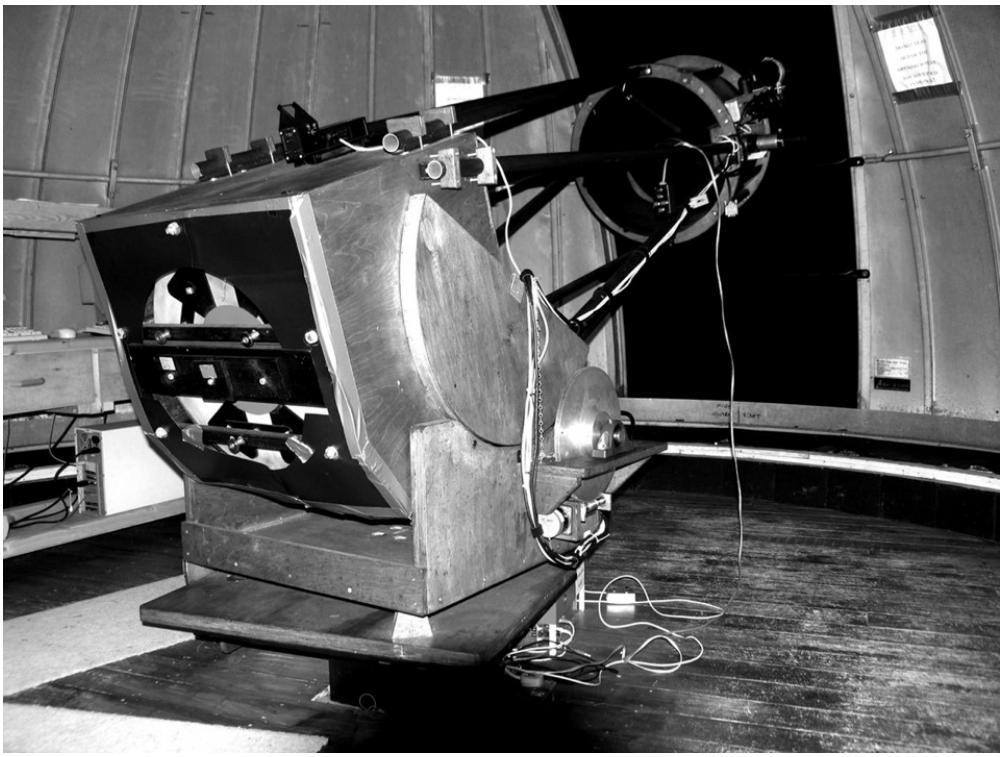
Breckland Astronomical Society

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

EXTRA TERRESTRIAL

Newsletter August 2021



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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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Chairman's Notes

August 2021

We've had a few clear nights. At the observatory, we have had a small number of members visit on Tuesdays. Some gardening was done, but we cannot reach the huge Hazel branches that are really dominating the horizon. If any Ellingham allotmenteers read this, we need some help again come early September. We had a great bit of cutting done in 2019 by the allotmenteers to the South West of the dome, which still has fantastic views but we need to start looking into cutting the roadside verge as the South horizon is starting to get blocked by branches. Richard regreased and tightened John C's donated telescope, which we are going to add as a raffle prize for the November Quiz. This is an awesome prize. We Richard also helped install drivers for Bob Samuel's mono ZWO camera, coupled with an adjustable mount and an 80mm refractor. We've now successfully tested this as a guide camera and need to fix the mount down. It gave a well-tracked 30 second shot on a camera.

In the Sky

Venus is still barely peeping above the western horizon. Saturn and now Jupiter are arriving in the skies at not too bad a time. They are also a little higher than last year. Hooray! Just as a reminder Saturn is at opposition around August 3rd where you may see the Schröter effect of the rings brightening around the opposition for a couple of days. Saturn is in Capricornus under a dark sky and the Milky Way should look beautiful overhead. Jupiter is at opposition later, in Aquarius, at the end of August when the moonlight interferes.

The moon appears in the evening August the 12th - 14th, also the main nights of the Perseid meteor shower, which is in the dark this year! An ideal night for getting on a lounger outside, it follows after Andy's talk on the 13th. It is best in the early hours. By the 17th, the moon really does interfere.

The beautiful nebulae in Sagittarius are briefly with us again, M8, the Lagoon nebula is easily visible in binoculars as a horizontal line of 4 components: 2 stars flanking a bright cluster and the inner Hourglass Nebula. This is just right of the top of the Teapot asterism very low in the South. A nice large globular M22 is just up and left of the upper star in the Teapot, Kaus Borealis. Moving up, past the faint and visually obscure Trifid Nebula M20, there is the Milky way star patch M24 and M18, cluster M21 sits on top of the Trifid and M23 and M25 are floating nearby. Going north, towards Scutum are M17, the Omega or Swan nebula – beautiful in any telescope on a dark night, and M16, the Eagle nebula and cluster. The pillars of creation are offset a little from the cluster, and the nebulosity isn't always so easy to see but it makes a superb photograph.

Events

As well as Andy's talk, we are doing some outreach at Marston Marsh in Norwich on Wednesday the 18th as part of a Nature Day. We are holding our first open night on Friday 27th August.

The Star Party at Haw Wood is now run by DASH. As a reminder the dates are: Mon 1 Nov – Mon 8 Nov with Saturday 6th being the main day, and the spring one is on Thu 21 Apr (2022) - Thu 28 Apr with Saturday 23rd being the main day.

Misc.

Roadworks may make it a little slower getting to the Rec Centre. The Hingham Road should be closed in August and a slow changing traffic light is along the main section of the Watton Road.

As always any suggestions and help actually finding speakers would be useful and we are looking for the right person to volunteer as a committee member to make 6 of us – this improves our decisions and discussions.

Talks

On Friday July 9th, we had Nick James talking about Comets on the Google Meet Platform. He was very friendly and kindly gave his time and his enthusiasm for free. He is so enthusiastic he is slowly making BAA's historical observations of comets into an electronic archive, in his own house, in his own time. I admire that sort of dedication. He has of course built on Jon Shanklin's comet observation webpages, available at people.ast.cam.ac.uk/~jds/ which have been going since the late 1990s. These observations, mostly from amateurs, contribute to the understanding of what comets are.

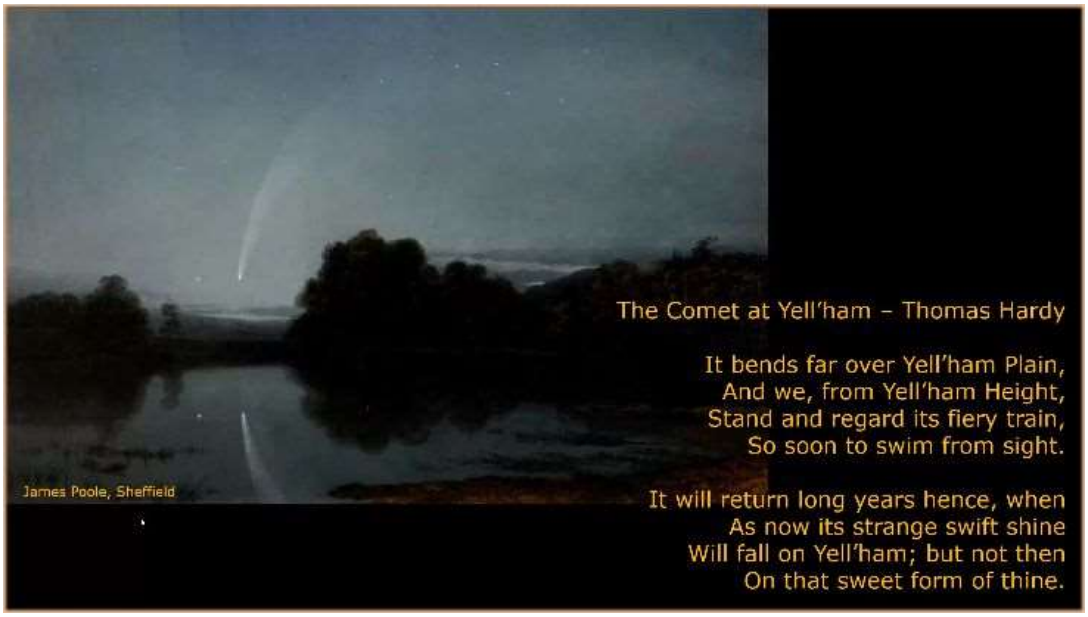
Nick started by reminiscing about Hale Bopp and Hyakutake in the 1990s. The picture he put up was of an incredible standard, and looks like a modern photography job. Going back further, there have been some stunning comets. In 1957, as The Sky at Night first started with a young Patrick Moore, comet Arend-Roland graced the skies, and was superb. Much later, Comet Kohoutek was snapped from orbit, in Skylab, and it had a spike coming from its head. The next year, 1975, we had Comet West, a real memorable one for some. We were treated to some great images and facts, such as an early comet photograph of a single 67 minute image, guided manually. It obviously had no planes or satellites to interfere. It was only possible for an extremely bright comet, as the ISO of the film emulsion then was about 0.1 or so.

