominal operating limits of the telescope.Having the light emerge upwards along the polar axis is highly unusual, as most large reflecting telescopes with a tertiary mirror have it arranged to fire the beam downwards through a hollow polar axle, instead. In this case, though, the emergent beam of light is captured by yet another flat mirror situated atop a tall tripodal gantry positioned to the north of the telescope, as you can see in Figures 6, 7 and 8 (though the mirror's cover is not open in the

photograph).operating limits of the telescope.Having the light emerge upwards along the polar axis is highly unusual, as most large reflecting telescopes with a tertiary mirror have it arranged to fire the beam downwards through a hollow polar axle, instead. In this case, though, the emergent beam of light is captured by yet another flat mirror situated atop a tall tripodal gantry positioned to the north of the telescope, as you can see in Figures 6, 7 and 8 (though the mirror's cover is not open in the photograph).

As you can also see from the diagrams (Figures 6 and 7) the light still has not come to the end of its journey. The fourth mirror directs the beam vertically downwards to the head of the spectrograph.

Within the telescope, the secondary mirror is on a motorised mount (controlled by the observer) that allows it to move back and forth by a small amount for focusing. In normal use the light is focused onto the jaws of the entrance slit of the spectrograph. As you might expect, the effective focal ratio of the telescope at this focal position (the coudé focus) is rather high. Indeed, it is f/47 and so the image scale at the coudé focus is 5.8 arcseconds per millimetre.

…more story to follow.

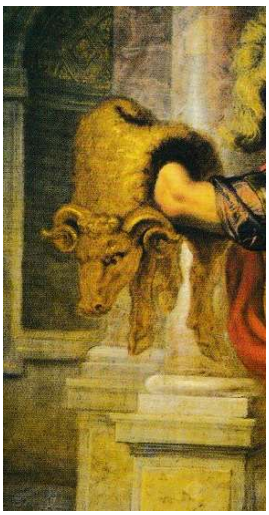
Harold Spencer Jones article link - http://articles.adsabs.harvard.edu/full/1950PA.....58..479S

Permission kindly given (some time ago) for members to read this first person account and history by ***Gerald North***.

Aries (continued) and Coma Berenices

Alison Chapman

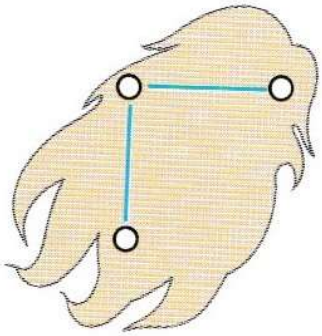
A couple of months ago I began the story of Jason and the Golden Fleece and continue it here.



After many adventures on the voyage from Greece, the Argonauts sailed into Colchis. Jason made his way to the palace and politely asked for the Golden Fleece of the ram. The king pretended that if Jason performed two impossible tasks he could sail away with the fleece. Jason was feeling very downcast when he heard what he had to do, but at that moment the king's daughter, Medea, joined them. From the first moment she set eyes on Jason she fell in love and later promised to help him accomplish the tasks. She was the grand-daughter of Helios the Sun god and had magic powers.

Jason had first to yoke together two fire-breathing, bronze-hoofed bulls and then plough a large field. Medea gave him a magic lotion so that he was not burned by the fiery breath, and thus he completed the ploughing. Then he had to sow the field with the teeth of a dragon. At once fully-grown warriors sprang up from these seeds and advanced on him. Jason threw a boulder into their midst and they began fighting each other until all lay dead.

Aeëtes, the king, however, had no intention of parting with the fleece and threatened to burn the *Argo*. That night Medea led Jason to the sacred grove where the fleece was guarded by a loathsome, hissing dragon that never slept. Medea soothed the dragon with her spells and then sprinkled a magic potion that sent it to sleep



very quickly. Jason snatched the fleece and then with Medea he hurried to the ship and sailed away. Aeëtes gave chase with his fleet, but the *Argo* got away and came safely back to Greece. Here Jason married Medea in gratitude for her help, but they did not live happily ever after.

The gods immortalised the ram, whose golden fleece it was, in the sky as the constellation Aries.

Last month I wrote about Corona Borealis – the Crown of Ariadne. But that is not the only adornment of a mortal head to be put in the sky. The constellation Coma Berenices represents the hair of queen Berenice, a historical figure from the third century B.C.

Berenice married her second cousin, Ptolemy the 3rd, one of the Greek rulers of Egypt. Ptolemy was known as Ptolemy Euergetes (the Benefactor), which helps to distinguish him from his father, grandfather and descendants, who were all called Ptolemy. Ptolemy Euergetes had brought back from Persia all the statues of the gods stolen by an earlier conqueror of Egypt. Thus, his grateful subjects called him their 'Benefactor'.

