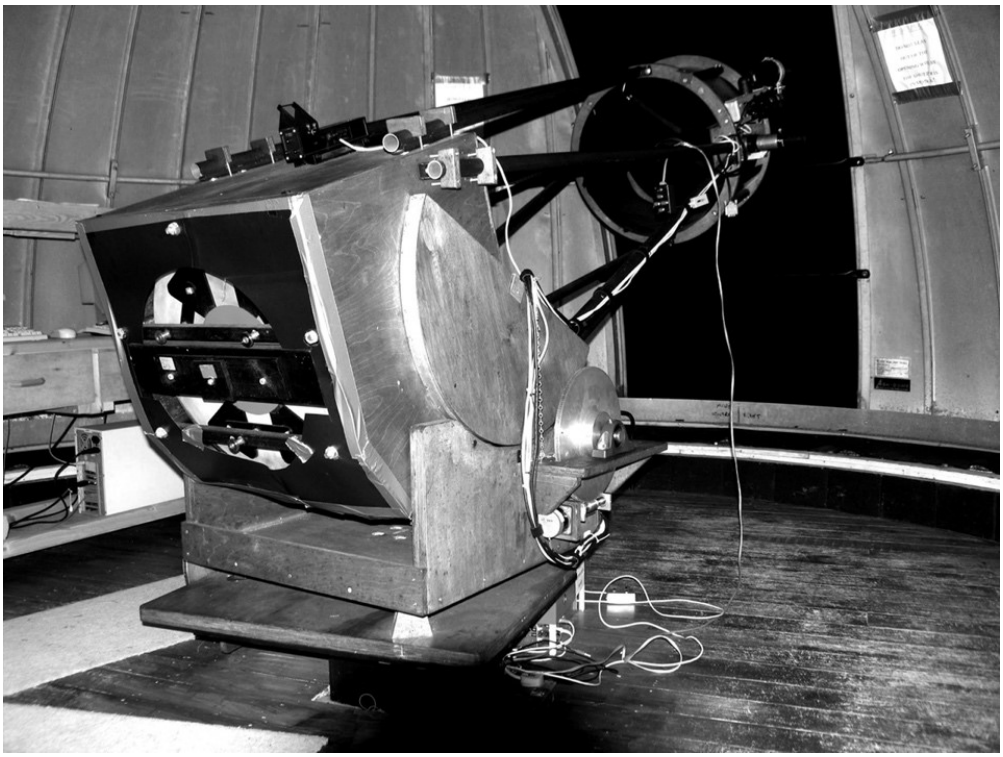
Breckland Astronomical Society

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

EXTRA TERRESTRIAL

Newsletter January 2023



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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 January February 2023

Dear all at Breckland Astronomical Society. Welcome to winter nights featuring Orion Taurus Pleaides and Mars. Get out there and brave the cold we want to see your pictures and hear your stories. You may catch a meteor.

A BIG THANK YOU to the helpers we have had 2022. It has been a challenge to get there myself as much but have had some great chats and lots of interesting times when I have made it later on Tuesday nights. I know you deserve a chairman who has lots of time but I have had to dedicate more of my evenings and energy to my young family at the moment. But I hope you can feel the enthusiasm still oozing out of me.

We didn't get the new account sorted yet, due to the bank requiring more and more and more paperwork, so please pay your subs into the account you did last year, or see Andy at the talk. We haven't put up the prices for many many years!

The Facebook group has continued to grow. As group joining options were changed, we were forced to let people join without approval. Also I have had problems approving posts where I click approve but nothing appears, so apologies if you are a newcomer and wanted to add a comment or reaction, try messaging me at chairman@brecklandastro.org.uk.

Let's break this up with a little whimsical puzzle. I'm wondering what your Blankety Blank answer would be for Astro____ . Maybe the most popular answers would be
"logy","nomy","photography".
However if you:
are really into photographic telescopes maybe "graph" would excite you
admire fine precision measurements "metry" would be a good answer
for me, standing in a field with some 20x80 binoculars "therapy" would work
I'm also thinking "Art" and of course we now have "biscuit" on YouTube and for one our members' online pseudonym is "Geek". Answers on a postcard (not really, just a figure of speech)

Twilight and Moon for Jan and Feb 2023

Evening twilight finishes around 17:45 at the start of the year and around 18:45 at the end of February.

Moon is full on the evenings of Friday Jan 6th and Sunday Feb 5th. The Lunar 'X' feature should be visible on the 27th February, from afternoon into the early evening.

The Moon will be 'out of the way' for deep sky observing from about the 11th Jan and 9th Feb when it rises about 9pm. For those midnight observers, the 15th Jan and 13th Feb. The crescent moon (or Toenail Moon as Dr Becky calls it) sets with Jupiter on Wed 25th Jan or after Jupiter on Thu 23rd Feb.

Check out this awesome moon page by nasa. https://svs.gsfc.nasa.gov/5048

Solar system

At the end of January Mercury is visible low in the SW in the mornings, from 19th to around the 30th when it gets a little brighter – look at 7 am.

We are lucky to catch a grazing occultation event in East Anglia. The Moon grazes its South Pole over Uranus on January 1st at around 22:45 – this would be worth filming as it could look very odd with the planet disappearing behind various mountains and reappearing. Attleborough looks like a perfect graze of half of Uranus' disk whereas Norwich shows a 10 minute occultation. Reports and especially videos with exact timings of this would be interesting for the British Astronomical Association bristastro.org or the Society for Popular Astronomy www.popastro.com . The 10th magnitude asteroid 27 Euterpe is a degree South of the moon at the time also.

Mars is amazing and starting to recede, but will be noticed more by the public as it moves into the evening sky. Starting at magnitude -1.2 and size 15", it fades to 0.4 and shrinks to 8" gaining a 90% gibbous phase. It hangs around in the evening sky for many months, fading slowly and shrinking.

Venus starts to show itself in the evening twilight as a small disk, distant and not at its brightest, but still blazing bright -3.8 magnitude. It approaches close to Jupiter on the 1st and 2nd March.

Asteroid 2 Pallas is very low in Canis Major but fairly bright as it was the 2nd to be discovered. Also 1 Ceres is in Virgo in the morning sky, with Earth approaching until March/April, and 6 Hebe is in Cancer near Hydra's head.

Comets

2022 E3 ZTF shoots across from Draco to Ursa Minor in January, when it will have a closer pass to Earth. Use Heavens Above or Seiichi's comet page http://www.aerith.net/
for a January chart https://www.skyatnightmagazine.com/advice/comet-c-2022-e3-ztf/
or https://shopplaza.nl/astro/ It should reach a decent brightness all being well.

Heavens above are generally more up to date with a chart but now you can use charts such as The Sky Live or Stellarium Web for live calculations. I find The Sky a bit clunky and less useful.

https://heavens-above.com/Comets.aspx?lat=52.5&lng=1&loc=Unnamed&alt=50&tz=GMT

Events

Our open evenings in October and November were popular and well attended, a great atmosphere and lots of new people viewing things as the clouds started to clear. Hence we are so grateful for the help as this is our charity's aim. It seems the astronomers live far and wide, and a lot of us have a lot of time pressures squeezing the astronomy out. Special thanks to Mick for keeping on top of arranging all the bookings and Chris for the long drives. I look forward to doing as many more of these as I can - they are very rewarding for all involved.

Mick Ladner, Malcolm Dent and I gave a workshop on astrophotography for camera users on Tuesday 8th November at the Camera Club in Saham Toney. This was followed by a practical astrophotography session outside, where we tried to get the external lights turned off! It was very appreciated and we have invited the club to visit the observatory mid January.

There are many online talks these days but a couple of friendly faces that came into a few of our pandemic zoom sessions, Roger Hyman from Somerset, and Rachael Wood from Doncaster are now appearing in a Monday night YouTube streamed 'programme' *Space Oddities*, which is well

worth a look at 8pm Mondays. There is a friendly small crew of mainly astrophotographers that run the broadcast, which has a nice atmosphere to it. You can find links on the facebook group.

Talks – Quiz Night and Flat Earthers

Next events

Quiz Night was really great thanks to all of you that came. There were so many I knew that were more distant that didn't come this time but it was made up for by more local people. I think its safe to say what made the night was the Grant party. We will have to think if we can add an extra lottery prize next year. Thank you very much for all the compliments, I put lots of effort into the questions and so I'm very pleased they were appreciated and we had 6 teams battling it out. And remember it's not the winning... (Dan)

The December talk was a very welcome and interesting departure from the science of astronomy. Dr Harry Dyer, a lecturer in education at UEA had been to the UKs first Flat Earth Conference. Harry is starting a brave and fascinating career in sociological research and is very careful about how he views people.

While Harry was somewhat undercover as he hid some details when registering, he gave the impression he was 'the scientist' to some, which didn't provoke as hostile a reaction as one would have thought. Note that on meeting Harry, he comes across as the sort of chap it would be difficult to be hostile to, he is all smiles and looked especially calming with the woolly jumper attire, hence, perhaps a Louis Theroux approach.

There has conclusively been a rise of alternative ways of thinking thanks to the dawn of the internet age. This is both dangerous and intriguing and so worthy of research and understanding. At the conference there were so many different models of the Earth. An 'egg' model !?! with lights, some religious models, and a lot of mentions of Ice Walls and as a bonus, a Hollow Moon was commonly spoken of.

Models aside, the participants wanted to discuss science, they loved serious science, some even wanted to be proven wrong. But they had a strong distrust of science communication as a common personality trait. There were experiments and observations of moon timings, which they compared against timeanddate.com website. One giving underqualified conclusions about why the moon doesn't move the same amount in time shift every day. There was a general lack of understanding and knowledge of the effect of two different planes of orbit and rotation, combined with eccentricity. Something showing a lack of relevant education in science while very instead good at communication.

The Socratic way of thinking dominated – I need to see with my own eyes. The gaps in their observation and knowledge were filled in with mythos and non-hierarchical thinking. They believed something called Syncretism, or a Holistic way of thinking, which tries to transcend the current scientific method, rather than realising trust allows knowledge to be pooled.

One uncomfortable bit of the conference was that they had invited a group of PhD students to have a "debate" under false pretences, which was a bit of a free for all attack from the one sided audience. One young child was there and stood up and professed how much he believed it, quoting numerous "facts" which looked rather manipulative of the parents.

So why now? It's not just the internet that's caused this flat earth revival is it? Well technology in whatever shape or form changes our culture – it has a big effect.

The first man who used an umbrella for rain was heckled. Prior to that they were mainly ladies' sun shades. He was judged on external appearance but it was a better use of the technology and so it took off. Harry showed us a lumpy bench in London, technology to stop rough sleeping, and a slope against a church wall in Norwich apparently to stop drunken peeing. So technology IS changing how flat earthers view the world somehow.

Harry wants to know why they persist in their belief, because the Internet was created as a space for a utopic vision, for us all to see everything and become one but the opposite has happened. HG Wells' the World Brain is coming true. FEs distrust the internet and media so totally, that it reinforces their cognitive dissonance encountered when their schema butts up against established science. To them, it is dystopia. Media, science and the people. This effect was noticed in 2007 by David Foster Wallace in "Deciderization" and in Time magazine's "Is truth dead" headline. The phrase "post truth" is now common and our Michael Gove said in an interview that "the public have had enough of experts"..."trust your gut" he says – that's a vote winner for many, unfortunately.