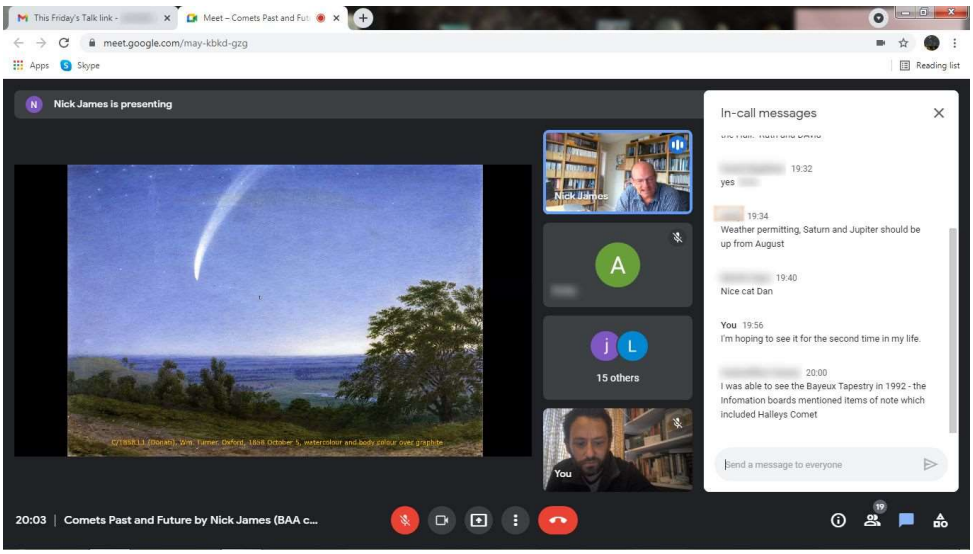
Some were flops and some popped up out of the blue, such as periodic comet Holmes in 2007 that flared up from 16th to 2nd magnitude, making a new star in the sky, or ISON that completely evaporated as it passed the sun, and I could not see it. It was predicted to be -16th magnitude and I only caught it at 15th magnitude. Comets are notoriously unpredictable.

As a comet approaches the sun in the outer solar system, it is usually a tiny invisible very low density assemblage of ices, such as Carbon dioxide, water, ammonia, Carbon monoxide, Nitrogen, etc. At a certain point from the Sun, usually well within Jupiter's orbit the volatiles evaporate and the water condenses on to them, making a fog-ice. The gas underneath levitates dust much finer than talc, bound by weak gravity, and solar radiation pressure blows this back. Rapid changes to the tail can be seen from the earth by photography. Disconnections in the tail were seen well in the beautiful Hyakutake in 1995. Sometimes strange or multiple tails can be explained by nuclear rotation and pulses causes banding, seen in McNaught in the southern hemisphere and the great comet De Chesaux in 1744. The gas or ion tail is blown back by the solar wind at maybe 400 km/sec and fluoresces a beautiful blue or green-blue, as NEOWISE started to show after its perihelion. This comes from small carbon molecules.

NEOWISE was a well studied example in 2020. It had a dust tail 20 degrees of sky across, yet it had a very small nucleus, only 2km maybe. However 2021 looks to have pretty poor prospects.

Maybe comet Leonard is coming this winter, but it should only reach about 6th magnitude and be visible in the morning sky. The comet studied by Rosetta, 67P/Churyumov-Gerasimenko should be visible this autumn also, at 10th magnitude. I really want to see this, knowing so well the shape and size of its nucleus. It passes very near Neptune on Christmas and boxing day.





All being well, Andy will be doing a talk in the hall in Friday 13th August, on “Extreme Universe” followed by the AGM.

AGM:

I hope you have all received the documents, they were sent out with a month’s notice via our email distribution system. We’re going to have to get used to all the physical work of moving the gear across, getting the keys, putting out chairs, bringing raffle prizes, sorting out someone on the door to take cash and sell raffle tickets. Coffees, etc.!

I have included a Hall Risk Assessment, and we will maximise ventilation, ask for mask wearing, and have an extra break to clear the air. We will run a simultaneous google meet livestream here:

https://meet.google.com/hin-ffwd-xxj

except we won’t have a host to let anyone in after 19:32, as the recording equipment will be facing the speaker. So in case of connection problems, we can’t let you in if you reconnect. This is one reason why things are better face to face. Of course it is everyone’s choice whether to come or not, so the online sessions are free. We shall be charging just £2.50 for entry and £1 for under 18s, which may mean we’re running at a loss for a while until people feel safe to return in larger numbers. Hopefully we will all be able to come safely for the November Quiz. There is a very small chance I may not be able to host it so a backup quizmaster would be very much appreciated (more on that in person).

PS If anyone still want’s Russell Parry’s book on the Appley Bridge Meteorite please email me on chairman@brecklandastro.org.uk and I will put you in touch with him. Don’t forget, last year’s speaker Steve Tonkin still has a great book on Binocular Astronomy – it is an easy google search away.

Dan Self

JOHN'S NEWS BITS
August 2021

NASA's Hubble telescope stopped working on June 13. Ground controllers had to put it in safe mode trying to switch over to a back-up hardware. Fix finally worked and Hubble was back in operation as of July 17th.

NASA's un-crewed Orbital Flight Test 2 of Boeing's CST-100 Starliner will be launched on an Atlas V rocket. Its primary mission will be to ferry astronauts to the ISS as part of NASA's commercial crew programme.

Although Branson;s Virgin Galactic successfully went on a suborbital flight with his rocket plane, Jeff Bezos took four civilians on a REAL fully automated rocket ship, his Blue Origin, with a high tech. capsule. The rocket returned to the launch site and the capsule parachuted back to Earth. The rocket went up to 62 miles, the Karman Line at the boundary of space, reaching a speed of 2,200mph . passengers included 82 year old Wally Funk, a Mercury pilot from the 60's. Great video on YouTube..

Reported in Science Daily, Harvard University and MIT have developed a quantum computer known as a programmable quantum simulator capable of operating with 256 quantum bits or qubits. This is the first step towards building large scale machines. The number of quantum states that are possible with 256 qubits exceeds the number of atoms in the solar system.
Opportunities there for the 11 year old who got a degree in quantum physics at the University of Amsterdam!!

Reported in the Times, the well-known physicist, Professor Jim Al-Khalili of the University of Surrey has got a £2 million award for research into investigating the arrow of time and exactly what happens at the interface between the quantum world and the classic world. In the quantum world time has no direction but as you zoom out the irreversibility of time emerges. Doctor Andrea Rocco will co-lead the global team.

China is working on a plan to send 23 Long March rockets to an asteroid to divert it from its course should it be heading for Earth. The combined rocket mass will be 900 tons for a simultaneous hit and would shift a 78billion kg asteroid Bennu by some 9,000 km. Bennu could get to within

75million km of Earth between 2175 and 2199, close enough to be classed as potentially hazardous, so a likely target for the investigation..

Space.com report, astrophysicist Thomas Buchert from the University of Lyon Astrophysical Research Centre in France examined the light from the very early universe and concluded that the universe may be like a three-dimensional doughnut and that space is closed in on itself in all three dimensions. This would make it finite so that the entire cosmos may be no more than three to four times larger than the limit of the observable universe which is some 45 billion light years away. So if you head a space ship in one direction you would end up where you started, well, a long time later!!

NASA's Perseverance rover is about to take its first rock sample from the floor of the Jezero crater. This is a deep lake bed depression so ideal for looking for ancient microbial organisms.
The sample will be placed in a container for a later return to Earth.

Reported in Planetary News, the Mars InSight Lander has detected hundreds of marsquakes. beneath the Elysium Planitia landing sight. The S (shear) waves vibrate perpendicular to their direction of motion indicating a thick crust in excess of 400km beneath the mantle. The German Aerospace Research Centre that did the computer modelling of the temperatures inside Mars indicated heat producing elements such as uranium, thorium and potassium.

John Gionis

A dozen frozen denizens: interesting and obscure planetary nebulae of the summer Milky Way

Planetary nebulae are the final stage of lower mass stars, having lost their atmosphere after the core collapsed to a white dwarf. This can happen in a multitude of ways, resulting in an incredible array of light year wide fluorescent glows. These are some that you can research further, that are visible in modest telescopes in summer, preferably when the moon isn't in the sky. You will need a reasonable South view to catch those in Sagittarius and Ophiuchus. You will also need software or the ability to look up charts, or a GOTO telescope, that is correctly aligned. I will start by giving details of a couple of easy objects then work my way to harder objects. By easy, I mean easy to see, not easy to find.

NGC 6572 - 18h12m06 +6º51'13" (J2000.0)
North Ophiuchus. M27 is too obvious for this sort of article, I will instead redirect you to an object that appears very compact and bright. Bright enough in fact that if you use a big enough scope, you can see a quite intense green colour and some tantalising small structure. It is 9.0 magnitude, putting out many times the light the above nebulae do, within a small radius of 7 arc seconds. Really boost the magnification on it! Sometimes this is called the Blue Racketball, but looks green to me, and I don't know how anyone can see enough structure in it to call it that.

NGC 6210 – 16h44m29 +23º48'00"
Hercules, at lower right of main asterism, close to beta. High in the West after sun has completely set (11pm). This is another quite bright planetary at 9.3 magnitude, and all that light from a volume 14 arc seconds across. It can take a while to find as usual but quite green and quite interesting to test your eyes by teasing out structure at high power.

NGC 6309 The Box Nebula – 17h14m05 -12º54'36"
3 degrees up from Sabik in Ophiuchus but closer to nu Serpentis (Cauda). Visible 11pm early August. This is a 10.8 magnitude, small, 16 arc second rectangular nebula that lies very close to a similar magnitude star. It can be a little challenging to see, despite looking like it has a reasonable surface brightness. I have manually found it in my 8 inch from a very dark site. Photographs show it to be a little fainter, but a much clearer shape, with wiggles to the sides of the box.