Soon after his marriage Ptolemy set off on an expedition to invade Phoenicia (modern Lebanon) and Syria. It was a dangerous mission and Berenice vowed that she would cut off her hair and dedicate it to Aphrodite if he returned safely. Ptolemy came home unharmed and Berenice fulfilled her promise. She deposited her locks in the temple of Aphrodite on the promontory of Zephyrium east of Alexandria. However, that night either the hair was stolen or, as the priests insisted, the wind blew it away. Conon of Samos, a mathematician and astronomer at court, diplomatically suggested that Zeus had carried it off and placed it in the sky as a constellation. The astronomical and mathematical writings of Conon have not survived, but we

know of his work from the references of his friend Archimedes. Conon was especially interested in the phenomenon of eclipse.

The story of Berenice's hair was immortalised by the Greek poet Callimachus, who was at the court in Alexandria at that time too. Only 25 lines of the poem survive, but it was translated into Latin by the Roman poet Catullus. In his poem Catullus has these lines:

Virginis et saevi contingens namque Leonis

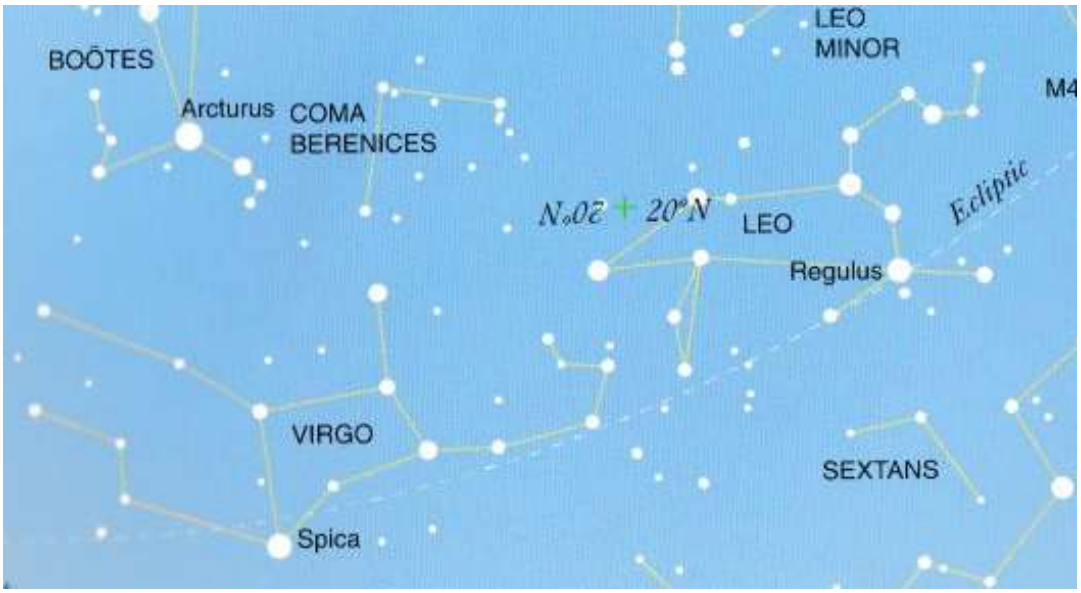
lumina, Callisto iuncta Lycaoniae,

vertor in occasum, tardum dux ante Boöten,

qui vix sero alto mergitur Oceano.

For as I (Coma Berenices) turn in the sky to set, close to the stars of Virgo and savage Leo, and near Callisto, daughter of Lycaon, I lead the way ahead of slow Boötes, who plunges into the deep Ocean a little later.

Berenice is not only honoured in literature, but her image appeared in sculpture, paintings, mosaic and on coins. She was put to death later by order of her own son, Ptolemy the fourth.



Imaging Noctilucent Clouds

Night-shining

David Bryant

We are now in the traditional season for seeing Noctilucent clouds. They may be visible until the middle of August.

Observing Noctilucent Clouds

Noctilucent clouds are only visible from latitudes between around 50 to 60 degrees north or south. If you are too far in the arctic during the summer months, the sun will either not set or be so close to the horizon that it will not be quite dark enough. Further towards the equator the clouds do not occur and the clouds that do occur will be below the horizon for you.

Noctilucent clouds cannot be forecast, so if you want to observe them you will have to check the sky from time to time during every clear night. Once you see them, they are often unmistakable.

After the sun has set and civil twilight has ended (about 30 to 45 minutes after sunset), scan the sky for silvery white clouds. They will appear different from tropospheric clouds such as Cirrus. Cirrus and other clouds will appear dark in front of the twilight arch, while Noctilucent clouds will appear to shine and be brighter. Also, using binoculars you will see more detail in Noctilucent clouds, whilst using binoculars on Cirrus will show little detail.