Emotional decision making, paranoia, and information overload thanks to the web looked like the most likely reasons to lead to Flat Earth belief. However the emotional decision making isn't to be knocked – this parafiction, the alternative to pure logic, is a bit like appreciating the heavens. Creating new magic. A bit like us amateur astronomers. We are all human and all different.

One recent study showed that it is my generation, 40s-50s+ that have had the internet introduced during their lives that have more difficulty sifting fact from fiction there. Children apparently have a better ability and filter to spot truth, so there is hope.

We had a great observing session after Harry's talk, it was a very stimulating evening, thanks!

Coming up we have the very knowledgeable Dr Matt Bothwell head of astronomy outreach at Cambridge telling us the latest about cosmology, then Paul Daniels, the president of the FAS talking about the megaconstellation threat (littering the skies).

Society notices

We always could do with more help at our visitor nights. Please contact Mick on visitors@brecklandastro.org.uk . There are also folk out there that would like to share advice in astro equipment and use, so the more expertise or experience at hand for the new members the better. I will restate that we are always looking for helpers at open nights and events also, so if you can help at one or more of these please contact chairman@brecklandastro.org.uk

Hopefully you are all able to pay your subscriptions due for 2023 calendar year and clear skies to you all! Here's wishing you a year of reasonable weather, we need it after 2022's temperature swings.

Dan Self

JOHN'S NEWS BITS
January 2023

Artemis 1 finally took off on Saturday 16th November after a 26 day round the Moon mission and splashed down in the Pacific on December 11th. This was the first test flight of NASA's Space Launch System megarocket with the unmanned Orion capsule. This will now be followed by the Artemis 2 manned mission round the Moon in late 2024 and then Artemis 3 the actual moon landing probably in late 2025 with a future Moon to Mars crewed mission. More on www.nasa.gov/what-is-artemis/

Work has started on SKA, Square Kilometre Array, which will be the world's largest telescope when completed in 2028 at a cost of $10 billion. Hundreds of radio antennae will be spread out between the Murchison site Western Australia at the Karoo in North Cape South Africa with the HQ in the UK. www.skatelescope.org

USA scientists at the National Lawrence Livermore Lab. Have successfully produced nuclear fusion ignition. 2.05 megajoules produced 3.15 megajoules of energy.
This is the first time ever that fusion ignition was achieved creating more energy than consumed. www.llnl.gov.
Don't get too excited, one megajoule is equivalent to 278 watt-hours! That's about 3 x 100-watt bulbs, still some way to go.

JWST focused on the atmosphere on a 'hot Saturn' exoplanet WASP-396 some 700 light years away, and found SO2, a sign of. active chemistry.

Reported in Live Science, an artificial holographic wormhole was simulated on a quantum computer and data was transmitted across two simulated two black holes.

The team at California Institute of Technology used Google's quantum computer Sycamore. The scientists saw a key signature that qubits were passing through the wormhole.
www.quantamagazine.org

A 2020 a Japanese study of Venus's atmosphere for traces of phosphine, a chemical that is released when organic matter rots indicating possible form of alien life. A Nasa funded study has now debunked this theory, latest research shows no evidence of phosphine. The Stratospheric Observatory for Infrared Astronomy (SOFIA) a plane mounted telescope showed little evidence of this compound.

The Pentagon's new UFO tracking office renamed AARO, All-domain Anomaly Resolution Office, has received several hundred reports but so far, nothing to indicate alien life. AARO will investigate any unidentified objects both in the sky, in space and underwater. www.defense.gov

On December 23, Perseverance dropped its second rock sample on the Martian surface, the largest so far. The sample came from sedimentary rock from the edge of an ancient river delta. A future mission in 2033 will collect the samples for return to Earth.

The Webb has now confirmed that the four oldest galaxies were dated to less than 400 million years from the Big Bang. The light took 13.4 billion years to reach us with redshifts greater than 10.

The European Space Agency has chosen SpaceX to replace Russian's space agency launcher. This will include the dark matter Euclid Space telescope and the Hera probe which is the follow-up to the DART asteroid mission in 2023 and 2024 respectively.
www.euclid-ec.org and www.heramission.space
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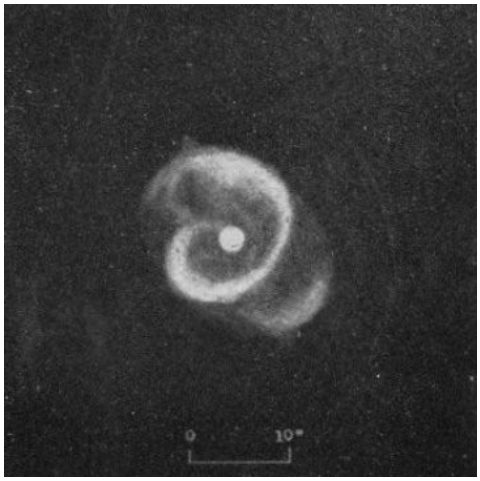
John Gionis

From Glowing Gas to Heavenly Atoms

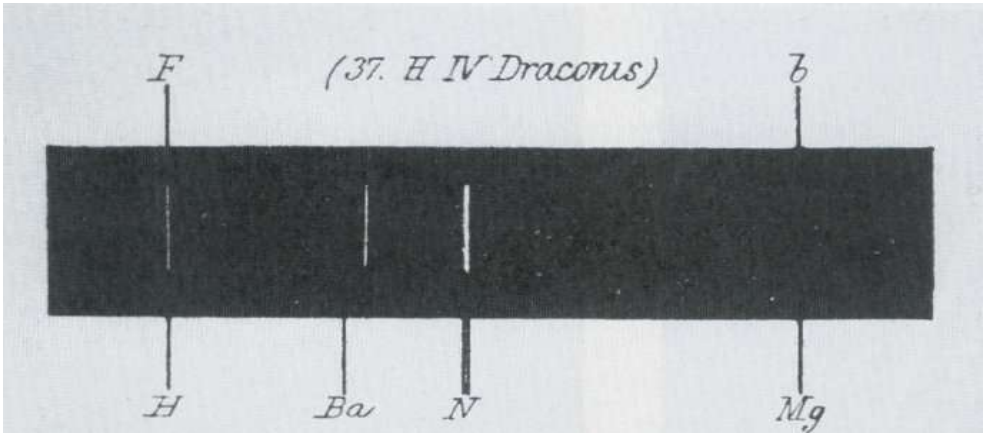
It was said by Auguste Comte in 1835 that we would never be able to know anything about the chemical composition of stars. The discovery of dark bands in the spectrum of sunlight had been made in 1802 by William Wollaston and Joseph Fraunhofer catalogued them extensively, but no connection was made with elements at the time. In 1860 Gustav Kirchoff and Robert Bunsen had produced glowing emission lines and realised spectral lines were due to elements. William Huggins had seen the “Fraunhofer lines” in the spectra of stars and he turned his spectroscope to the Cat’s eye nebula NGC6543 in Draco and it was made of emission lines, opposite to the Fraunhofer lines.

Huggins had realised straightaway that he was looking at a glowing gas. At some point later in his career he had hypothesised a new ‘heavenly’ element, and according to Margaret his wife had called it Nebulium. Mendeleev’s Periodic Table had been established in 1869, complete with gaps for undiscovered elements, so one can understand the influence it had on Huggins. Helium had been identified on the sun in 1868 and was only later detected on Earth in 1895, when the Nebulium theory was recalled and revived. It suggests it is relatively easy and common to theorise these things based on the current science.

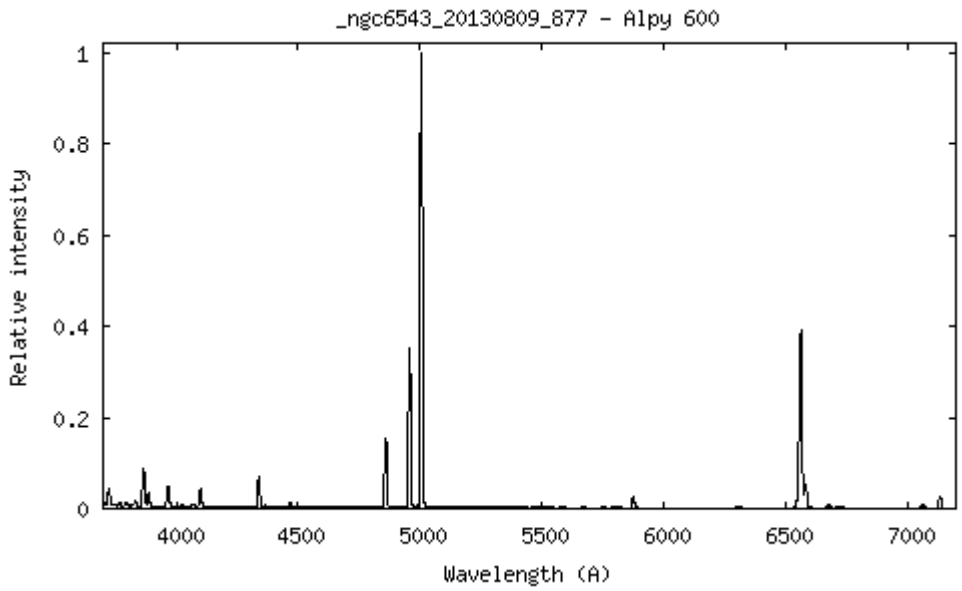
Henry Draper and Norman Lockyer who had advanced the science of astro-spectroscopy and taken careful photographic recordings, both wrangled with understanding of the meaning of all this new data. The ‘Nebulium’ spectral lines took some time to sort out. Eventually in 1927 Ira Bowen was the first to correctly identify Nebulium as oxygen (and the UV lines, nitrogen), ionised (i.e. electrically charged) to a state not obtainable on earth to this day. A pair of emission lines appeared in the blue/green and more were discovered in the near ultraviolet. After having tried to obtain a spectrum of a meteor train for my own PhD in 1998, this story fascinated me. For most people, it is a mysterious world and understanding it is seen as one of the more difficult sciences. The so-called ‘forbidden lines’ as they were dubbed, need not be forbidden to understand.



Left: NGC 6543 drawing by H.D. Curtis, publications of the Lick Observatory, 13 III, 1918.
Right: NGC 6543 BAS 20 inch telescope with Atik Camera October 2021 D Self.



Huggins' drawing from the spectroscope pointed at object G.C.4373 or 37 H IV Draconis in 1864 (now called NGC 6543 or the Cat's Eye Nebula).



Modern amateur spectrum of NGC 6543 presented in graph form by Christian Buil (astrosurf.com/buil). Huggins' N line is the peak at 5000A.