(Mayall) M1-32 / PK11+4.1 – 17h56m18 -16º30'00"
A 12th magnitude, tiny distant planetary at the Northern reaches of Sagittarius, above the Lagoon Nebula. Visible 11pm early August. This should have a high surface brightness as it is only 8 arc seconds across.

NGC 6578 – 18h16m17 -20º27'03"
A 13th magnitude tiny object, a short star hop from mu (orange) Sagittarii to the near double 15 Sgr and this distance again, close to a reasonably bright star. Visible 11pm early August. This is a challenge. Compare to Mayall 1-32 to see if the magnitude estimate matches up, as why did this get picked up by the NGC survey and not M1-32? How deep and distant can your equipment go?

NGC 6567 – 18h13m45 -19º04’34”
Rated as 11.5 magnitude, this tiny planetary lives in the right hand edge of the M24 Sagittarius Star Cloud. Even if it is a bit misty, try it out visually. The biggest challenge would be picking it out from the stars. It should appear greenish, or disappear slightly more when you look directly at it. There is a 15th magnitude central star. It is 11 x 7 arc seconds, so a good surface brightness.

NGC 6818 – 19h43m58 -14º09’13”
Also in Sagittarius, but the far North Eastern Part, beyond Nunki, is this planetary nebula, a degree above Barnard’s galaxy. It is moderately bright at 9.9 magnitude, and 17 arc seconds across. It rises a bit higher than some and culminates about 11:30pm in early August before the moon comes into play.

NGC 6781 – 19h18m28s +6º32’19”
Moving up into Aquila, higher in the sky, anytime early August. This is a much larger, more diffuse one. A lower surface brightness, but still quite visible, and this time you are rewarded with a bit of structure, a ring of glow. I have found this one visually by star hopping, it took a while as it’s not near many bright stars in the Western (right) part of Aquila. It is said to be 11.8 magnitude.

NGC 6704 – 18h50m45s -5º12’36”
Closer to Altair than NGC 6781, a slightly fainter, but much more compact 31 arc seconds, should give a higher surface brightness and a strong chance of spotting this one. There is also NGC 6703 above it.

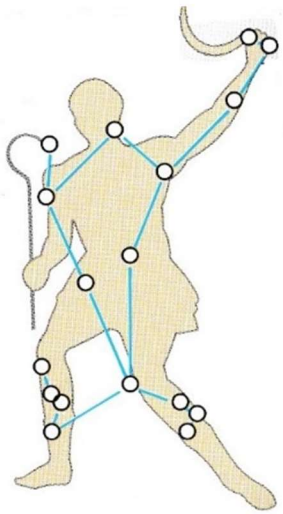
NGC 6905 – 20h22m23s +20º06’16”
Just over from Sagitta into Delphinus, this little nebula has reasonable prospects of being spotted. It is 11.9 magnitude and 39 arc seconds. It is a little greenish ring around a central star.

NGC 6765 – 19h11m06s +30º32’43”
Lyra has another planetary nebula, besides the Ring Nebula, near Albireo. This one is 12th magnitude or dimmer and looks like an irregular smear. It is not too small but quite hard to find as it is fairly dim to the eye. It is off the South East of the main asterism, past M56 the less spoke of globular cluster.

Campbell’s Hydrogen Star PK64+5.1 – 19h34m45 +30º30’59”
Cygnus has a ‘star’ that is a protoplanetary nebula towards Albireo, along the main neck of the swan. This one is very hard to distinguish from a star – it needs very high magnification once found. It is currently glowing brightly in Hydrogen Alpha light, which gives it a crimson appearance. It is only 5 arc seconds across, but 10th magnitude and can appear like a tiny, tiny red ring. It is unusual to see red through a telescope due to the lack of intensity required to stimulate your retina, but it can be seen in a larger telescope. It shows obvious spectral emission lines of hydrogen alpha as has been determined by putting a mesh over the front of our 20-inch telescope.

Dan Self

Boötes and Virgo,and an anecdote about Hercules

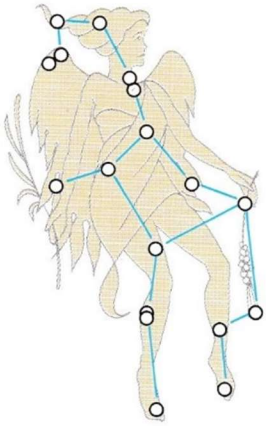


The constellation Boötes depicts a man herding a bear. The brightest star in the constellation, Arcturus, in Greek means 'bear guard' and the bear in question is Ursa Major. One story says that the man was Icarius, a farmer in Attica in Greece. He had a daughter called Erigone and together they welcomed the god Dionysus to their region and offered him hospitality. In return the god gave them a vine branch and taught them how to make wine. Icarius and Erigone enjoyed this new

drink so much that they wanted to share the pleasures of wine-drinking with others, so offered some wine to a group of Athenian shepherds. Unfortunately, the shepherds drank the wine undiluted and became very tipsy. The wine was so strong that it needed to be diluted with three times as much water. The drunken shepherds staggered about and angrily accused Icarius of bewitching them. They went in a gang to his house, set upon him and clubbed him to death. His body they buried under a tree.

Erigone, unaware of these tragic events, searched everywhere for her father. Meanwhile, their dog, Maera, found the burial spot, dug away at the loose soil and then pestered Erigone until the girl followed the dog to that spot. The distraught girl hanged herself from that same tree, while the dog jumped down a well and drowned.

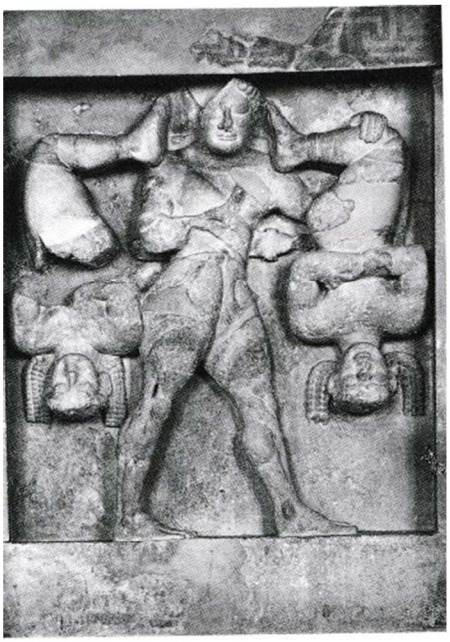
When he heard of this tragedy, Dionysus was very angry at the undeserved deaths of his friends. Therefore, he sent a madness on the girls of Athens that made them hang themselves from trees. Someone quickly consulted the Delphic Oracle and found out the truth of the matter. The murderous shepherds were hunted down and put to death, while the Athenians organised an annual festival in honour of Dionysus at the time of the grape harvest. This was called 'Aiora' (Swinging), during which girls swung on ropes suspended



from trees, with their feet resting on small platforms. Dionysus, for his part, immortalised his friends by putting their images in the sky as the constellations Boötes and Virgo. Some versions of the myth say that Maera, the faithful dog, is Canis Minor, although that constellation is usually believed to be one of Orion's hunting dogs.

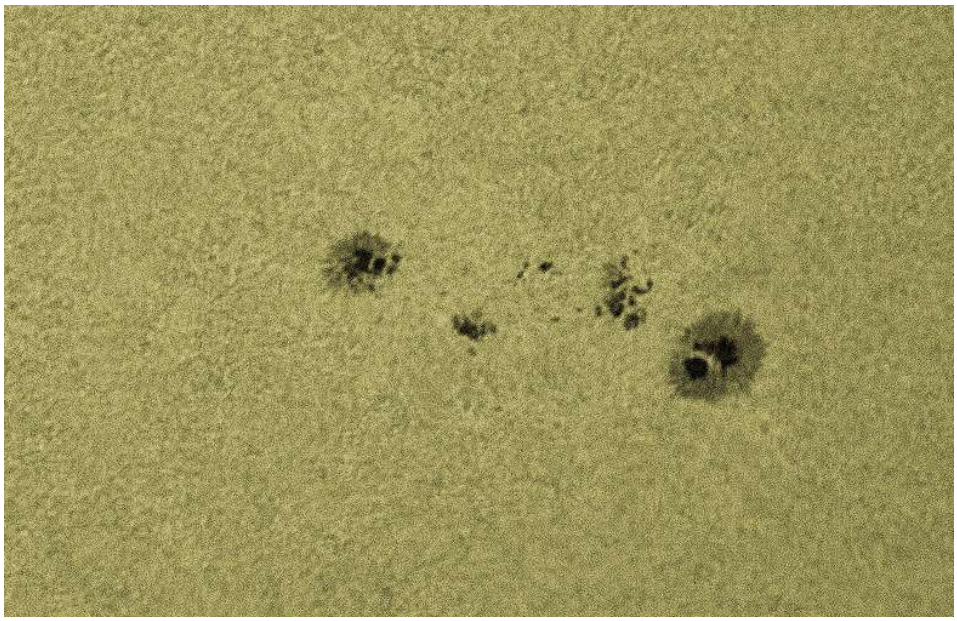
I have written about Hercules before and have described some of his many adventures. This one is not so well-known, but gives a little light relief after the tragis story of Icarius and Erigone.