Noctilucent clouds need water vapour, dust, and exceptionally low temperatures to form. Low temperatures are easily attainable in the Mesosphere, but water vapour and dust are in short supply. The dust may well come from tiny meteors from space, although dust from volcanoes or man-made pollutants may add to these. Scientists believe that the moisture comes through gaps in the Tropopause, or perhaps forms from the chemical reaction of methane and hydroxyl radicals.

Under these circumstances ice can only form when temperatures drop below minus 123 degrees centigrade, which ironically only occurs during summer.

Due to the increased carbon dioxide concentrations, the Mesosphere humidity is thought to be increasing thus possibly making Noctilucent clouds more common.

Dan Self

Various forms of noctilucent clouds

Noctilucent clouds can appear as a structureless veil, bands, waves, undulations, a net-like structure, whirls, or other complex forms. Bands, waves and whirls are most likely. All shapes (except maybe the veil) are spectacular to watch.

Noctilucent clouds, if they occur, become visible during nautical twilight, about one hour after sunset. Usually they are very inconspicuous.

Noctilucent clouds are rare collections of ice crystals and form above a height of 200,000 feet. They occasionally appear after sunset in late clear summer evenings. They become visible about the same time as the brightest stars and often stay visible after dark because they are still reflecting sunlight due to their great height. They are

higher up than any other clouds, occupying the layer of atmosphere known as the Mesosphere, and are only seen at latitudes between 45°N and 80°N in the Northern Hemisphere, and equivalent latitudes in the Southern Hemisphere. They are seen less often in the Southern Hemisphere as there is very little land and very few people there. Only the southern tip of Argentina and Chile, and the Antarctic are at the correct latitude.

They often closely resemble thin streaky cirrus, though other shapes are often seen. They are usually blue or silver in colour, but sometimes orange or red.

Eddie Mallet

Imaging

If you have a digital SLR camera it is best to use it since you can see the results immediately and decide if the exposure time is good. Noctilucent clouds can vary much in brightness and the exposure is somewhat critical.

Some Noctilucent clouds will be bright enough to cast shadows and be bright enough for your camera light meter to function.

It is important that your equipment is charged and ready as they may appear with very little notice.

Locate an area that is both dark and has a low horizon in the Northwest in the evening and Northeast for the morning. Noctilucent clouds can be at a low altitude and therefore can be lost behind buildings or trees.

It is best to mount your camera on a sturdy tripod and use some form of remote shutter release, either cable or radio (Wi-Fi). This gives the best stability for the image. Having said this, I have had reasonable success with the camera resting on the roof of a car (preferably with some soft material between them).

Chris Bailey

Focus on a distant light or focus in daylight and then leave focussing alone. Manual focus is essential at night.

It may help to set the LCD brightness to the darkest possible setting.

Set ISO 400, f4 and about 2 seconds and see what you get. You may need to adjust this if the light is increasing or decreasing. It will also vary with the lens and camera you are using – this is just a rough guide.

Take a range of pictures at different exposures.

You can also take images with overlap to form a panorama, or zoom in to show the details of the clouds.

I suggest taking a dark frame for every shutter speed and ISO setting and do dark frame subtraction later in your preferred computer programme, rather than using the camera's noise reduction mode in the field. This will save you some valuable time (Noctilucent clouds may not last very long). But most likely there won't be much hot-pixel noise anyway for exposures of a few seconds.

Undulations, whirls and net-structure are great to zoom into with a telephoto lens. Keep exposure times short so as not to have the photo blurred. For a 200mm telephoto lens, do not expose longer than 5 to 10 seconds.

Noctilucent clouds and the sky around them are slightly polarized, but in the same direction, so polarizers should have little effect except to darken the entire frame a few stops, which is undesirable due to the low light. I never tried using a polarizer, but you can experiment with it.

Noctilucent clouds often move and evolve extremely fast. I recommend you take a series of exposures at regularly spaced intervals to do a time lapse.

Andrew Luck

All the images in this article were taken last year by Breckland Members. Hopefully we will be lucky again this year. If you are lucky enough to get something, could you please either forward to me (newsletter@brecklandastro.org.uk) or post on the FaceBook Page. At the end of the season, I will make up one article of all the images taken.

Good Luck

Chris Bailey

The problem with Muons: Part 1

Andy Jones

In April 2021, particle physicists at Fermilab produced a report that indicated that muons were behaving in a way that the Standard Model could not predict. This is considered exceptionally bad for particle physics.

For 50 or so years, the Standard Model, which is usually represented as a grid of all the subatomic particles that currently exist, has been the bedrock of which particle physics is based on. It is a large set of equations to predict the behaviour of particles and in the past has been able to predict the infamous Higgs Boson, which was eventually discovered at the Large Hadron Collider.

Within the Standard Model is the muon, a heavy electron and for all intents and purposes it should behave pretty much like an electron. We are constantly being bombarded by atmospheric muons when ultra-fast cosmic rays hit our atmosphere and create a cascade of different particles and subatomic particles, like the muon. So, they are pretty common.