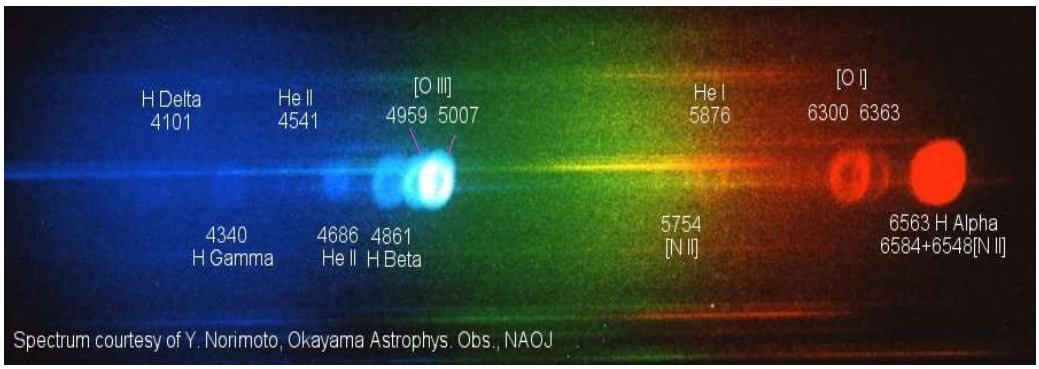
Light is just the visual part of the electromagnetic spectrum which now known to be a very small part of the whole spectrum. Light is now known to comprise of photons which act as both particles and waves and these photons carry different energies. The spectrum runs across many orders of magnitude from very, very low energy photons called radio waves, through micro waves to infra red visual, and ultra violet, and then on to X rays and gamma rays. These waves or photons are measured by various means:

Wavelength – it is the physical size of the wave measured in: metres (m), centimetres (cm), millimetres (mm), microns (μm, millionths of a metre), nanometres (nm, billionths of a metre) or ångströms (most often written without accents). The Ångström is a traditional measure of light and those wavelengths near visible light, usually ultraviolet (UV, this region is usually called UV-Vis) and are one ten-billionth 10^{-10} of a metre in size 1Å = 10^{-10}m. Red light is around 6300Å (or 630nm) Green is around 5500Å and Blue, 4700Å, the eye is sensitive to the range 4000 – 7000Å extending a bit for highly intense sources.

Frequency – measured in Hertz. it is the number of wave cycles that occur in a second, as experienced by an observer. Of course you can't count the waves, but they have an effective very high oscillation frequency. You should be familiar with this from FM radios, that spoke of 95.5MHz (mega hertz), this is 95.5 million cycles per second. This frequency can be understood well if you do electronics, as a radio circuit involving capacitors and inductors. The frequency of microwaves in ovens are 2.5GHz (giga hertz, or billion hertz). Infra red and visible light are much higher and are a few quadrillion 10^{15} Hz. Our eyes see from 4 – 7 x 10^{15} Hz, although the frequency scale is inverse from the wavelength scale and 4 x 10^{15} Hz is the red end and 7 x 10^{15} the blue/violet end. You can get from frequency to wavelength by using the speed of light: 299800000 metres per second divided by one will give you the other.

Energy – is measured in J (Joules) or eV (electron volts). It is the energy the individual photon has, so is very tiny. It can be calculated by multiplying Planck's constant 'h' by the frequency in Hertz ($h = 6.626 \times 10^{-34}$ J s). electron volts are equal to the kinetic energy an electron's charge gains when accelerated through a certain electrical voltage, which is equal to 1.609×10^{-19} J. This gives a more convenient unit, so 1 eV is infra red, 2eV is visible, 3eV is ultra violet, etc. Particle physicists use these units for energies, and they can also be interchanged with masses according to Einstein's equation $E = mc^2$.

So based on that short explanation you should have a slightly better understanding of the spectrum. The elements are single atoms which are giving out photons light with energies of a few electron volts.



A modern spectrum of the ring nebula M57 using a grating not a slit. The elements are identified, and lines labelled with wavelengths in angstroms and visual colours given. Some of the images look different to others due to the different distribution of elements and radiation zones in the nebula.

Something is clearly causing the gas in the planetary nebulae to glow, and the only source of energy intense enough to cause this is the central star. However, if you have tried to see the central star of the ring nebula, you will find it very faint. This is because it is a white dwarf, a collapsed core of a star, that is still very hot, being squeezed by intense gravity at its surface. There is significant UV light coming from it which can be absorbed strongly by atoms and ions of certain elements.

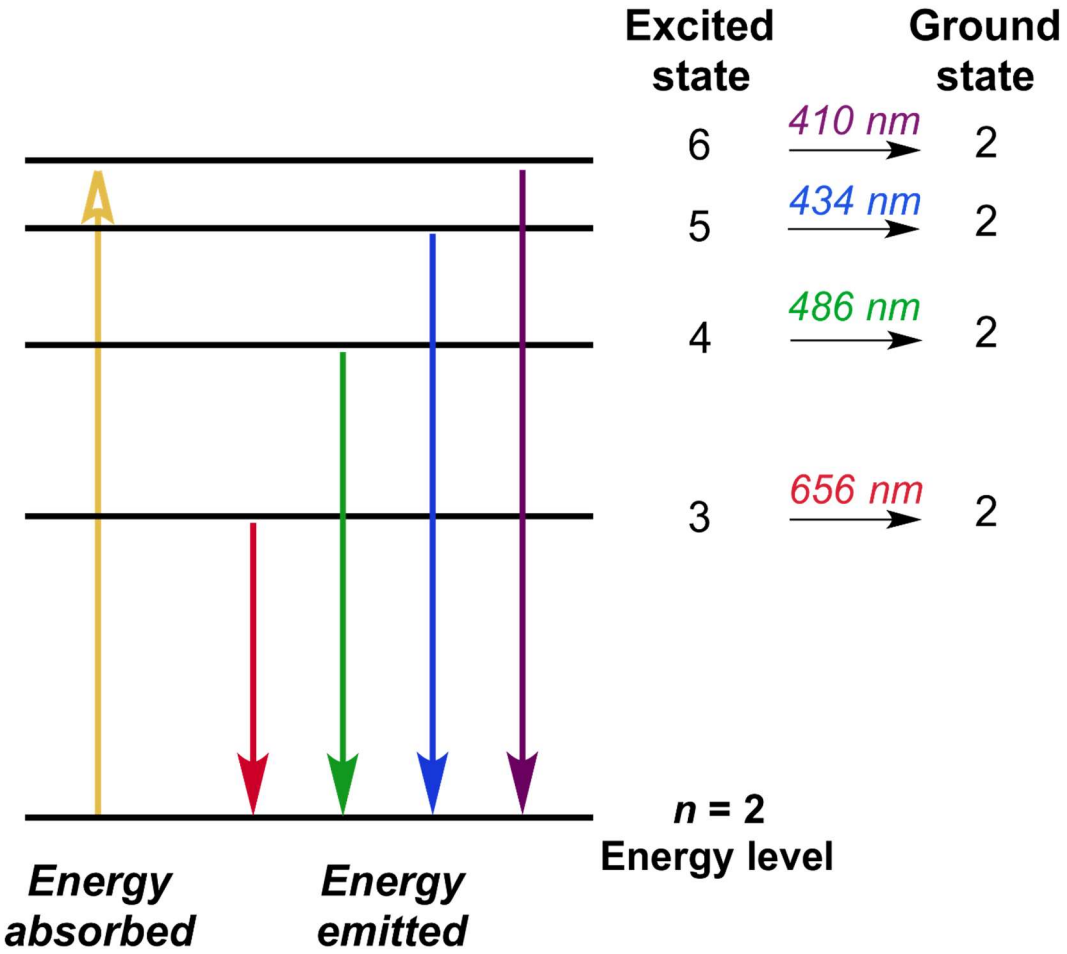
Spectral 'lines'

These features arise from single atoms or ionised atoms freely floating in the vacuum of space. Atoms are chemically more stable when bound together in compounds, such as here on earth, but in space and rarified upper atmospheres, they float singly without any companions to bond with. Above about 180km, the oxygen in our atmosphere, transitions from O_2 molecules into single O atoms, they are broken by the higher energy UV from the sun during the day and can't recombine again quick enough at night. It is these atoms that are responsible for the colour of the northern lights.

The simplest atom, a hydrogen atom, consists of a proton at its centre and an electron that is bound to it in an 'orbital'. They don't orbit like satellites as they are quantum particles, but exist in various allowed states. Other elements have more protons and electrons and some neutrons in their nucleus too, but the universe is dominated by Hydrogen.

These orbitals are the possible states where the electrons ‘live’, they give the atom various properties and this produces all of their chemistry. Depending on the element, the configuration of electrons has a certain ‘energy level’, which is related to how far the outermost electron is generally from the nucleus in a very complex way. Electrons can also spin one way or the other, called up or down, a quantum effect and they can absorb or emit a particle of light a ‘photon’ and change spin when they do so. In doing this they take on the energy, and can jump up or down to another level. Hence they can only absorb certain exact amounts of energy and so most photons of light pass through the atom. The photon energies (frequencies or wavelengths) correspond to different colours of light, and the absorption or emission of light produces light or dark lines in the spectrum, respectively.

The hydrogen atom has the simplest of energy levels, with different quantum number, n. The atom is usually in state n=1, called the ‘ground state’, which lies a long way below the other levels. Any jump from or to this level involves the electron absorbing or emitting a photon that is UV, ultraviolet. The lines in the visible light spectrum involves jumps to level n=2.



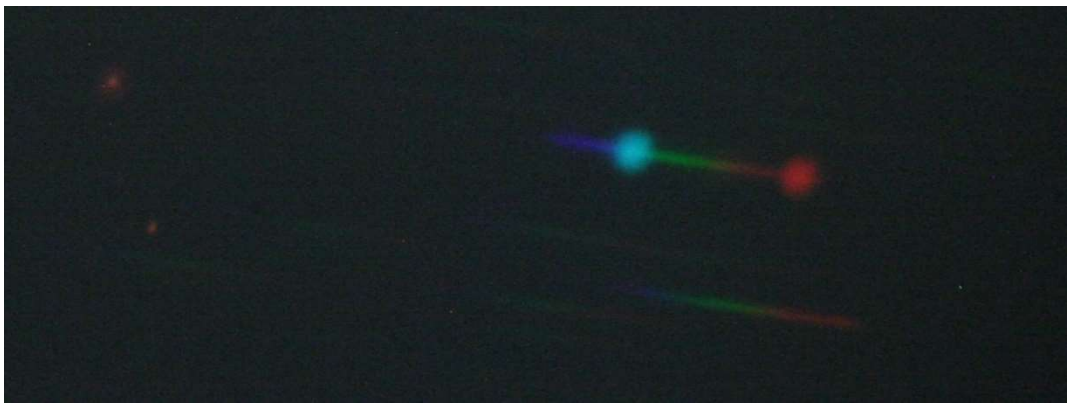
The colours you see in those wonderful nebula pictures are dominated by the red, ‘Hydrogen alpha’ Hα light, of wavelength 656.3 nm or 6563Å corresponding to a jump from level n=3 to n=2. This diagram shows the different ‘transitions’ and their colours.

But something has to give the hydrogen atom the energy in the first place, that would be the stars; the high energy UV radiation from the star pumps some of the hydrogen atoms up from n=1 to various ‘excited states’, e.g. n=4 or n=5. The blue Hβ (beta) line at 4861Å is the jump from n=4 to n=2 and the Hγ (gamma) line at 4340Å is n=5 to n=2. The atom can also be ‘ionised’ and the electron can absorb an energy higher than the greatest energy level (this is usually far UV, wavelengths < 1000Å) and the electron and rest of the atom is separated, leaving behind a positive charged ion, just a proton in the case of hydrogen.