Hercules was once sold into slavery as a penance and served Omphale, queen of Lydia. His crime had been to try to steal the sacred tripod from Apollo at Delphi. Hercules carried out many courageous deeds for Omphale. One day, on his way back from one of these, he lay down for a nap in the shade of a tree. He presently awoke when he became aware that two imps, the Cercopes, were trying to steal his weapons. These imps were twins and had been warned by their mother, many years earlier, to 'beware of Black-bottom'. Hercules tied them up by their heels and strung them from a pole he carried across his shoulders. Hanging upside-down, with a good view of Hercules's rear, too late they realised that he was none other than 'Black-bottom.' His lionskin did not quite hang down far enough at the back and he was very sunburned. As Hercules walked along, the Cercopes made so many jokes and ribald comments about his rear that he couldn't help roaring with laughter. Eventually he set them free in return for amusing him so much.



Hercules trying to steal Apollo's sacred tripod

Imaging the Sun Part 1



Solar activity attributable to Solar Cycle 25 is now on the rise, so maybe this is the time to share ideas and techniques. This article will reflect the methods that I use which may not be the same as other imagers. The Sun is probably the most dynamic object to image as features change daily, or with prominences and flares even over a few minutes/hours,

Warning

Observing the sun either visually or imaging can be dangerous and great care must be taken to avoid either personal or equipment damage. Focussing sunlight results in very high levels of concentrated energy. Below is shown the end cap on a telescope which was melted by just passing the sun with the objective cap removed to reach Mercury.

Had the camera been attached at the time I think that the sensor would have been destroyed, so great care is required. It is also possible to get a bad burn on oneself whilst attaching or removing equipment. Always make changes with the objective cap on.

The most common methods for imaging the Sun are :-

1/ White light

2/ Narrow band imaging which includes Hydrogen Alpha and Calcium K.

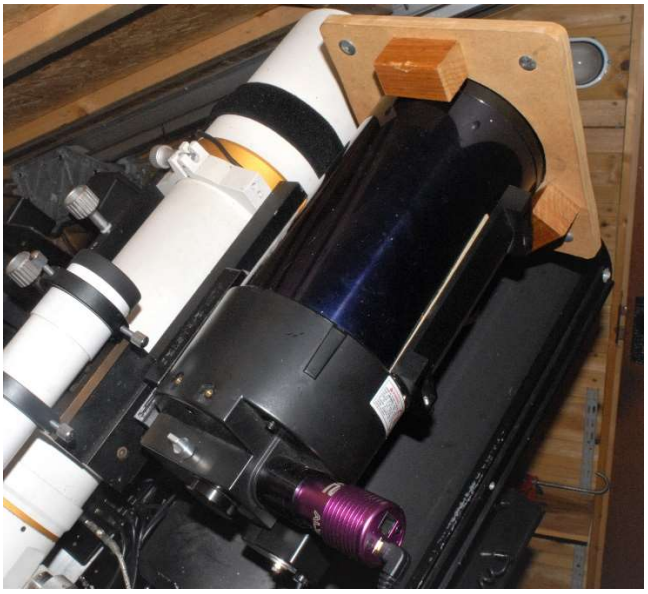
Other narrow band imaging can be used including the use of a Spectrohelioscope.

White Light

This uses some form of filter to remove most of the energy from the sun entering the telescope. There are several means of doing this.

Solar Filter

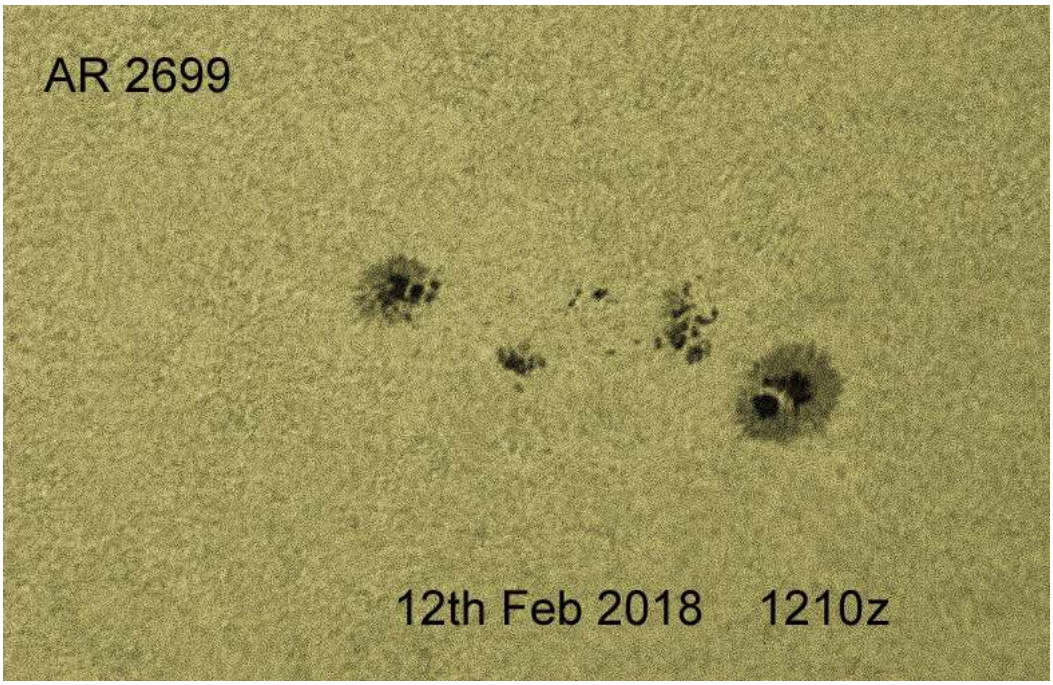
This is a filter that is placed in front of the objective or corrector plate and controls the amount of light entering the telescope. They are made either of a strong film or a coated glass plate. For visual use an Optical Density factor of 5.0 is required. For imaging, a film with an Optical Density of 3.8 is available. This must not be used for visual work but allows a shorter exposure time for imaging. Any filters using 3.8 film should be clearly marked “Not to be used for visual observations”. The film can be made into a holder and fitted securely to the telescope.



The film is clamped between 2 sheets of fibreboard and can be changed easily, and by slackening the wingnuts it can be made flat again. The film is very tough but needs to be inspected regularly to ensure it is in good condition.

I have been asked in the past, why not use a smaller telescope if you have a surplus of light. Normally with deep sky imaging we are trying to gather as much light as possible so a large aperture is desirable. The larger aperture also gives better resolution and it is this factor that also applies to Solar imaging. (The Dawes Limit is 4.56 seconds of arc, divided by the telescope aperture in inches.)

For most of the imaging that I do in white light I use a de-mounted Meade ETX125 with an Optical Density 3.8 film filter.



Herschel Wedge

This is a prism type arrangement, first proposed by John Herschel, that is placed on the eyepiece end of a refracting telescope. It must not be used on a reflecting telescope as damaging heat build-up will occur within the optical train. (The only exemption for this is using a reflecting telescope with an uncoated primary mirror specifically used for Solar imaging.)

With a refracting telescope the outer surface of an objective has no more risk of heating than an ordinary windowpane. Oil spaced objectives are not at risk either as the oil is chosen to be transparent so does not absorb energy. There is a slight possibility that expansion of the glass may cause a problem in the objective cell especially with fluorite type glass which has a high coefficient of expansion. If any form of Barlow lens is used it should be placed after the wedge as concentrated heating will occur if used in a position before the wedge.

There is some concern that if the telescope is not quite on the Sun then any tube stops may be heated, as the inside of the tube is normally coated matt black and therefore this would be absorbed. With the scopes I have used I have not had a problem and normally keep the Dew Shield fully extended.

The Herschel Wedge transmits between 3 and 5% of the light and the rest is safely directed away. For visual use this may be too much and depending on manufacturer this is further reduced either by neutral density filters or polarising filters which allow variable control of the output. It is possible to allow more light through for imaging to allow the exposure times to be reduced.

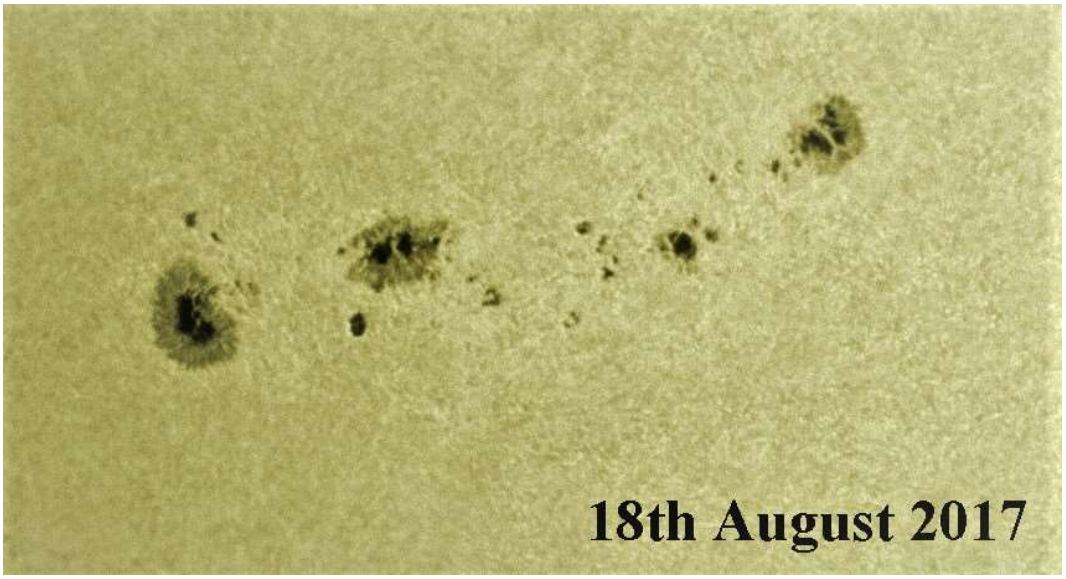
The picture shows a Herschel Wedge in use with a 2X Barlow placed after the wedge. (Also note the solar finder which was made from a scrap piece of scaffold pole.) The camera fitted is a fan cooled MX178 Mono. The Herschel Wedge also has a solar finder where the dissipated energy impacts on the ceramic cooler. The grills are to allow air flow for cooling and even after an extended period the screen remains cool.