Before moving on to the Muon g-2 experiment, it is important to understand that there is a soup of virtual particles popping in and out of existence everywhere, something which the Standard Model can predict the masses of. Even in the centre of a proton, which contains gluons, two up and one down quark, this is a very basic view of the internal structure of a proton. It is more like a roiling sea of particles that are popping in and out of existence, with the 3 quarks acting like islands of stability in the proton.

At the Muon g-2 (pronounced g minus 2) experiment, muons are fired around an accelerator. They spin, much like a gyroscope and have their own magnetic properties. So, when placed into a magnetic field, there is a precession in the muon's spin (much like the precession of Mercury)

as the muon's magnetic field is disturbed by the magnetic field of the accelerator.

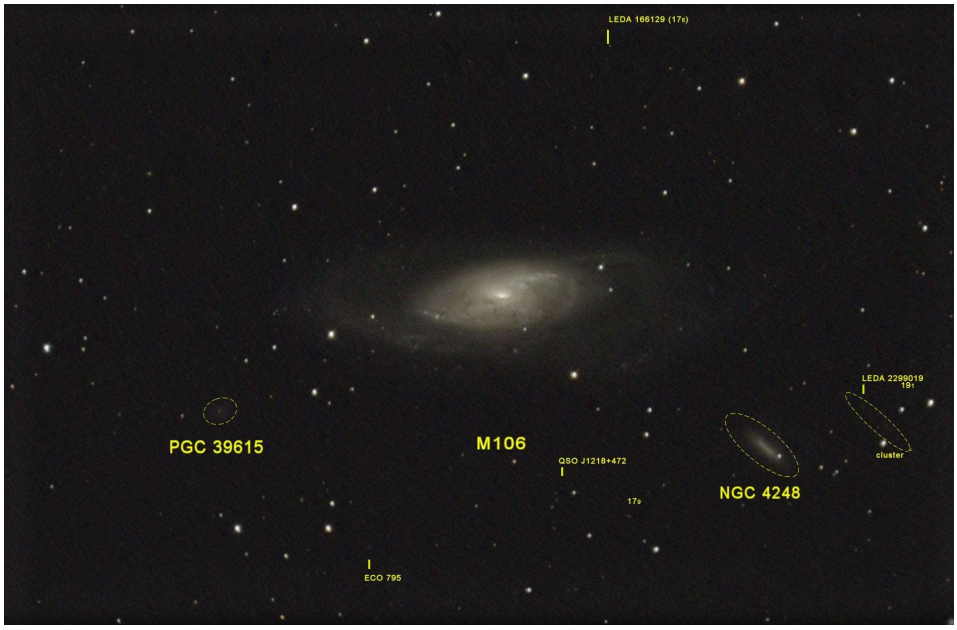
Slightly annoyingly, to physicist's 'g' means gravity, but to particle physicists 'g' means gyromagnetic factor. Why minus 2? An electron and a muon have a spin of a half, so to return to their original state, they rotate twice on their axis, hence the 2. You take this 2 away from your experimental data to find out what you are left with. That number represents the sea of virtual particles that are produced and reabsorbed by the muon, and there are thousands if not hundreds of thousands of variations of these virtual particles that the Standard Model can predict.

You have your muon spinning about in your accelerator. As a muon is unstable, it decays into an electron and you can work out where in it's spin the muon was by measuring the angle which the electron was produced and it's energy. This is that the Fermilab experiment has been doing since 2001.

So, the Standard Model puts the muon's g at 2.0023318319. The experiment at Fermilab observed the muon's g to be 2.0023318404, a difference of .0000000085. Not much I hear you cry! But enough to cause a seismic shift in the minute world of particle physics. Why? We will go into that in the next issue of Extraterrestrial.

Members Astrophotography

Dan Self



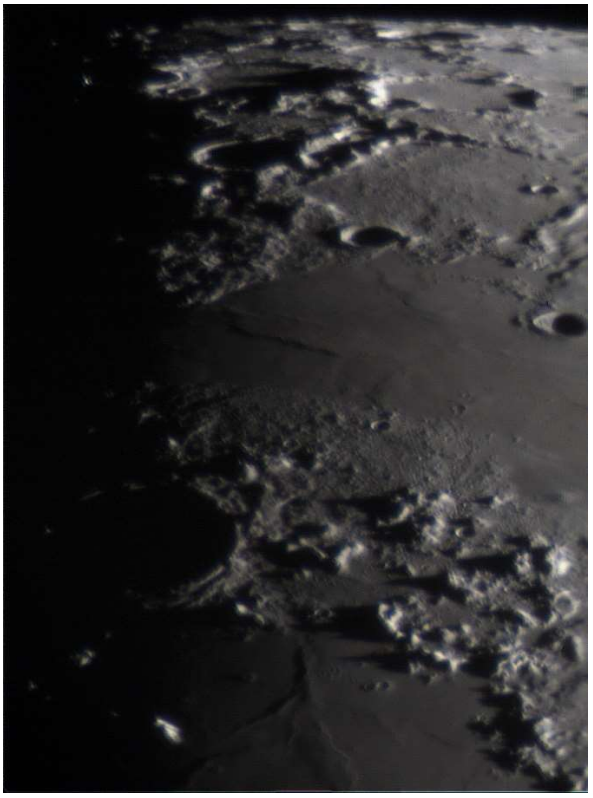
M 106 20" Observatory telescope f/3, quickly. 11½ minutes of exposure