Planetary Nebulae

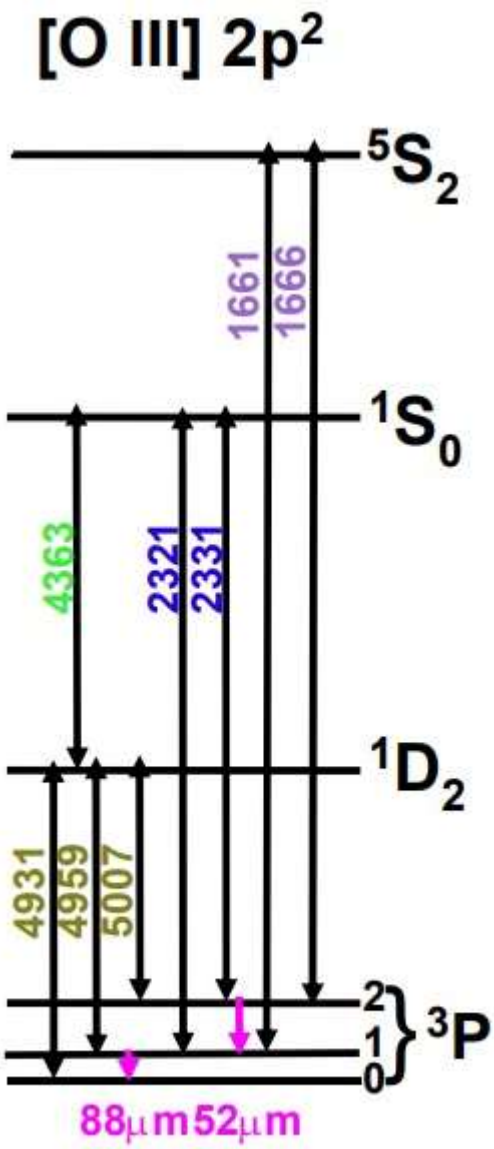
The planetary nebulae that I am looking at here don’t have so much Hydrogen. They are the ‘brief’ dying stage of low mass stars. Hydrogen has been fused to make Helium and the outer shell burns extra Hydrogen at the red giant stage, until the hydrogen has reached a certain low percentage where it can no longer undergo fusion. The core can burn Helium to make Carbon, Nitrogen and Oxygen if there is sufficient gravitational pressure, but fusion ultimately stops and the core collapses with no radiation keeping it as a dense plasma. It falls back in to a tiny, hot white dwarf star, but the heat radiation drives the rest of the atmosphere of the star outward in fantastic symmetrical patterns, creating the rarefied nebula around the hot stellar core. The radiation from the dwarf star includes a lot of ultraviolet that is absorbed by the elements in the nebula.

Here is a spectrum I took in December of Planetary Nebula IC 3568 on the 20” telescope with a Star Analyser grating, 30 second exposure. I didn’t optimise the image scale so it is fairly crude and I haven’t processed the image yet. The mystery Nebulium lines appear as an extended green-blue image, as they do in the M57 spectrum above, as you can see it is classed as OIII. The red blob is the strong emission from the remaining Hydrogen, Hα, the Hβ isn’t visible in my spectrum, but is in the M57 spectrum. There is a brighter blue end of the central star spectrum (continuous line going through the blobs), indicating the star is much bluer and thus hotter than the star at the bottom.



OIII is the brightest band of light in most planetary nebulae and our eyes are optimally sensitive to it at night, you can even see the green-blue colour in the smaller brighter nebula. This state of oxygen III, the third ‘state’ means oxygen has had two electrons removed, going from O I to O II

to O III as the high energy photons remove each electron. It is a state that is achievable in the laboratory, but this emission isn't achievable because the electrons recombine too quickly. In space however the vacuum is so rareified that the electrons can't find the atoms quick enough and it hovers in a high energy state, for many seconds, releasing the energy as light only very slowly. It is known as a forbidden transition, as quantum mechanics rules don't allow it to jump down. A hot star will ionise the oxygen and the excess energy will produce excited states of O II and O III that can fall back down to accessible lower energy levels, where the electrons are configured differently. In the case of OIII there are two "2p" electrons in the the form that we see this emission from.



The $^1S_0$ state lives for just half a second https://www.researchgate.net/ which is a long time quantum mechanically speaking, but it can undergo occasional 'forbidden' decay to the $^1D_2$ state emitting a photon at 4364Å.

It gets stuck in the $^1D_2$ state (singlet D) and can't emit a photon to get in any of the three ^3P (triplet P) states. To quote Carl Sagan, it just sits there in the coma, throbbing. It can only release its energy if there is another molecule around to dump it on and of course this happens far too quickly here on Earth, even in high laboratory vacuums.

https://star.pst.qub.ac.uk/webdav/

public/STFC_ISS/lectures/barlow_qub2015.pdf

This process was inferred by Ira Bowen in 1927 due to studying oxygen in the far UV, where the high photon energies completely remove electrons from O atoms. From the emission lines seen in the lab one can work out what energy levels it has, and therefore infer the 4959 and 5007Å lines correspond to it. So the mystery was solved. Oxygen is fairly plentiful in end of life stars, in fact it is responsible for some of the Sun's current energy output, so this hypothesis is now fact.

If you want to see a nice resource that complements this article, go to: https://web.williams.edu/Astronomy/research/PN/nebulae/exercise3.php and you can replace the 3 with 1 or 2 for different exercises. There is a link to lots of nebula spectra there.

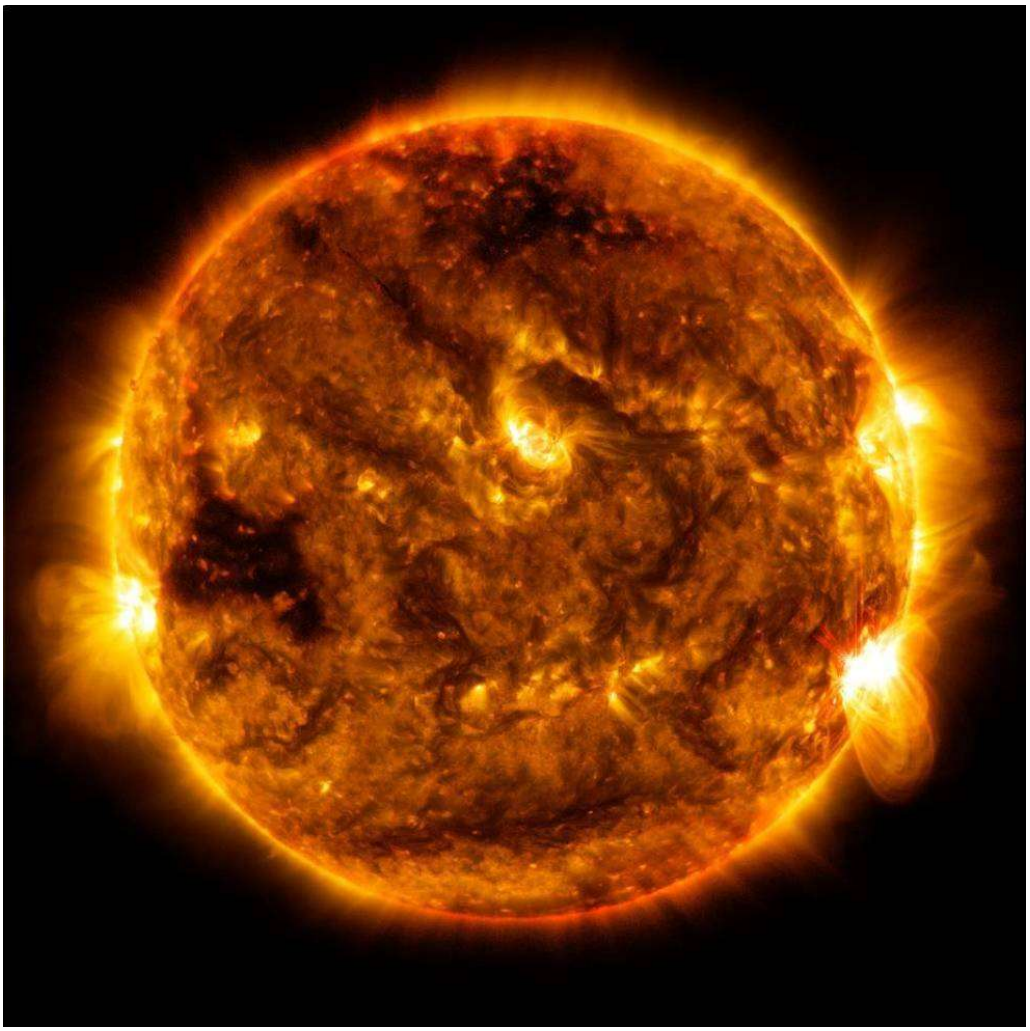
There are various other elements found in the spectra of planetary nebulae, N II ionised Nitrogen and He II, ionised Helium, being the next strongest lines. S II Sulphur glows in some, plus O I and O II – atomic and singly ionised oxygen, producing lines all across the UV, visible and infra red. Hence nebula filters work well with them and can be a visual aid to spot the faint planetaries at the eyepiece.

A fortunate coincidence about planetary nebulae, and perhaps why many of us enjoy viewing them, is that the forbidden O III lines are almost exactly in line with the peak sensitivity of our eyes at night, the rod cells in our retina respond well to this blue-green light, so of course we don't see the colour, but a grey-green or grey-blue patch of light, as interpreted by our brains. Sometimes we need to use our peripheral vision to see the object. A good example of this is the Blinking Nebula, NGC 6826 in Northern Cygnus, one that appears as a star when looked at directly, and a large circular patch when looking to one side.

If you have a telescope, some great planetary nebulae to view this winter would be NGC 2392 in Gemini – the eskimo nebula, which is fairly bright and concentrated. Or try the Cat's Eye NGC 6543 in the North, it is circumpolar. More challenging would be NGC 2022 in Northern Orion, near star lambda, Meissa and NGC 1514 above the Pleiades – near the 'foot' of Perseus. It is hard to pick out from the glare of the star. The discovery of these objects is a fascinating piece of history of science so enjoy viewing these while appreciating the context of the amazing deductive processes involved in working out just what they are.

Dan Self

New Sun **Missions** to Help NASA Better Understand Earth-Sun Environment



A mid-level solar flare that peaked at 8:13 p.m. EDT on Oct. 1, 2015, captured by NASA's Solar Dynamics Observatory.
Credits: NASA/SDO

NASA has selected two science missions – the Multi-slit Solar Explorer (MUSE) and HelioSwarm – to help improve our understanding of the dynamics of the Sun, the Sun-Earth connection, and the constantly changing space environment. These missions will provide deeper

insights into our universe and offer critical information to help protect astronauts, satellites, and communications signals such as GPS.

“MUSE and HelioSwarm will provide new and deeper insight into the solar atmosphere and space weather,” said Thomas Zurbuchen, associate administrator for science at NASA Headquarters in Washington. “These missions not only extend the science of our other heliophysics missions—they also provide a unique perspective and a novel approach to understanding the mysteries of our star.”

MUSE

The MUSE mission will help scientists understand the forces driving the heating of the Sun’s corona and the eruptions in that outermost region that are at the foundation of space weather. The mission will offer deeper insight into the physics of the solar atmosphere by using a powerful instrument known as a multi-slit spectrometer to observe the Sun’s extreme ultraviolet radiation and obtain the highest resolution images ever captured of the solar transition region and the corona.

The mission will also provide complementary observations from heliophysics research such as the Extreme UltraViolet Spectroscopic Telescope and ground-based observatories.

“MUSE will help us fill crucial gaps in knowledge pertaining to the Sun-Earth connection,” said Nicola Fox, director of the Heliophysics Division at NASA Headquarters. “It will provide more insight into space weather and complements a host of other missions within the heliophysics mission fleet.”

The primary goal of the MUSE mission is to investigate the causes of coronal heating and instability, such as flares and coronal mass ejections, and gain insight into the basic plasma properties of the corona. MUSE will obtain high-resolution images of the evolution of solar flare ribbons in a field of view focused on a large, active region on the Sun.

The principal investigator for the MUSE mission is Bart DePontieu of the Lockheed Martin Advanced Technology Centre (LMATC) of Palo Alto, California. This mission has a budget of $192 million. LMATC will provide project management.