Image during partial eclipse taken using

Herschel Wedge and MX178 Mono camera

Solar Telescopes with uncoated mirror.

In 1858 Porro had realised the advantage of an uncoated primary. This solution was updated by Art Whipple in the early 2000s then developed more widely in the early 2010s. It is simply replacing the primary mirror in a reflecting telescope with an uncoated ‘mirror’. Take into consideration are heat dissipation, ghosting and the reduction in intensity level. For a very modest outlay the amateur has a powerful solar telescope offering a large aperture and the consequent high resolution. The coating should be left on the secondary mirror as to remove this would give a ghost image from the rear surface. The primary should not be coated on the back as the need is to disperse the light and heat although again this is no higher density than a window. The mounting of the primary would need to be considered so the heat dispersion did not cause expansion and therefore affect collimation and image quality. For imaging, the sensor could be placed at the main focus and the need for a secondary dispensed with; -:Project anyone?

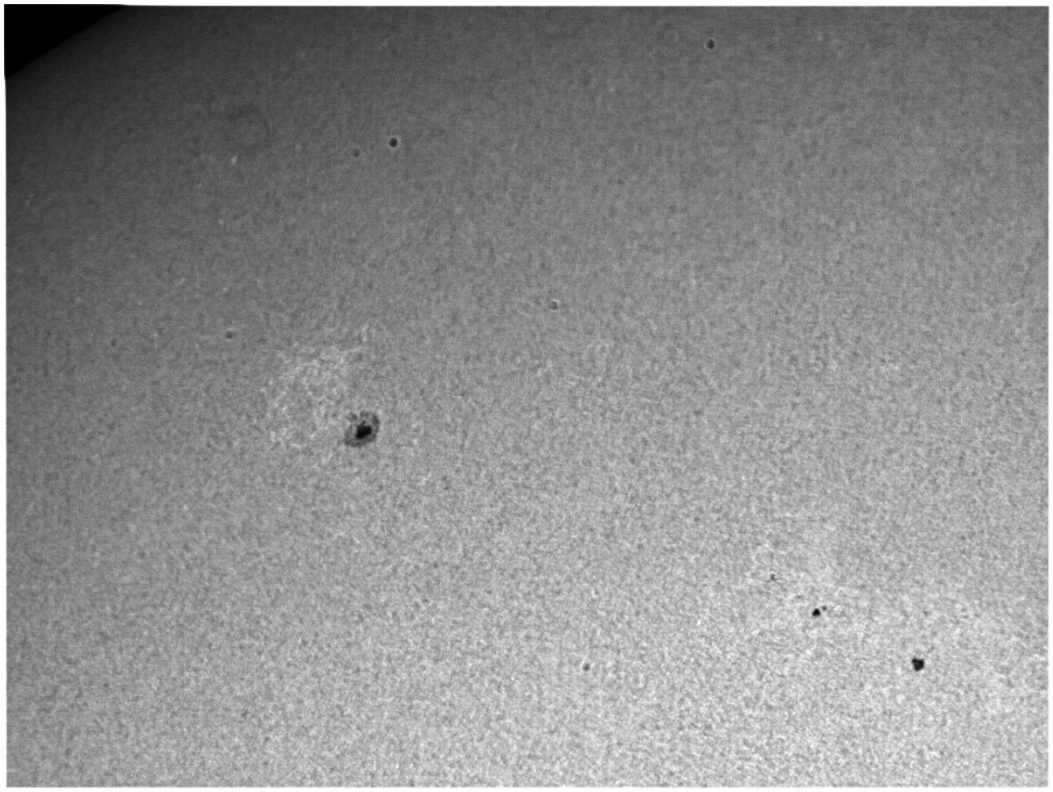


Camera

Almost any camera could be used but some types lend themselves better to the task. The normal method is to take a large number of images and use software to select the most suitable and stack them together to get the final image. For this a small webcam type camera is very suitable. There is no real advantage to using a colour camera so for all my work I use a mono camera which gives better resolution and tends to be more sensitive as they do not have the Bayer filter. For a lot of the images I use an ALTAIR GPCAM2 130 which will run on a 5 mtr lead at about 25 fps (frames per second), so for 1000 frames it takes about 40 seconds. This is stored as an Av file and processed in Astrostaka or Registax.

For larger areas I use the ALTAIR MX178 Mono shown before. This is a fan cooled camera and therefore the chip may stay cooler. This works on a local computer via 0.5M USB3 cable and reaches full frame speeds of 55fps. The files tend to be large and can soon fill up most disk drives unless the unneeded files are removed. There is another ALTAIR camera which has recently arrived on the market, the GPCAM3 287M Mono USB3 camera. This camera has a very high frame rate on USB3 (stated to be up to 540fps). Very high-end cameras may be best avoided as there is always a chance of accidental damage which could destroy a camera sensor in a fraction of a second.

One difference in Solar imaging is that dust bunnies etc show up more than any deep sky images. Light frames should be used if this is a problem. The image below shows what may be a problem



Normal flats can be used but it is also possible to move to a reasonably blank area of the Sun (no sunspots) and defocus; this will allow an Av file to be created which can be processed in either of the above programmes and then applied to remove the defects. This may not be technically totally correct, but it works well for me and is quick and easy to apply.

Filters for use with white light.

When using colour filters (either wideband or narrowband) with mono cameras the effect can be dramatic. The two main uses are to reduce the effects of atmospheric turbulence or to enhance detail on the surface.

Filters towards the blue end of the spectrum will improve the darkening of the limb and increase theoretical resolution (for a given aperture the size of the diffraction spot increases when wavelength increases.)

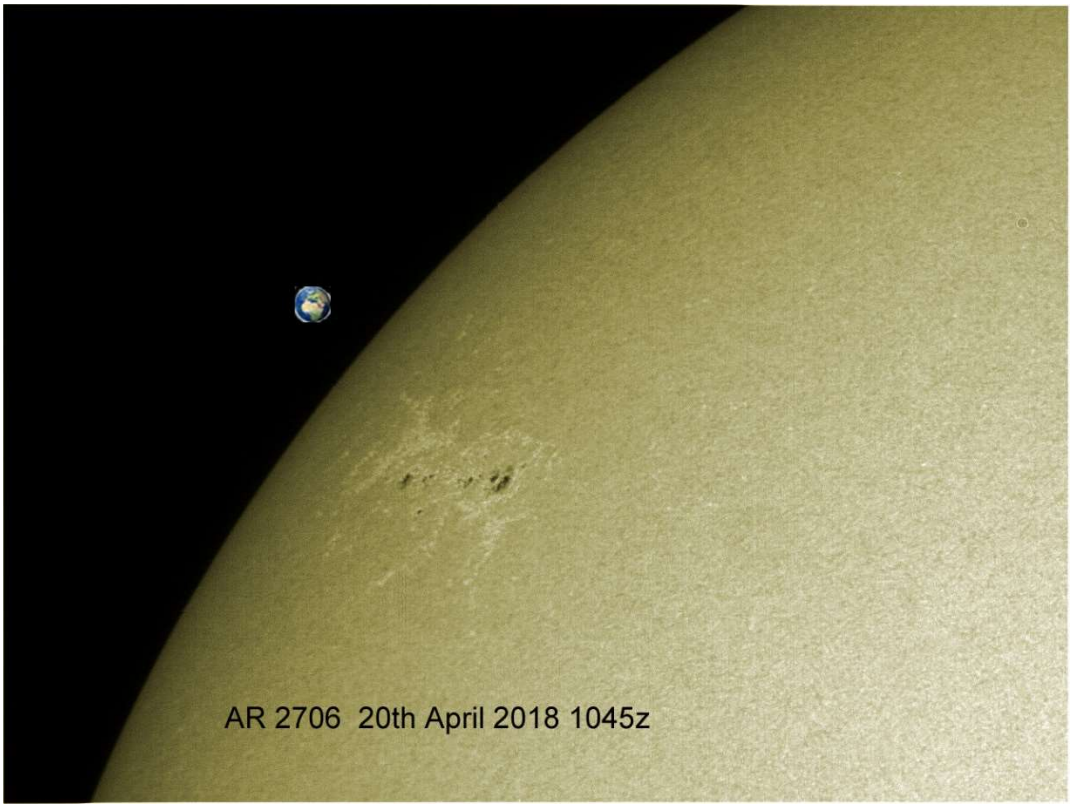
The contrast of granulation spots and faculae increases as the wavelength decreases. A blue filter increases the contrast of granulation by 35% compared to a red filter. The possible disadvantage is that with a blue filter the umbra becomes darker which makes it potentially more difficult to detect the possible presence of umbral bright spots.

The two filters that I most use are

1/ Continuum filter with a centre wavelength of 540nm and a bandwidth of 10nm this is in the blue end of the green.