Epsilon Bootes F4000mm Nice Double

Lunar Blue Lake 6 Stacks

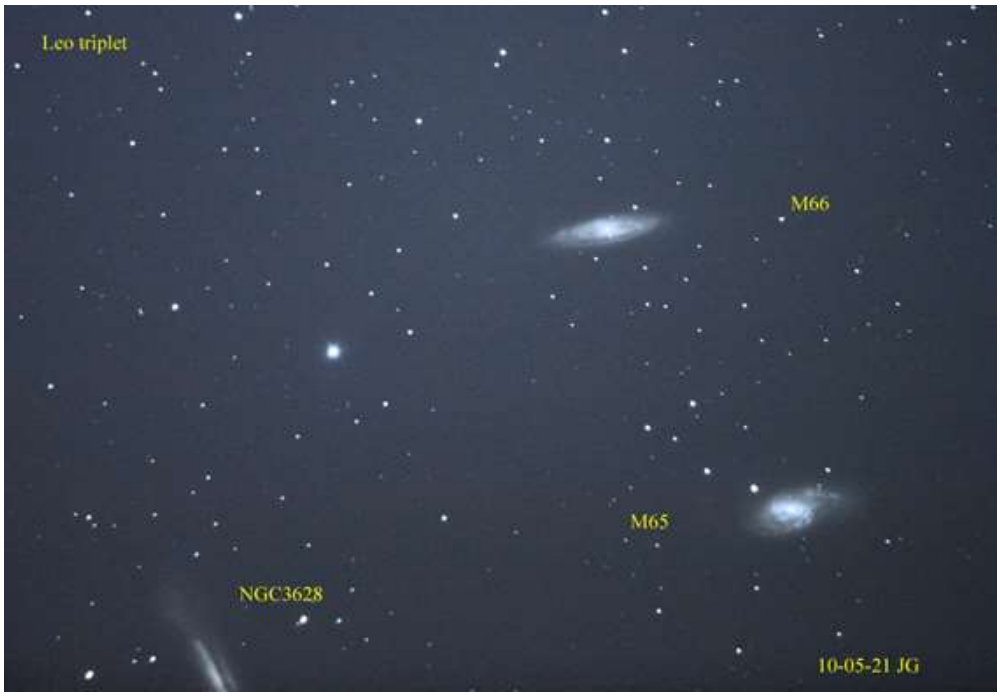
M101 LRGB Atik 20 inch Observatory telescope

Rupes Recta



Lunar North Pole 19th May 2300, Liberated away.

John Gionis



Neil Wilson

The Whirlpool Galaxy (M51)

Captured last November. Iris Nebula (NGC 7023)

Skywatcher MN-190 Mak Newt and Altair Hypercam 183C

50 x 120s light frames

20 x 120s dark frames

Mick Ladner

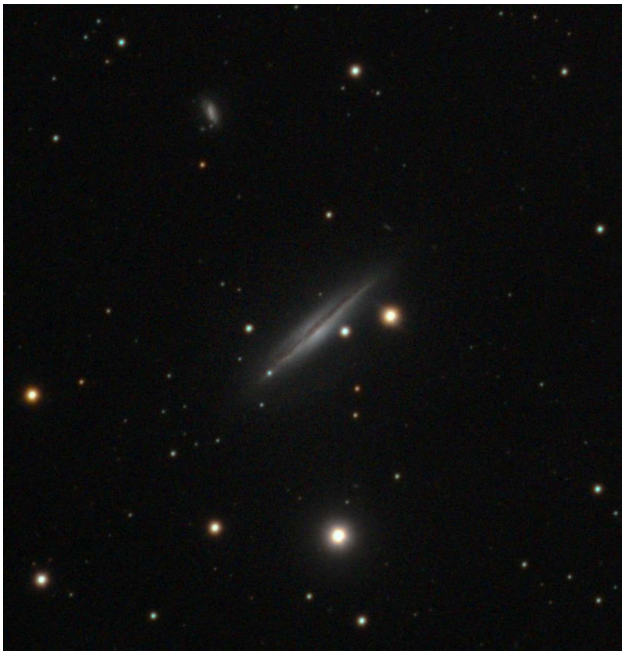
M104 The Sombrero Galaxy. Data was collected on 20th April and 2nd May.