HelioSwarm

The HelioSwarm mission is a constellation or “swarm” of nine spacecraft that will capture the first multiscale in-space measurements of fluctuations in the magnetic field and motions of the solar wind known as solar wind turbulence. The Sun’s outermost atmospheric layer, the heliosphere, encompasses an enormous region of the solar system. Solar winds spread through the heliosphere, and their interactions with planetary magnetospheres and disruptions such as coronal mass ejections affect their turbulence.

Studying solar wind turbulence across large areas requires plasma measurements taken simultaneously from different points in space. HelioSwarm consists of one hub spacecraft and eight co-orbiting small satellites that range in distance from each other and the hub spacecraft. The hub spacecraft will maintain radio contact with each small satellite. All radio contact between the swarm and Earth will be conducted through the hub spacecraft and the NASA Deep Space Network of spacecraft communication antennas.

“The technical innovation of HelioSwarm’s small satellites operating together as a constellation provides the unique ability to investigate turbulence and its evolution in the solar wind,” said Peg Luce, deputy director of the Heliophysics Division.

The HelioSwarm mission’s principal investigator is Harlan Spence from the University of New Hampshire. The mission’s budget is $250 million. NASA’s Ames Research Centre in Silicon Valley, California, will provide project management.

Funding and management oversight for these missions is provided by the Heliophysics Explorers Program, managed by the Explorers Program Office at NASA's Goddard Space Flight Centre in Greenbelt, Maryland.

For more information on heliophysics missions, visit:

https://www.nasa.gov/sunearth

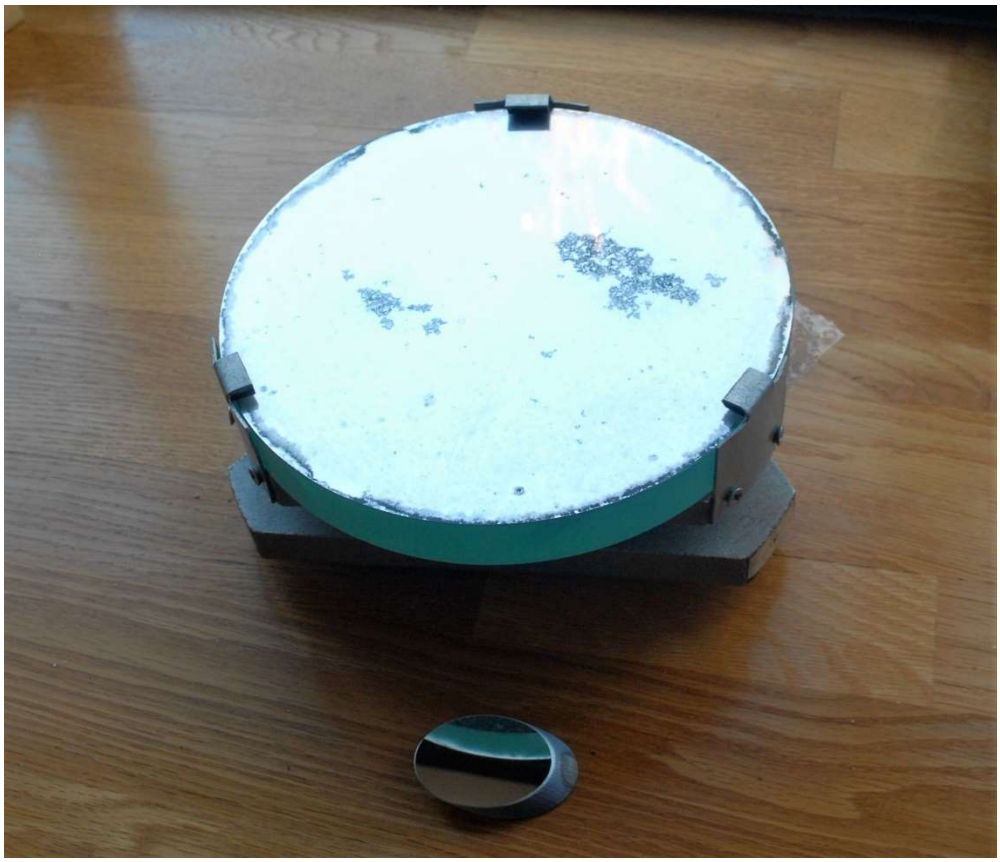
Constructing a White Light Solar telescope

Part 1

Having enjoyed taking white light solar images using a Hershel wedge I have wondered if it was possible to improve upon the images by using an uncoated primary mirror in a Newtonian arrangement. The catalyst came earlier this year when a redundant mirror became available through the society. Planning has been undertaken since and these are the results.

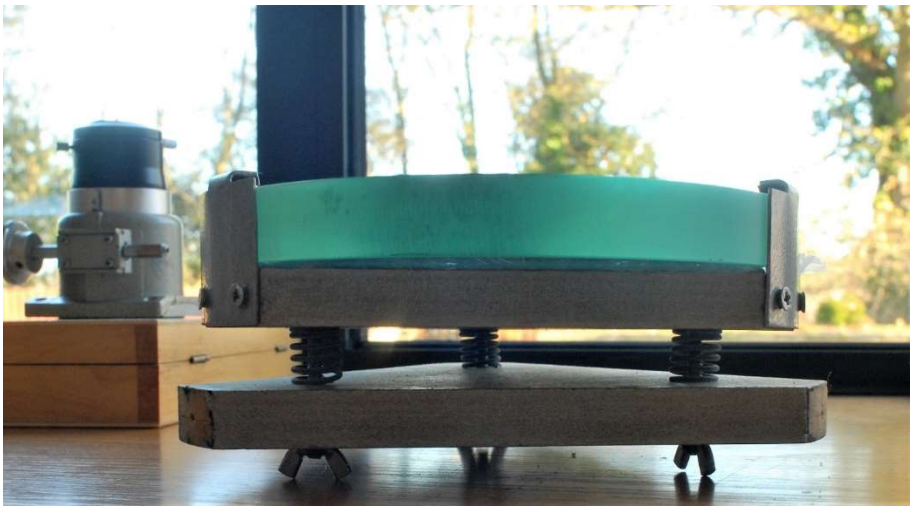
Main Mirror

As stated above this was a redundant mirror and cell that became available through the Society



The Flat that is shown with it is one that has been in my possession for a while and hopefully will be suitable for the project. As can be seen the aluminising of the main mirror it is in poor condition but this is of no consequence as it is to be removed and only the glass disk used uncoated.

The disk is 222mmm in diameter and is 25mm thick at the edge. Testing shows it to be 1/8 wave or perhaps slightly better although there is the indication of a slightly turned down edge on one side. The focal length has been tested and is measured at 1347mm which makes it approximately F6. One problem has been the material from which the mirror blank is made. Careful weighing and measurement (with allowance for front curvature) indicate that it has a density of 2.501 which puts it in the low expansion ceramic glass band, so may be something like Zerodur or Astrosital.



Using this mirror as an uncoated primary there should be an improvement in imaging due to the increase in diameter compared to the 110mm refractor currently in use with a Hershel wedge, due to the Dawes limit of resolution being increased.

The reflective index of an uncoated mirror is given by the formula

$$R = \frac{(n_2-n_1)^2}{(n_2+n_1)^2}$$

n_1 is for air and is 1.0 n_2 for the glass being considered is 1.52 therefore R is 4.2% and is comparable to a Hershel Wedge which is about 4%. So this is considered a suitable figure.

Above the atmosphere the solar constant is 1380Watts/m^2. At noon in the height of the summer the expected radiation level at our latitude is approx. 1000Watts /m^2. Arriving at the primary surface with a 222mm diameter is therefore about 38Watts. The central obstruction caused by the secondary reduces this by about another 2Watts so actually arriving at the surface is a maximum of 36 Watts. With a figure 4.2% reflected only about a maximum of 1.5 watts is passed to the secondary and/or any imaging camera.

From the above calculations It must be assumed that approximately 34.5 Watts will pass through the mirror material. Most of this will pass straight through and out through the back surface. A small amount will be reflected by the rear surface. There is some consideration for the light reflected by the rear surface but if the rear surface is polished then the light that enters the front face of the primary with be refracted outwards (except near the centre which is in the shadow of the secondary/camera and can therefore be discounted). On being reflected by the rear surface it will double this angle and therefore leave the telescope in a diverging beam that will not be picked up by the camera. The rear surface could be roughed up or frosted but it would not appear that this offers any advantage and may cause additional heating of the rear surface. There will also be some heating of the glass as the light passes through. The mirror being used is 25mm thick which is fairly thin for the diameter. The heating can be estimated by using the specifications of the glass. As has been previously stated it is not known with certainty what the glass is, although it has been assumed to be a low expansion ceramic glass. Using the transmission curves for the glass it is possible to find the absorption lines. These appear strongest at 1400, 2200 and 2800nm best estimates for the absorption is about 1.7Watts. This is not considered a major problem provided the mirror cell is designed to both allow the maximum passage of light and also dissipate heat.

Mirror Cell

The 1st consideration in designing the mirror cell is that the maximum amount of solar energy that passes through the glass primary is not absorbed in the cell or reflected back to the glass. 3 options were considered

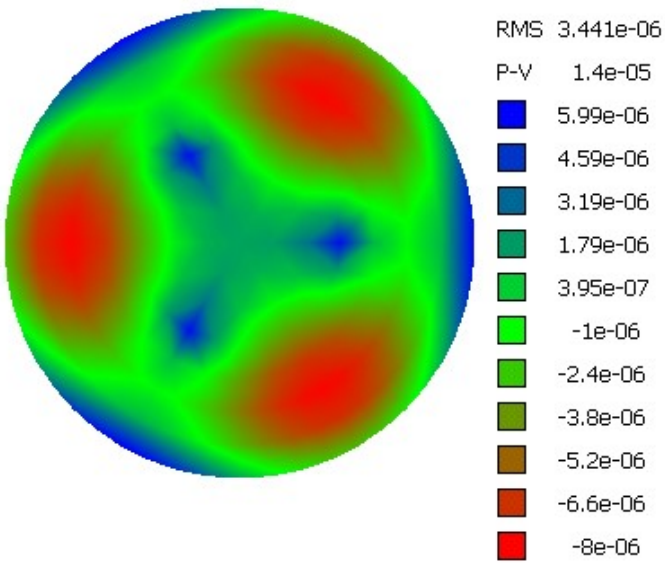
3-point cell

6-point cell

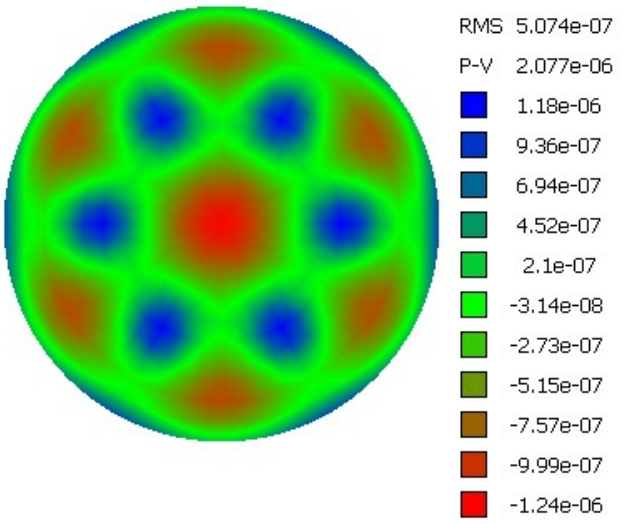
9-point cell

3 and 6 points could be built with about the same percentage of obstruction. The 9 point design requires 3 triangular secondary elements which would be quite an obstruction. The 6 point requires 3 secondary elements but because they are only supporting 2 points each can be placed above the primary supports.