2/ Calcium K Line with a centre wavelength of 395nm and a bandwidth of 10nm. This is in the violet part of the spectrum and cannot be used for visual observations by most people. Also, it may damage eyesight due to the near ultra violet nature. When using cameras with this, their sensitivity curve should be checked to ensure the camera is capable of using the spectral wavelength.

The additional filter is a Wratten type filter no11 which is listed as yellowish green. This has proven useful when high cloud is present.



In the second part of this article, I will endeavour to unwrap the methods for Ha imaging and also other narrowband imaging.

Jupiter's Moons during August

The dates below are the nights of the date given, leading to the morning of the next day, i.e. Aug 3 at 4:00 am is actually Aug 4, but the night following Aug 3. Jupiter reaches opposition around Aug 20, so shadow transits fall almost directly behind the moon at that time, as the sun is behind us. Jupiter is 1º11' South of the Ecliptic plane this year, but at a declination of -13½º meaning it rises to 25º above the South horizon. Much higher than last year. Jupiter is 4.01 Astronomical Units away and spans 49 arc seconds. In September 2022, Jupiter has a slightly closer opposition (3.95 AU) as Jupiter approaches perihelion.

Aug 1	23:00	Rare event. Ganymede approaches, partly eclipses then recedes from Europa (2hrs).
Aug 2	22:45	Io and Europa appulse (pass)
Aug 3	4:35	Io's shadow enters disc shortly followed by moon.
Aug 4	21:38	Ganymede goes into eclipse (shadow)
	0:27	Europa's shadow starts to cross disc
	1:10	Europa starts to cross disc
	1:46	Io goes into eclipse
	2:50	Ganymede emerges
	3:13	Europa's shadow leaves disc
	3:56	Europa leaves disc
	4:28	Io emerges, three moons cluster closely round Jupiter
Aug 5	23:00	Io's shadow enters disc, shortly followed by moon.
	1:16	Io's shadow leaves disc, shortly followed by moon
Aug 6	22:30	Europa emerges
	22:52	Io emerges close to Europa
	0:14	Io and Europa appulse
	3:15	Callisto goes into eclipse
Aug 9	1:03	Io and Europa appulse
Aug 11	1:00	three moons cluster closely round Jupiter
	1:38	Ganymede goes into eclipse
	2:59	Europa's shadow enters disc
	3:23	Europa enters disc
	3:39	Io goes into eclipse
Aug 12	0:55	Io's shadow enters disc shortly followed by moon.
	3:13	Io's shadow leaves disc shortly followed by moon.
Aug 13	9:35	Europa goes into eclipse
	10:08	Io goes into eclipse
	0:18	Ganymede and Callisto appulse, far from disc, while other 2 hidden.
	0:35	Io emerges, having overtaken Europa behind the planet
	0:46	Europa emerges a short distance N of Io

Aug 14	8:40	Jupiter rises with Io and shadow transit in progress
	9:40	Io shadow leaves disk, shortly followed by moon
	0:09	Ganymede and Europa appulse
Aug 15	8:40	Jupiter rises with all 4 moons clustered around it
	11:05	Callisto and Europa appulse
	5:15	Ganymede and Callisto appulse as Jupiter sets
Aug 16	1:11	Ganymede and Callisto appulse (again)
	3:38	Io and Europa appulse
Aug 17	9:37	Europa and Io appulse
Aug 18	8:35	Ganymede and Io appulse (very low 2 degrees)
	5:19	Ganymede and Io appulse very close to Jupiter's disc (low 5 degrees)
Aug 19	2:48	Io and its shadow almost directly behind it enter disc (opposition transit)
Aug 20	11:31	Europa and Io appulse close to Jupiter's disc
	0:00	Io goes behind planet
	0:09	Europa goes behind planet
	2:19	Io emerges from shadow very very close to other side of Jupiter
	3:05	Europa emerges from shadow (")
Aug 21	9:15	Io, then shadow very closely after start to cross disc
	11:32	Io, then shadow exit disc
	4:24	Ganymede and Europa appulse
Aug 22	8:20	Jupiter rises with two moon and two shadow transits underway
	8:49	Io emerges from shadow close to edge of Jupiter
	9:30	Europa then shadow leave disc
	10:57	Ganymede then shadow leave disc
Aug 23	8:32	Callisto disappears behind Jupiter (low 4 degrees)
	2:00	Callisto emerges from shadow
Aug 24	11:57	Europa and Io appulse
Aug 25	1:28	Ganymede and Io appulse
Aug 26	9:18	Ganymede and Io appulse
	4:33	Io starts to cross disc followed by shadow
Aug 27	8:38	Io and Europa appulse (close)
	1:45	Io goes behind disc
	2:25	Europa goes behind disc
	4:14	Io emerges from shadow
Aug 28	10:58	Io starts to cross disc followed by shadow
	1:16	Io leaves disc followed by shadow
Aug 29	8:09	Io about to go behind disc as Jupiter rises (low 5 degrees)
	8:09	three moons clustered around Jupiter

	8:57	Europa starts to cross disc
	9:29	EUrops's shadow starts to cross disc
	10:39	Ganymede starts to cross disc
	10:43	Io emerges from shadow
	11:41	Ganymede's shadow starts to cross disc
	11:43	Europa leaves disc
	0:14	Europa's shadow leaves disc
	2:14	Ganymede leaves disc
	3:18	Ganymede's shadow leaves disc
Aug 31	8:11	Io and Callisto appulse
	9:33	Europa and Callisto appulse
	2:28	Callisto starts to cross disc (it's shadow doesn't make it that night)

For September, perhaps check out Stellarium or any updateable planetarium software, this is what I used to produce the info above, manually searching.

For Great Red Spot timings, I believe there is still an applet by Sky and Telescope that calculates the next few crossings. The BAA handbook for 2021 is available at the observatory.

Dan Self

New Focuser for the telescope

I wrote a brief article about my H N Irvine focuser, which I have now replaced it with a Moonlite focuser. With mass produced off the shelf equipment these days one can often buy adapters and spacers etc. at silly prices. I needed to fit a CNC made focuser to a Homemade telescope built around a handmade focuser whose base mounting holes for fixings were drilled by eye in the four corners of the housing. I really wanted to still use the existing fixings and not have to make any alterations to the telescope.

Original H N Irvine focuser

Moonlite replacement

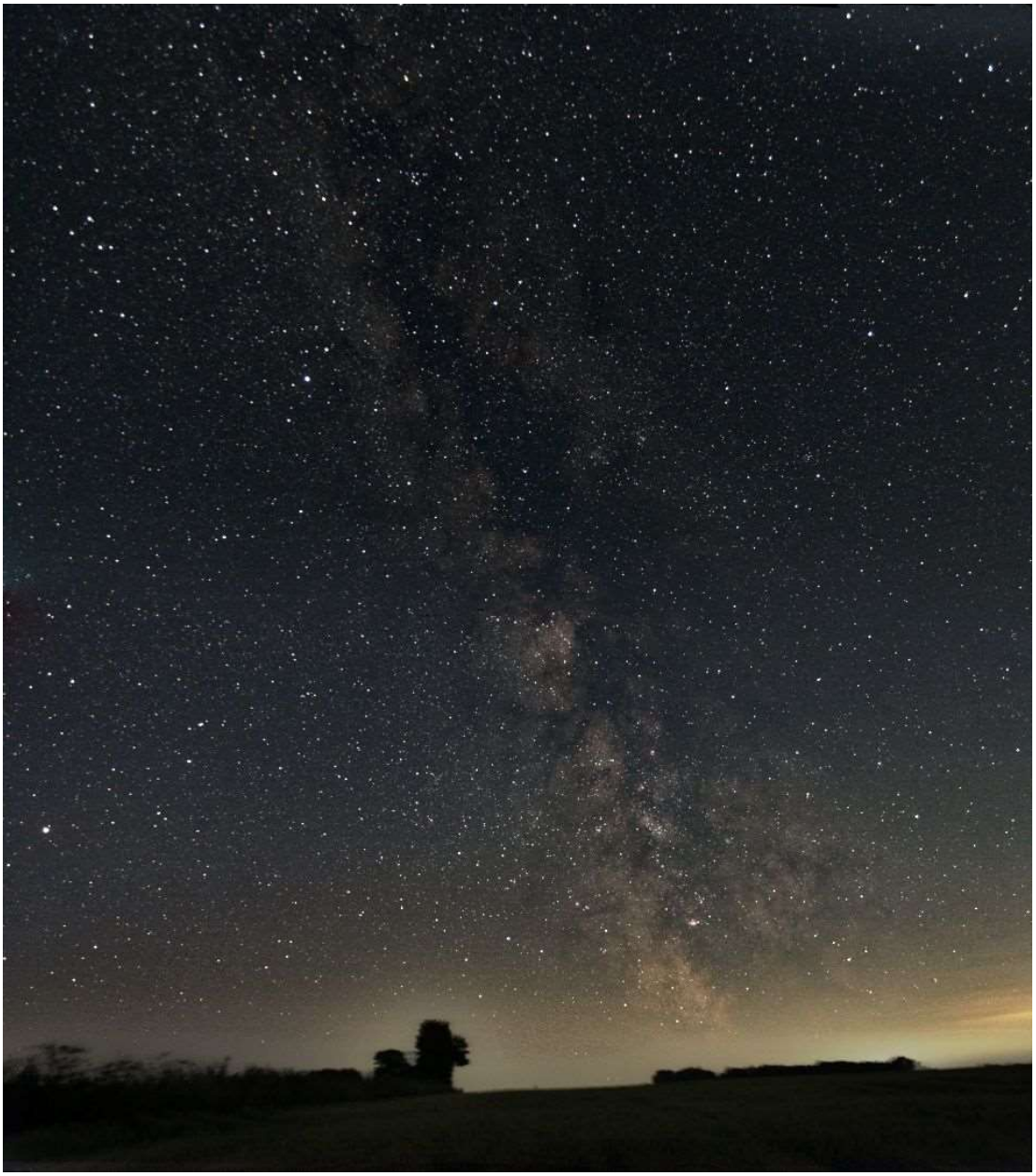
For the adapter I used Mahogany wood, light but strong, 4 pieces glued together. I could have used aluminium or even got it 3D printed, but the rest of the telescope is wood and this probably is the lightest option at 2 ounces. Now it has been sanded and finished with satin black spray paint you wouldn't know it was wood.