18 x 300 sec lights plus calibration frames.

Processed mainly in PI, with a small tweak in LR

M106

Malcolm James Dent



M97 the Owl Nebula & M108 the Surfboard Galaxy. The Owl is a planetary nebula.

Darrell Brown

Roger Hyman

14% Moon 15-05-21. Taken with WO GT71 and ZWO ASI462MC. 90 second video captured using SharpCap, processed with Autostakkert (best 50%) and finished with Photoshop.

Chris Bailey

Crater Clavius

BRECKLAND ASTRONOMICAL SOCIETY

Charity No.1044478

www.brecklandastro.org.uk

Affiliated to the British Astronomical Association and the Federation of Astronomical Societies

Dr Dan Self, Chairman

chairman@brecklandastro.org.uk

OBSERVATORY RISK ASSESSMENT 2021

This policy document applies to the aforementioned charity and covers all instances of normal use of the observatory building and equipment within it. All other statements of intent are laid out in the society's constitution.

The purpose of the society (Breckland Astronomical Society) is to promote and to advance public education in the Science of Astronomy and all branches of scientific research and in so doing the following policy statements are necessary.

Persons visiting are members and public of all ages by pre-arrangement, or on public open nights.

Section 2 - Risk Assessment

Hazards ***(The visit leader must identify any additional hazards relevant to the planned activity where applicable)***	**Risk Control Measures**	**Outcome risk rating**
For external parties: Safety whilst travelling to observatory.	Responsibility is with individual regarding transport.	Low
Lost people	A nominal roll should be available for parties with minors. Stay in groups and count in and out, especially risky when young children running around on dark field. Responsibility with teachers/akelas.	Tolerable
Pre-existing medical conditions	Visitors have been asked to bring with them anything they need with regard to medicine/ first aid training. DS is first aid trained as part of job.	Tolerable
In the Observatory: Moving the telescope dome - Mechanical hazard from cogs and metal clips on dome motors and sliding parts. Falling from dome.	Supervision is necessary to prevent visitors' fingers being caught in dangerous places before moving. Train supervisors. Gears are located in inaccessible places. Signs to keep head out of opening while moving it. Failure of clips holding very difficult due to strong fastening.	Tolerable Tolerable
Electrical hazards	All electrical circuits are protected by RCD trip switches, which have been checked. Equipment should only be used by trained demonstrators as PAT testing is not viable.	Tolerable
Light intensity from laser pointer, bright LEDs	A low power class 2 laser can be used to collimate scope, this should not be used	Low

	during visits. An upper end- class 2 green laser is sometimes used for pointing out stars outside. This should NOT be pointed near people, or planes, only switched on briefly and used by supervisors/demonstrators only. Laser is currently broken.	
Skin contact with dangerous chemicals	Fly spray, propanol, and cleaning fluid kept in cupboard in small quantities. Keep cupboards shut when visitors are present and supervise.	Tolerable
Standing in dome - Falling (height is 7 feet)	Shutter opening is guarded by 2 bars at child / adult heights. Limit numbers in dome 7 + supervisors can easily fit.	Tolerable
Standing in dark places - Stumbling in low light	Use dim red lights on floor to preserve night vision. Dim lights gradually.	Low
Climbing ladder in dark - Falling while viewing through telescope.	Ladder must be shown to people first, but enough light is available. Check for mobility difficulties.	Tolerable
Ascending stairs - Falling or being hit with trap door	Be sure demonstrator to go up first and lock door open. A knocking procedure is known if the door is shut.	Tolerable
Fire risk	Large items are not flammable. Mainly metal fixtures and fittings. Sources of ignition (sparks) are contained in electrical equipment. Flammable gases are not kept in building. Radio linked smoke alarms installed. Fire extinguishers available and annually checked. Call 999 in	Tolerable

	emergency. Can exit via dome opening in emergency.	
Standing in dark cold field - frostbite	Weather could be freezing at this time of year. Warm clothes have been advised before trip. Heaters indoors if cold and keep a blanket at the observatory. Trip hazard in dark. Torch guidance will be provided but is limited because of dark sky observing.	Tolerable
Child protection risks (under 18s)	Two adults should be available at all times. DBS checks are in place for INTO employee leading the visit. This visit is arranged in advance and INTO duty staff should be aware of the students' location. Students should have INTO's number. The organisation that runs the observatory, Breckland Astronomical Society, operates a child protection policy. The committee are vigilant with regard to risks.	Low
SARS CoVID19: Airborne Transmission indoors	Ventilate. Open shutter and doors. Wear Masks as long as Covid is at large in the population, unless exempt. Physically Distance 1m+. Limit numbers to what national guidelines state at the time. Given limited space not many are allowed in at a time. Provide outdoor activities, e.g. electronically assisted astronomy	Tolerable – as we have very good ventilation.
Outdoor transmission	Physically distance, however risk is found to be low outdoors. Follow	Tolerable

	national guidelines. Be mindful of face to face breath transmission.	
Surface transmission	Sanitise hands on entry. Wipe surfaces. Use fresh eyepieces for each household. Limit one to use of kitchen/bathroom area. Only use disposable drinks containers and paper towels.	Low
Reporting	Sign in for track and trace purposes.	N/A