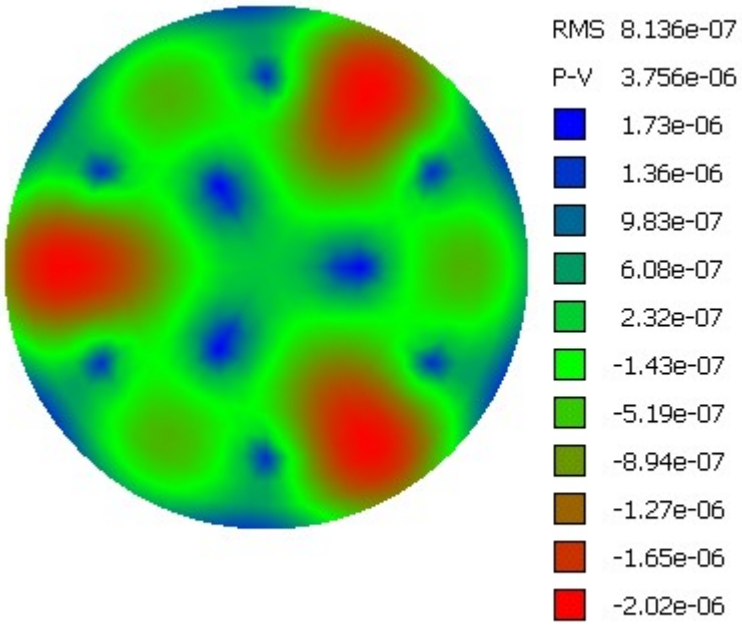
A computer programme called GUI PLOP was used to calculate the distortion of the mirror with each of the above options.



3 Point Primary Cell



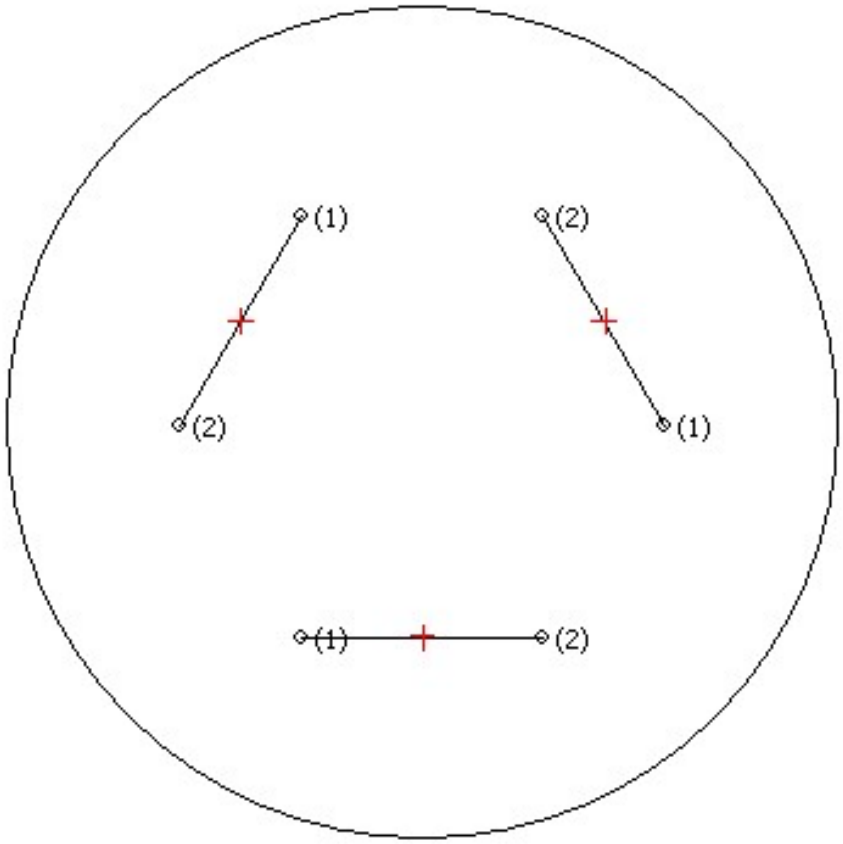
6 Point Primary Cell

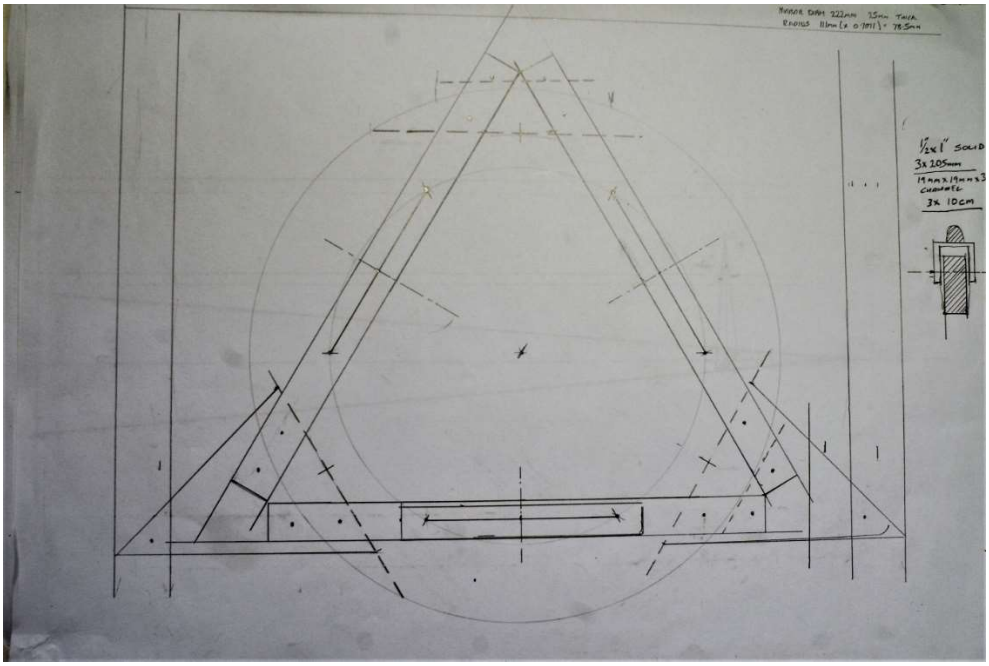


9 Point Primary Cell

As can be seen from the above the 6 point design gives the lowest RMS value. This is at first surprising. I must admit that I assumed the 9 point would be better. As the 6 point was not only the best result but also could be designed to reduce the obstructed area to a minimum. It was on this basis that the progress to design a 6 point cell was based.

From the same programme the optimum position for the support points was obtained.





The above diagram shows the basic arrangement of the intended Cell. The 3 supports are in a triangular arrangement and the area behind the mirror they obstruct is approximately 18% this is spaced behind the mirror so the heating effect would be minimal. Final coatings need to be considered when the time comes but this arrangement gives the minimum obstruction with the maximum rigidity. Also, the 6 point support is fully achieved. Running the GUI PLOP programme for maximum support (minimum distortion) gives the 6 points of support slightly closer to the centre of the mirror. This is a small change which although it will need a redraw does not change the overall configuration.

Secondary Mirror and Focussing.

A Newtonian type of arrangement will be the first to be attempted. There is some concern as to stray light entering the camera, but a baffle may be fitted to avoid this as far as possible.

The focuser is again a redundant item being repurposed and has been stripped down, cleaned lubricated and reassembled. It now operates

freely. It is of the rack and pinon type and the intention is to motorise it to allow remote focussing when the scope is in use.

The secondary would be coated as the reduction to 4% of received light is already achieved with the uncoated primary. As it is only intended for use as an imaging scope a slightly higher overall light level is an advantage and any further control that may be necessary can be achieved with neutral density/ polarised filters. Normally when imaging the sun using a Herschel Wedge I use a continuum filter centred on 540nm.

It was considered having an on-axis camera without the need for a secondary mirror. The advantage of this arrangement would be the provision of a baffle that would be more effective with regards to stray light interference. The disadvantages would be the camera cables would need to be in the light path and also focussing is more complicated. It has also been considered focusing by the primary but this would require moving the mirror some distance without loss of collimation.

As this is an initial experiment as to the use of an uncoated mirror it is considered that keeping to known methods and any modifications can be made once the concept has been proven.

Tube

The tube will be open design made primarily of aluminium. There will be 5 rings, two for the secondary/focuser, two for the saddle containing the losmondary dovetail and a single ring to support the main mirror cell. These will be four-sided and made of square section. Between these there will eventually be a Serrurier truss arrangement with two elements on each face. These will be made to fit after the design has been proven. The initial arrangement will usedheavy threaded rods at each corner of the rings. This will allow the adjustment of length to get final focus and weight distribution correct.

Will update as the project progresses

Chris Bailey

Geminids Meteor Shower 2022

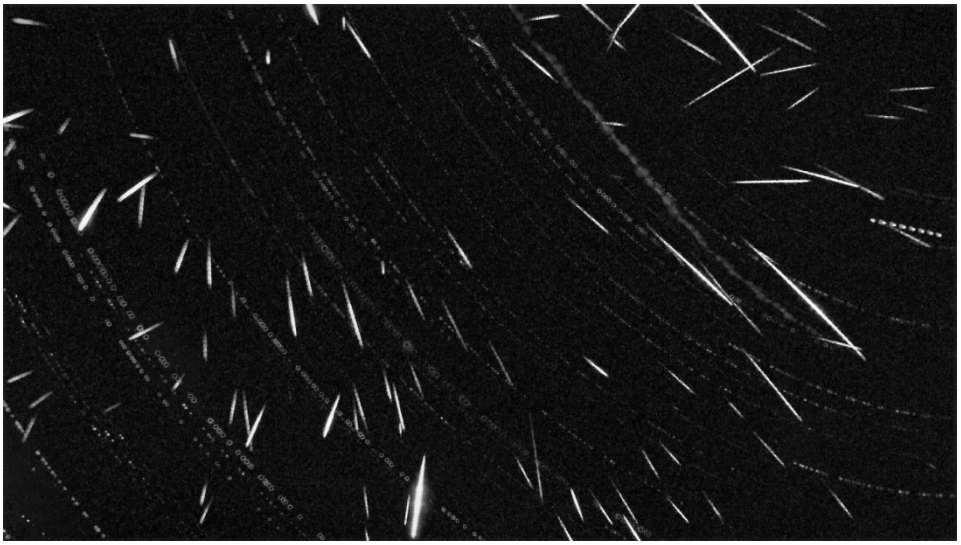
The Geminid meteor shower is the strongest shower of December each year. Before 1983 the object that caused the debris stream was unknown. Phaethon was discovered in Draco on October 11th, 1983, by John Davis and Simon Green using IRAS (the Infrared Astronomical Satellite) The object first known tentatively as 1983 TB until it received its permanent designation as 3200 Phaethon. It was moving in an orbit that closely matched the orbit of the Geminid stream. The orbit takes Phaethon close to the Sun with an orbit period of 1.4years.