The reason I choose this particular replacement focuser was because the specifications including weight was easily available on the internet and so I knew I could make it fit. The original H N Irvine focuser weighed 17oz while the replacement Moonlite weighed 13oz plus 2oz for the mounting adapter/spacer. At 15oz, you wouldn't believe it looking at the size difference . The 1 1/4" to 2" eyepiece adapter weighs an additional 4oz (could have easily been lighter). My telescope is a trussed Dobsonian with the bulk of the weight at the lower end in the mirror box. The focuser is fitted to a light secondary mirror cage assembly mounted on trusses some four feet distant, so just a few ounces makes all the difference in balance.

John Wilkins

Members Astrophotography

Dan Self



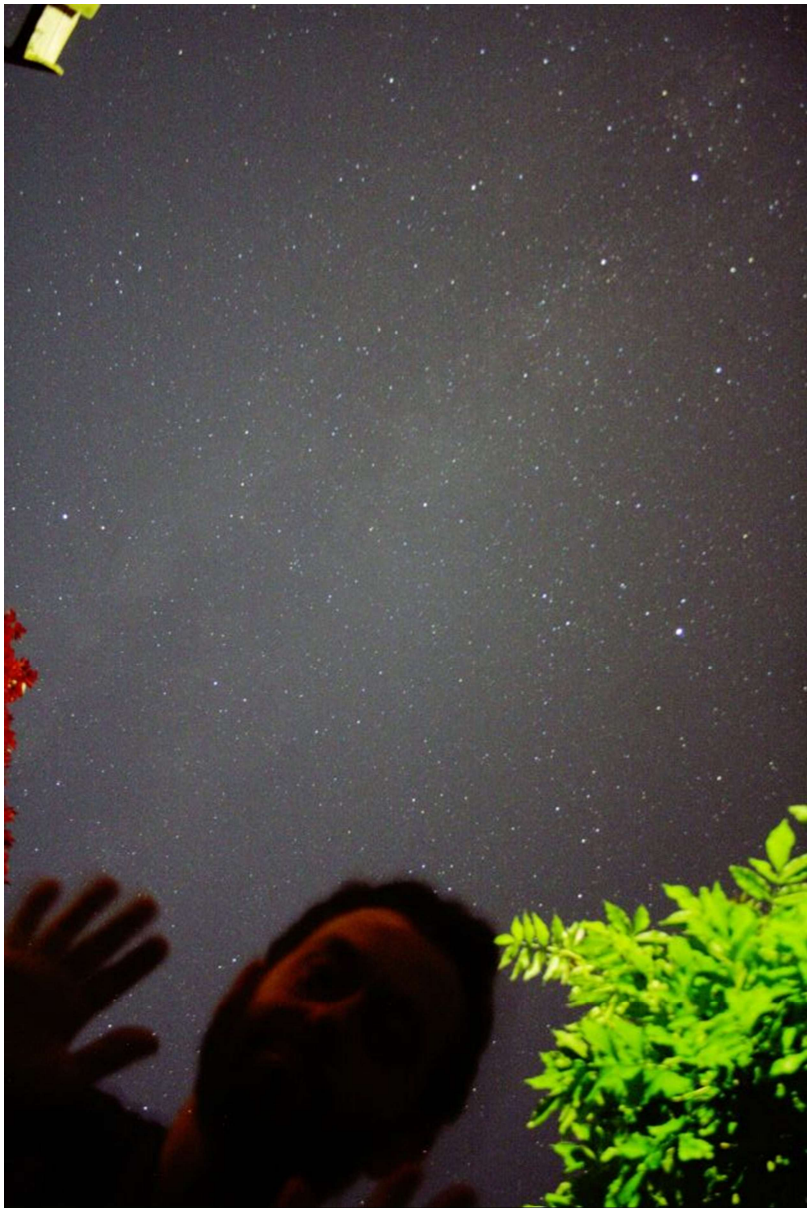
Mosaic of 2 Vertical Milky Way rural

Lunar ‘V’ Barlowed 8” SCT

Hercules C130J Flyby Observatory field.

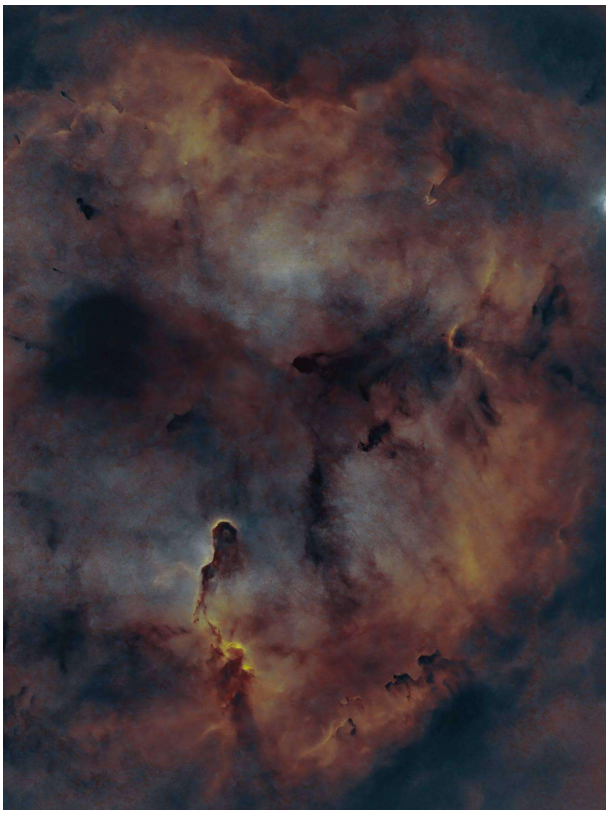
Cygnus Loop 15X1min from city with OptLE Filter Cropped

Abell 70 23X30Secs 20” Observatory telescope

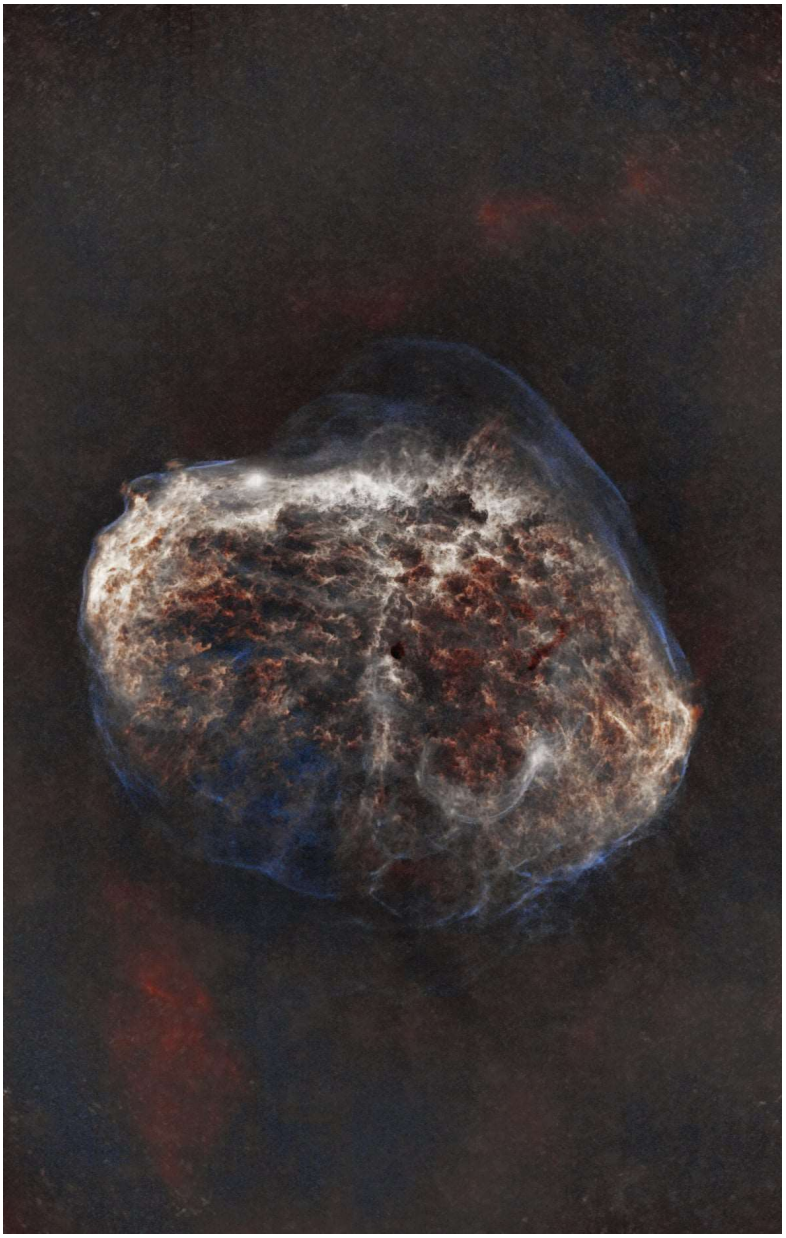


Summer Triangle and Dan -Back Garden

Andy Weller



Elephants Trunk Nebula



The Crescent Nebula (NGC 6888)

Celestron C11 SCT, ZWO ASI294MC Pro Astro Camera and an Optolong L_Extreme filter.