Trustees as of 16/05/2021 are: Dr Dan Self *+(Chairman), Andy Jones*+ (Treasurer), Richard Harmon. Committee members (acting trustees): Rebecca Greef*, John Copsey. Trusted supervising members: Mick Ladner, John Gionis, Peter Farmer, Andrew Luck, Chris Bailey.

*DBS checked for day job. +First Aid trained for day job

Signed  ……

Chairman, Breckland Astronomical Society, UKCC 1044478.

For Sale or Wanted

This section is for the sale of Astronomical items and any wants from members. Details of items for sale (With photographs where applicable) should be forwarded to the newsletter editor at newsletter@brecklandastro.org.uk

It is suggested that a donation of 5% of the final sale price be given to the Society to assist with funds. If sellers do not wish to make their contact details public then please make this known to me and I will field any enquiries on a box number system. Please send any sales details to me before the 26th of the month for inclusion in the next issue.

Please ensure that if any item is sold by another means prior to publication that I am advised so it can be removed to avoid confusion.

Equipment available for loan to Members

As well as our fantastic library members of the society can borrow our equipment. Here is an equipment list that can be used or borrowed by members, subject to personal responsibility for replacement value. Discuss your plans with one of the regulars first, as it is not easy for beginners to use some of this kit. We are here to help show you how to use it, when the weather holds up, then you will need to sign it out and get approval by a member of the committee. We can discuss a reasonable term.

Refractors:

William Optics Megrez 102 S.V. F7 D102mm f/7 and reducer to f/5.6 – this may be unavailable soon.
William Optics GT-102 2019 D102mm F703mm f/6.9
Vixen 4" Refractor f/9

SCT/Maks:

Celestron C925 Starbright F10 SCT FL D234.95mm F2350mm f/10 Refractor – preferably this should not be taken off the premises.
Celestron C8 SCT D203.2mm F2000mm f/10 Refractor (orange tube)
Meade LX200R SCT D203.2mm F2000mm f/10
Konus Motormax-90 Maksutov-Cassegrain 90mm F1200mm f/13 #1795
Meade ETX125 D127mm F1900mm f/15 Maksutov-Cassegrain Reflector
Mak-Newt:
Skywatcher 190MN DS Pro Maksutov-Newtonian Optical Tube Assembly D190mm F1000mm

Dobsonians:

Skywatcher Skyliner 200mm F1200mm Dobsonian Reflector
Helios D200mm F1000mm Dobsonian Reflector
8-inch Dobsonian (turquoise tube, hand-made)

Solarscope:

Coronado Solarmax 40

Meade 8x50mm Guide Scope

Binoculars:

Vanguard KR-7500 7X50mm Field 7 degrees Binoculars – a little out
Konus #2253 7x50 Field 6.8º Binoculars
Chinon RB Optics 8-20 x 50 HB Zoom Binoculars
Prinzlux 10x50 Binoculars – needs optically cleaning

Mounts:

Berlebach Planet Tripod with Double Clamps
Orange EQ4 telescope mount
Skywatcher SynScan EQ5 Equatorial Mount & Tripod
SynScan mount controller
Meade LXD German Equatorial Mount & Autostar Controller
SynScan mount controller
iOptron IEQ45 Mount and Pier
iOptron Go2Nova mount controller

Eyepieces:

Tele Vue Delos 17.1mm 2"
Antares Speers-Waler 4.9mm SWA Series 2 2"
Antares Speers-Waler 9.4mm SWA Series 3 2"
Meade Ultra Wide Angle 14mm 1.25/2"
Antares W70 Series 8.6mm
Meade Super Wide Angle 18mm 1.25"
Celestron 32mm Plossl 1.25"
Celestron 26mm Plossl 1.25"
Antares 17mm Plossl FMC 1.25"
Intes-Micro Q74 WA 21mm 1.25"
Orion (Or) Circle-T 9mm 1.25"
Vixen K 18mm 1.25"
Fullerscope K 25mm 1.25"
66 Ultrawide 20mm Long Eye Relief 1.25"
Or 6mm 1.25"
Plossl 40mm Multi-coated
Plossl 17mm Multi-coated
14mm (7mm 21mm) 1.25"
Super 20mm 1.25"
Soligor PE-6mm 1.25"
Super Plossl 32mm 1.25"
Lanthanum LV 2.5mm 45 degree 20mm 1.25"
Televue 2x Barlow 1.25"
Televue 2.5x Barlow Powermate 1.25"
2x Barlow Lens
Meade Telenegative 2x Barlow 1.25"