Meteor streams tend to come from comets and this object has not shown any cometary activity, neither coma nor tail, at all since it was discovered. Most scientists now believe that Phaethon was once an active comet, but that the repeated close encounters with the Sun caused it to lose its cometary material leaving only its rocky core. Others have the theory that Phaethon is indeed an asteroid and that pieces of it fall off each time it passes close to the Sun, in fact it is about one seventh the distance between the Earth and the Sun at its closest point. It is possible that at such a close distance small pieces of rock would leave the asteroid adding strength to the Geminid stream.

The discovery of Phaethon was a highlight of a long story. In the 1950s it was suggested that the parent comet was once in a very different orbit. It was thought to be possibly connected to the big comet of 1680 on a parabolic orbit. Later Comet discoverer L'ubor Kresak' suggested that the orbit of the Geminids did not get perturbed into its present Earth crossing orbit, and that the comet should be somewhere in the same orbit as the debris stream. In October 1983 the discovery of Phaethon proved him right.

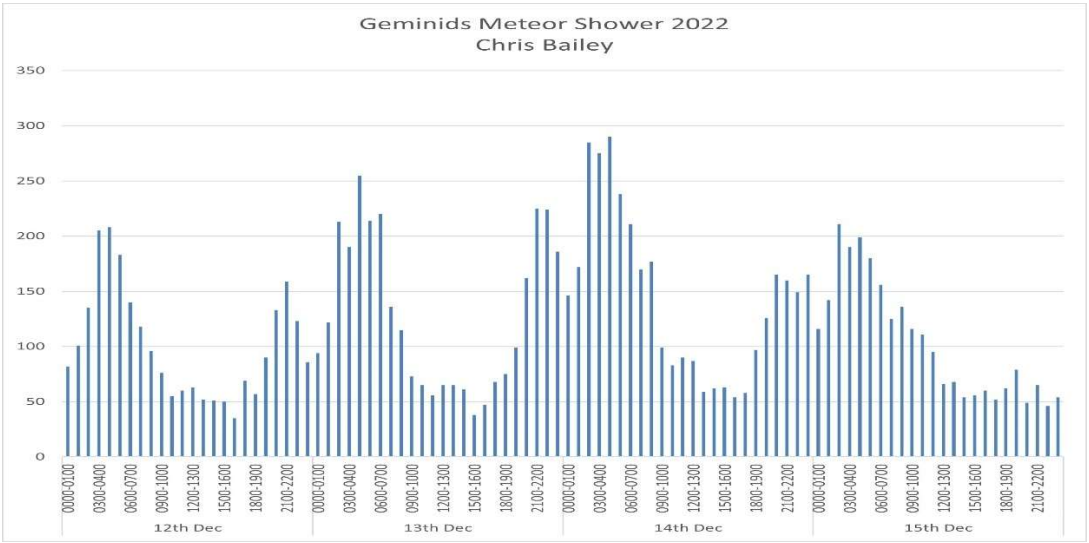
Observations of the 2022 shower

Visual observations were possible before Moonrise and there were several clear nights although the radiant was low until later in the night after the moon had risen.

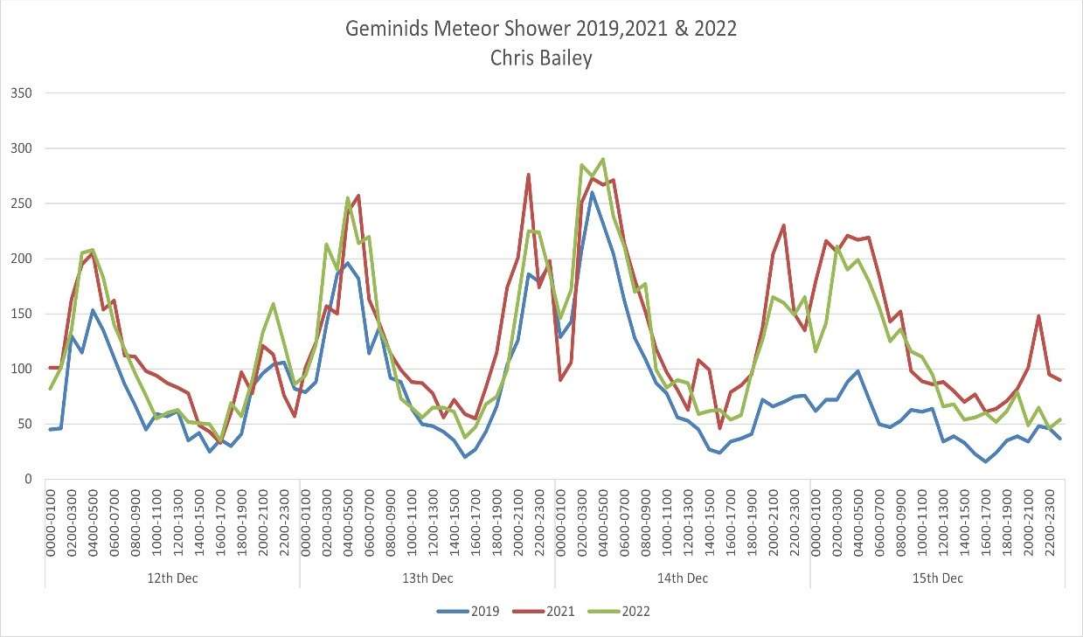


Radio observations were again centred on forward scatter radar using the GRAVES transmitter near Dijon France. One problem that is building with time is the serious interference and false echoes from Starlink Satellites. Automatic counting of the echoes is no longer possible (I have tried for comparison and there is an overcount of over 20%+ against careful manual counting.)

Below are the results obtained for the period 12th to 15th December 2022.



It is always good to compare the recordings from different years. I cannot find the figures for 2020 so have used 2019, 2021 & 2022. I also have recordings for 2018 for the peak days but as these were taken with a different setup they have not been added here. 2019 had a higher number all together and the peak appears to have built up earlier, but what I find the interesting comparison is the similarities between the two profile shapes. It is possible that I removed too many Starlink suspected echoes but it is also possible that it is just a slightly less active year. 2022 follows 2021 closely and taking sporadic meteors (not from the Geminids) into account there is very good correlation.



Also monitored the UK meteor beacon but not too many detected. Need to improve the antenna arrangement and then try again with future showers. Will make an interesting comparison although being a much lower power will probobally never have the same coverage.

VLF recordings were not taken due to local interference.

So lets be happy that we live in the short period of time when the Geminids are so strong. As their orbit slowly perturbs, in a century or so we may lose the Geminids, and there is also the risk of being hit by Phaethon as it has a crossing orbit with our own. It is estimated from observations that Phaethon is about 3 miles wide!!

Gresham College Lectures

I am delighted to invite you and your members to a series of lectures in 2023 by Professor Katherine Blundell, the Gresham Professor of Astronomy.

These lectures are hybrid as you can watch online, in person or on replay at a later date. Sign up to watch through the links below.

The End of Massive Stars

Wednesday 18 January 2023, 6pm-7pm (UK time)/ online/ watch later at:

https://www.gresham.ac.uk/whats-on/end-stars

Location TBC, but probably David Game College 31 Jewry St, Aldgate EC3N 2ET

The evolution of our Sun from ordinary star into red giant is radically different from the evolution of much more massive stars towards their end-points: supernova explosions followed by black holes. This lecture will contrast the relevant nuclear physics and thermodynamics that determine these very different outcomes.

Christopher Wren's Cosmos

Wednesday 22 February 2023, 6pm-7pm (UK time)/ online/ watch later at:

https://www.gresham.ac.uk/whats-on/wren-cosmos

Location TBC, but probably David Game College 31 Jewry St, Aldgate EC3N 2ET

Sir Christopher Wren was one of the most remarkable Gresham Professors of Astronomy. Though best known today as the architectural mastermind behind the rebuilding of London after the Great Fire, Wren's appointment to the Gresham chair in 1657 stemmed from his enthusiasm for turning his gaze well above London's skyline and focussing his attention on the heavens above. This lecture will consider Wren's contributions to astronomy and how Wren's appreciation of and contributions to art and design, and science and engineering, were fully integrated in his life and made him a polymath on a par with Leonardo da Vinci.

The End of Life on Earth

Wednesday 29 March 2023, 6pm-7pm (UK time)/ online/ watch later at:

https://www.gresham.ac.uk/whats-on/end-life

Location TBC, but probably David Game College 31 Jewry St, Aldgate EC3N 2ET

Astronomically speaking, there are a number of ways in which life on Earth could be wiped out. For example, a giant asteroid could hit Earth with such energy that the oceans are boiled off. This lecture will assess which astronomical events are likely and which are not. [It will not consider anthropogenic means by which life on Earth might end].

The End of the Universe

Wednesday 31 May 2023, 6pm-7pm (UK time)/ online/ watch later at:

https://www.gresham.ac.uk/whats-on/end-universe

Location TBC, but probably David Game College 31 Jewry St, Aldgate EC3N 2ET

The Universe is expanding, increasingly so. Will this persist or will it collapse back on itself? If it does expand forever, what happens to the galaxies? What is the long-term trajectory for the ultimate in collapsed matter, black holes?

Read more about Professor Katherine Blundell who has the Philp Leverhulme Prize in Astrophysics and the Royal Society's Rosalind Franklin Medal.

Gresham College is looking for a new Professor of Astronomy, an appointment that dates back to 1597 and professors have included Sir Christopher Wren, Sir Martin Rees and Professor Heather Cooper and you can find more information about how to apply at: https://bit.ly/3W8j67E

Leo Taylor

Communications Intern

Gresham College

+44 (0)20 7831 0575
https://www.gresham.ac.uk/

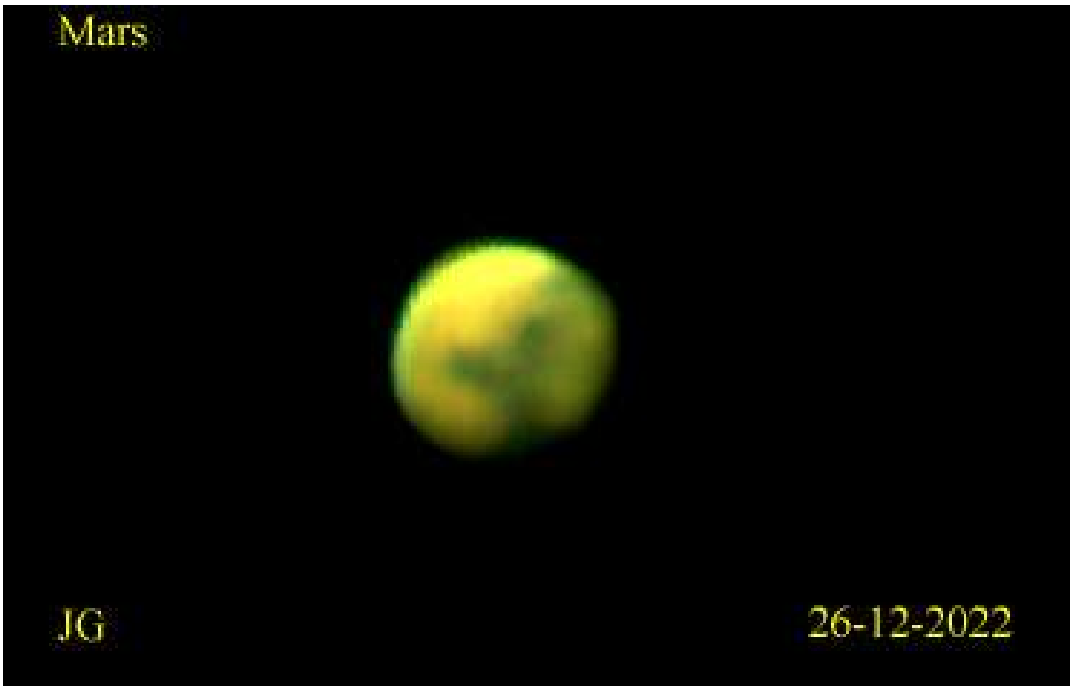
Members Astro-photographs.