I took around 8 hours of exposure but was only able to use 5.5 hrs

Dumbbell through C11 SCT.

Neil Wilson

Reprocessed bi-colour image of the Crescent Nebula (NGC 6888) captured last November.

another reprocess of some old data captured last November.

This is 'The Medusa Nebula' some 1500 light years away in the constellation of Gemini.

Skywatcher 80DS Pro. Altair Hypercam 183M Pro.9 x 5min Ha 9 x 5min Oiii

Stacked in DSS and processed with Photoshop.

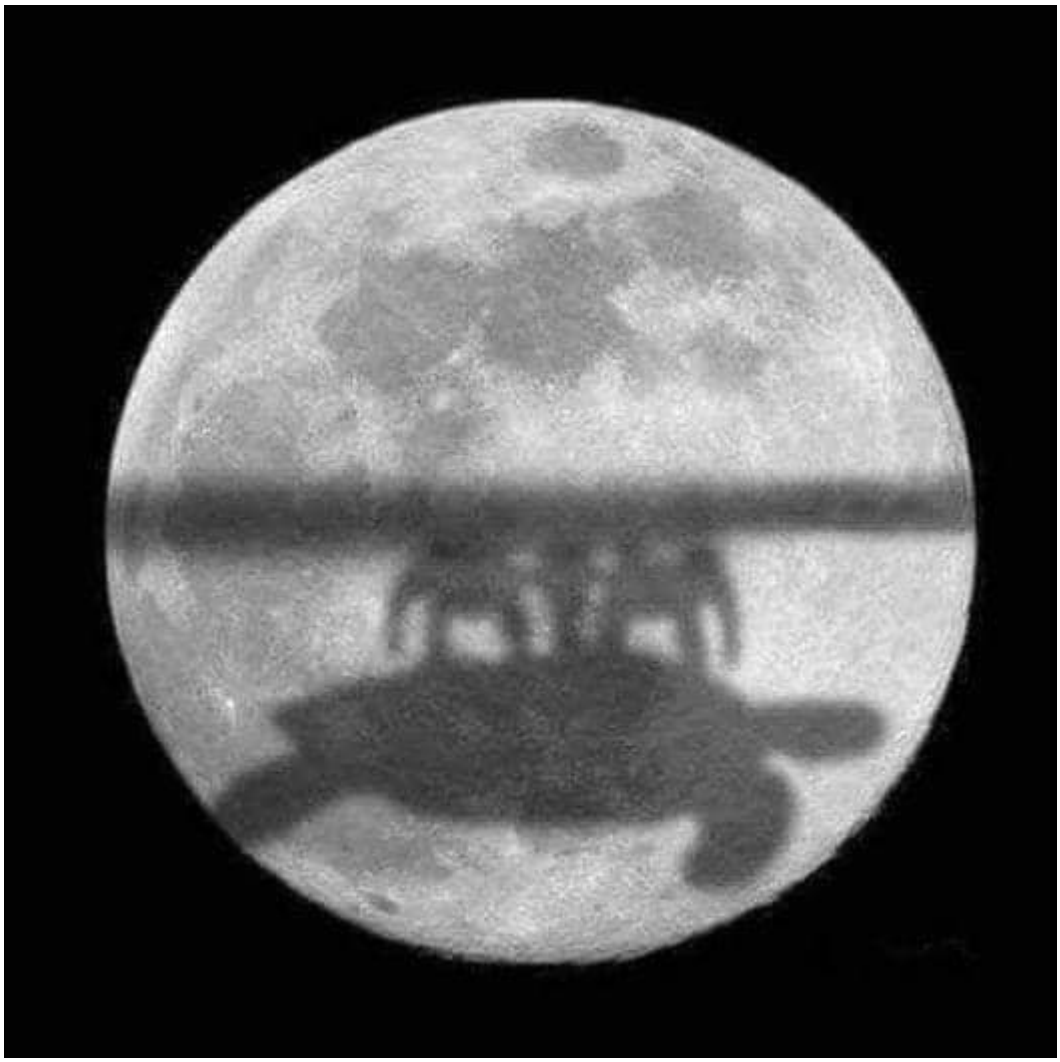
Malcolm James Dent

M71 15 x 3 minute exposures

M27 6 x 5 minute exposures

Michael Wilson

Andy Jones



And Finally

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 during visits. An upper end- class 2 green laser is sometimes used for pointing out stars outside. This should NOT be	Low

	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 emergency. Can exit via dome opening in emergency.	Tolerable
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	Low

	policy. The committee are vigilant with regard to risks.	
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 national guidelines. Be mindful of face to face breath transmission.	Tolerable
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. +Frist Aid trained for day job

Signed……

Chairman, Breckland Astronomical Society, UKCC 1044478.

BRECKLAND ASTRONOMICAL SOCIETY

Charity No.1044478

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Dr Dan Self, Chairman

chairman@brecklandastro.org.uk

RETURN TO HALL COVID RISK ASSESSMENT 2021

The risk COVID poses to local residents is now much smaller, with up to a 1 in 1000 or less who catch COVID dying (source Tim Spector, ZOE). This is still an intolerable level of risk, however is not greater than a winter flu. As more are vaccinated and the longer we wait for the vaccines to take effect, and booster shots are given, this risk will reduce. If anyone is particularly vulnerable, eg has a respiratory disease, or a serious autoimmune disorder they may wish to continue to not attend in person. This would mean the risk of dying if the disease is caught reducing to a more Tolerable level. We will endeavour to livestream the talks from a tripod near the projection stand, although the service will not be as personal as zoom or google meet.

Hazards	Risk Control Measures	Outcome risk rating
Spread of SARS COVID-19 delta variant by airborne transmission	Limit numbers in hall to 40, it is a community building. Legally any number is allowed from July 19. Usually numbers are well below this, so will be a small risk.	Tolerable if we can keep doors open
	Physical distancing between bubbles, of 1 metre + not face to face. This is not enforceable, as it is not government guidelines. Space out chairs to fill room.	Chairs are all facing forward anyway so this works
	Do not come to the hall if displaying two or more COVID19 delta variant symptoms. These are (for vaccinated people, most common first): Headache, Runny Nose, Sore Throat, Sneezing, Persistent Cough or Loss of Smell. Fever (high temperature) is more likely to be a sign of COVID if unvaccinated.	
	Wear masks as a request. Again this is not enforceable as it is not government guidelines.	
	Ventilate hall. Easy when weather is warm, not ideal when cooler, so only applicable in August/September. The back door and bar flap may be a better option to use as a ventilation path in colder months.	
	Have a ventilation break at half time, open up all doors fully and have coffee then, in order to clear the hall from any possible airborne particulates (see below).	
Spread of SARS COVID-19 delta variant by airborne transmission during coffee	Masks have to be removed for coffee or a break for air. Or for those with breathing problems. Having coffee partly outside, we may not all fit, but any reduction in people density in the hall is a recommendation. This can be under a Gazebo erected by the fire doors, if weather is poor.	Tolerable if warm enough. Revise if case numbers climb, or weather worsens.
Spread of COVID-19 by Surface transmission	Sanitise hands on entry. Wipe surfaces. Washing hands a necessity after toilet use. Surface transmission is a minimal cause of COVID spread however, so it is considered low risk to use	Low

	provided mugs again. However we must wash up mugs thoroughly.	
	Payment is still cash only (£2.50). The other method is by donating £2.80 to the Donate button at the website (add 30p for the PayPal costs). Raffle ticket prices to be added. Surface transmission via coins and paper is a minimal cause of COVID spread.	Low
Outdoor transmission	Physically distance more than normal, however risk is found to be low outdoors. Follow national guidelines. Be mindful of face to face breath transmission. Note: if you can see where someone's vape is going you can catch airborne particles from their lungs. Note 2: Please keep vaping outside the hall.	Tolerable
Reporting	Signing in for track and trace purposes will be stopped from July 19. However records of numbers will be kept by the entry log book.	Not necessary

Trustees as of 16/05/2021 are: Dr Dan Self *+(Chairman), Andy Jones*+ (Treasurer), Richard Harmon. Committee members (acting trustees): Rebecca Greef*, John Copsey.

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 chairman@brecklandastro.org.uk if you want to join

Back in the Hall August entry £2.00 + live stream option

Friday, August 13th	**Extreme Universe!** + 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	**Archaeoastronomy – A Brief History**	Prof Clive Ruggles, Emeritus Leicester Uni
Friday, October 29th	**Public Open Night**	Observatory
Saturday, November 6th	**Star Party* (DASH – Suffolk)**	Haw Wood Farm
Friday, November 12th	**Quiz Night**	Dan Self, BAS
Friday, November 26th	**Public Open Night**	Observatory
* 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		