Telescope accessories:

William Optics AFR-IV Adjustable Flattener Reducer
Meade Zero Image-Shift Microfocuser
Meade 4000 Series f6.3 Focal Reducer
Meade 4000 series f3.3 CCD Focal Reducer with T-Adapter
Celestron Reducer/Corrector f6.3 (Model: 94175)
Tamron Adaptall-2 Custom Mount

Eyepiece accessories and filters:

Meade Electronic Eyepiece
Meade Illuminated Reticle MA12mm
Celestron Radial Guider (#94176)
Light Pollution Filter 1.25"
Meade #908 O-III Nebular Filter
Variable Polarizing Filter #3
Baader Planetarium Contrast-Booster Filter (#2458360) 1.25"
Celestron Colored Eyepiece Filters (#25 Red, #38A Blue, #47 Violet, #53 L Green)
Baader G-CCD Filter 1.25" (Cat: 2458470G)
Baader R-CCD Filter 1.25" (Cat: 2458470R)
Baader B-CCD Filter 1.25" (Cat: 2458470B)
Baader UV/IR Cut/L-Filter 1.25" (Cat: 2459207A)
Baader H-alpha 7nm CCD Narrowband-Filter 1.25" (Cat: 2458382)
Baader O-III 8.5nm CCD Narrowband-Filter 1.25" (Cat: 2458435)
Baader S-II 8nm CCD Narrowband-Filter 1.25" (Cat: 2458430)
Baader H-beta 8.5nm CCD Narrowband-Filter 1.25" (Cat: 2458425)
Astronomik L-RGB Type 2c Filterset 1.25" (4 filters, Cat: 10220125)
Astronomik CLS-Filter 2" (Cat: 10213200)
Astronomik CLS-Filter 1.25" (Cat: 10213125)
Astronomik CLS CCD-Filter 1.25" (Cat: 10208125)
Star Analyser 100 (Model: PHEL-SA100) – produces spectra

Cameras:

Atik Focal Reducer 58mm
Atik 383L + FW 11/4"+Filters
Atik Infinity Camera
Atik 314L+ CCD Camera (SNI1003041)
Atik One 6.0 Monochrome CCD Camera (SN: 1191452-0093)
Atik 460EX Color (SN21223-26)
ZWO ASI290MM Mini USB 2.0 Monochrome Small Format CMOS Camera
Imaging Source DBK21AU618.AS 640x480 USB2 planetary camera
STV (‘vintage video CCD AV camera) and Filter Wheel
Astrovid 2000 (‘vintage’ CCD camera)
Nikon D100 DSLR
Sigma EX DG Macro 105mm 1:2.8 DLSR Lens
Geoptik CCD Adapter x Canon (Model: 30A189)

CONTACTS

Chair Dan Self
Contact **chairman@brecklandastro.org.uk**

Observatory/Visits Mick Ladner
Contact **visitors@brecklandastro.org.uk**

Webmaster Andrew Luck (temporary)
Contact webmaster@brecklandastro.org.uk

Newsletter Chris Bailey
Contact newsletter@brecklandastro.org.uk

Membership/Treasurer Andy Jones
Contact treasurer@brecklandastro.org.uk

Secretary Rebecca Greef
Contact secretary@brecklandastro.org.uk

Please check with any of the contacts in bold before visiting the observatory. Please ensure you are wearing appropriate footwear and clothing and bring a torch (preferably one showing a RED light)

Breckland Astronomical Society Events – 2021 7:30pm Great Ellingham Recreation Centre, Watton Road, Great Ellingham, Attleborough, Norfolk **Google Meet – details to follow - £free** please contact treasurer@brecklandastro.org.uk if you want to join **We may return someday! Hall entry £2.00**		
Friday, June 11th	**The Appley Bridge Meteorite****	Russell Parry
Sunday, June 20th	**International SUNday**	Observatory
Friday, July 9th	**Comets past and future****	Nick James, BAA
Friday, August 13th	**Minor Planets & Asteroids +agm**	Andy Jones (BAS)
Friday, August 28th	**Public open night**	Observatory
Friday, September 10th	**Planetary Imaging Techniques**	Dr David Arditti, BAA
Friday, September 24th	**Public Open Night**	Observatory
Friday, October 9th	**TBA**	-
Friday, October 29th	**Public Open Night**	Observatory
Saturday November 6th	**Star Party**	Haw Wood Farm
* Haw Wood Farm Caravan Park, Hinton, Saxmundham, IP17 3QT. www.hawwoodfarm.co.uk to book: info@hawwoodfarm.co.uk 01502 359550. £12 per pitch per night subject to updates		

** NB swapped places