Dan Self

NGC1999, the keyhole nebula

9 x 30second shots of it on the 20"

John Gionis



Mars taken on a 10" SNT with ZWO 120 camera.

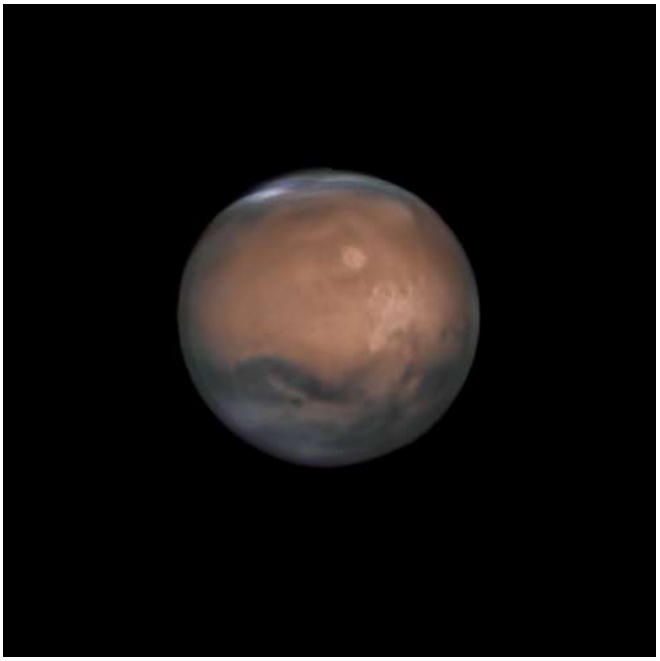
Processed with Registax 6

Roger Hyman

56% Moon GT71 with Televue x2.5 PowerMate, Saturn SQR-C camera. Best 10% from 500 frames in AS!3. Processed in Photoshop and Topaz Suite AI

C11 with ADC, x2.5 PowerMate and Saturn SQR-C camera on Skywatcher AZ-EQ6 mount. 90 second video for Jupiter and 120 second video for Mars. Processed in AS!3 (best 10%) and finished in Registax 6 and Photoshop.

98% waning gibbous Moon. GT71. iOptron SkyGuider Pro. Televue x2.5 PowerMate Saturn SQR-C camera. Best 10% from 500 frames in AS!3. Processed in Photoshop and Topaz Suite AI.

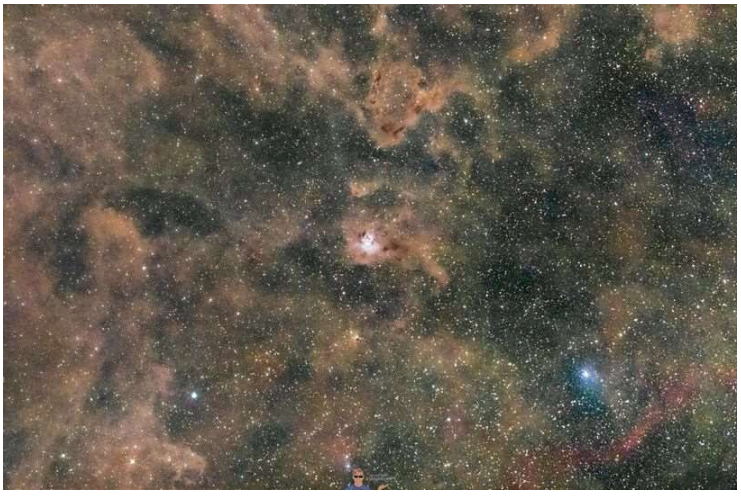


GT71, 68IIIA X0.8 reducer, Saturn-C camera. Optolong Ultimate filter iOptron SkyGuider tracker. 90 x 60 second exposures Processed in APP and Photoshop.

Michael James Wilson.

IPhone 13 Pro. 1x10 second exposure

Edited in Photoshop Express and Apple IPhone image editor apps



The Iris nebula Canon 6D UV/IR cut filter mod Samyang 135mm

Sky Watcher Star Adventurer star tracker Manfrotto 055 tripod

183x60 second tracked light exposures, ISO 800, F/2.8

Stacked in DSS. Edited in Starnet++V2, Photoshop and Lightroom

IPhone 13 Pro, 1x10 second exposure

Edited in Photoshop Express and Apple IPhone image editor apps

Neil Wilson.

NGC 6823 a small reflection nebula in the constellation Vulpecula.

Celestron 9.25" Edge HD + Hyperstar V4 Altair Astro 26C Protec camera @ -10'C

Altair Astro Tri-band Filter 100 x 30Sec light frames 10 x Flat frames

Pelican Nebula IC-5070.

Celestron 9.25" EdgeHD + Hyperstar V4 Altair 26C Protec camera at -10C

Skywatcher AZ-EQ6 mount Captured with N.I.N.A. and PHD2

Astropixelprocessor , Microsoft ice. Photoshop

Each panel consists of 50 x 30 sec light frames

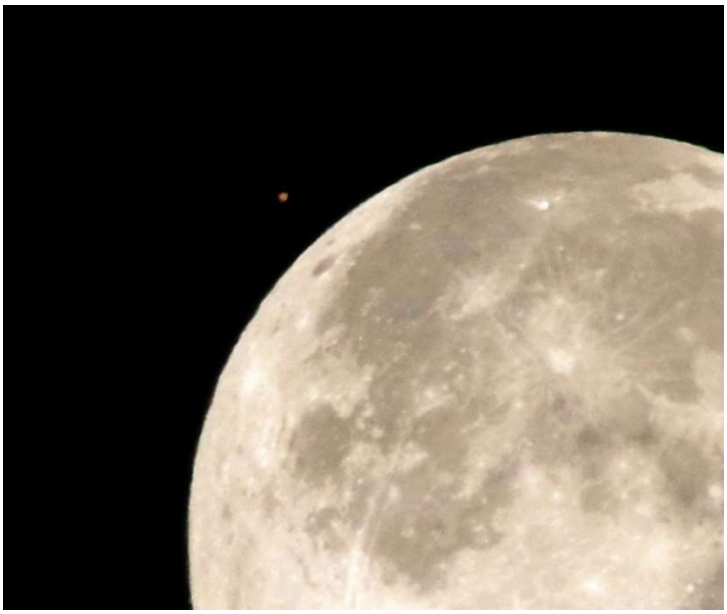
Malcolm James Dent

Jellyfish Nebula

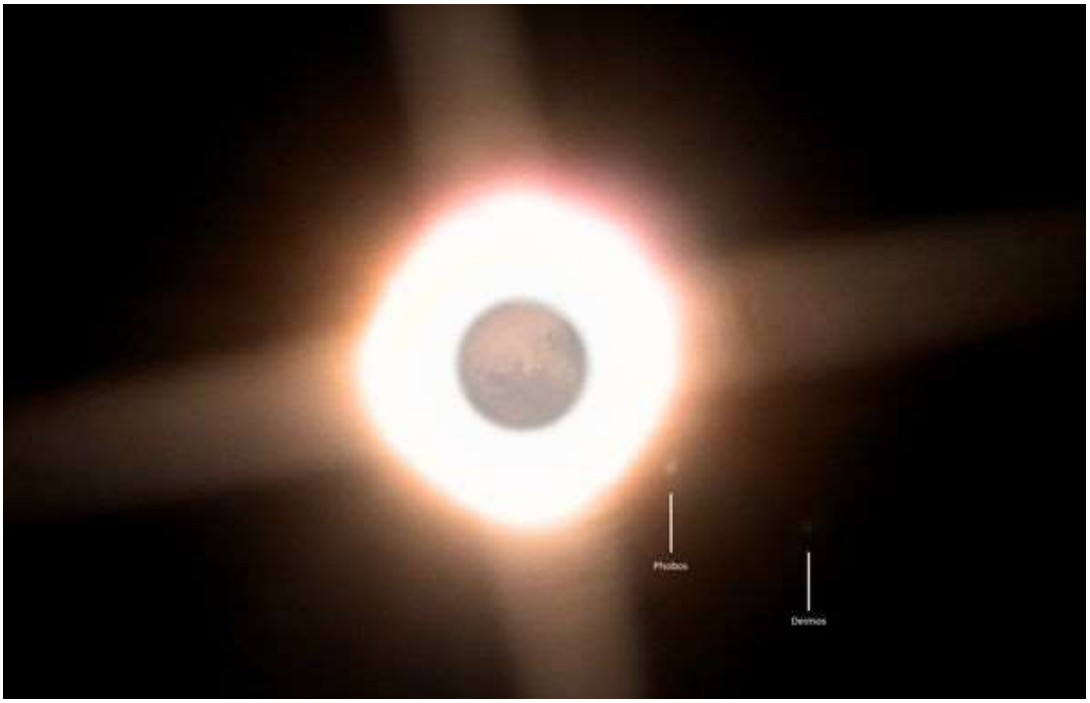
Darren Carter.

LDN 1251 2 hours of rgb data Altair 102 EDT triplet, atik 16200 mono camera. Captured using fully automated sgpro processed in pixinsight.

David Bryant



Luke Broom-Lynne



.200 full-frames each of R, G & B with my ZWO ASI290MM, 250mm f/4.8 Newtonian and 5x TV powermate. 200ms exposures at a rate of just 1-2 fps. Processed in Registax and Photoshop.

ZWO ASI120mc-s colour cam, 250mm f/4.8 Newtonian and 5x TV powermate. About 31,000 frames, 2.7ms exposures, 211fps

Trevor Mayes

Canon 80D (single shot)

Skywatcher 150pds

Eq5 mount

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, 56 Lindley Street, Norwich, Norfolk, NR1 2HF.
07734 364667 chairman@brecklandastro.org.uk

OBSERVATORY RISK ASSESSMENT 2022

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 (*visit leaders must identify any additional hazards 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 pointed	Low

	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 in most months. Warm clothes to be advised to visitors. Heaters indoors if cold and keep a blanket at the observatory.	Tolerable
Trips and slips	Trip hazard in dark. Torch guidance will be provided but is limited because	Tolerable

	of dark sky observing. Advised to dip and dim lights.	
Child protection risks (under 18s)	Two adults should be available at all times. DBS checks should be in place for group supervisors. The organisation that runs the observatory, Breckland Astronomical Society, operates a child protection policy. The committee are vigilant with regard to risks.	Low
Airborne viral transmission indoors	The place is fairly well ventilated with vents in toilet and loose fitting door and dome and dome floor hatch. Open internal doors Physically Distance 1m+ between groups Limit numbers to what any national guidelines state at the time. Space is quite limited. Provide outdoor activities, e.g. electronically assisted astronomy. Telescopes outdoors.	Tolerable – as we have very good ventilation.
Outdoor transmission	Risk is found to be low outdoors. Follow national guidelines. Be mindful of face to face breath transmission.	Tolerable
Surface transmission	Sanitisers are available. Wipe surfaces. Limit one to use of kitchen/bathroom area. Offer people option of using own mugs and washing up. Clean toilet regularly.	Low
Reporting	Not needed, ask permission, but a record of visitors names is good to keep a for any future possible information purposes. It will be destroyed before 5yrs (GDPR).	N/A

Trustees as of 17/04/2022 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.

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

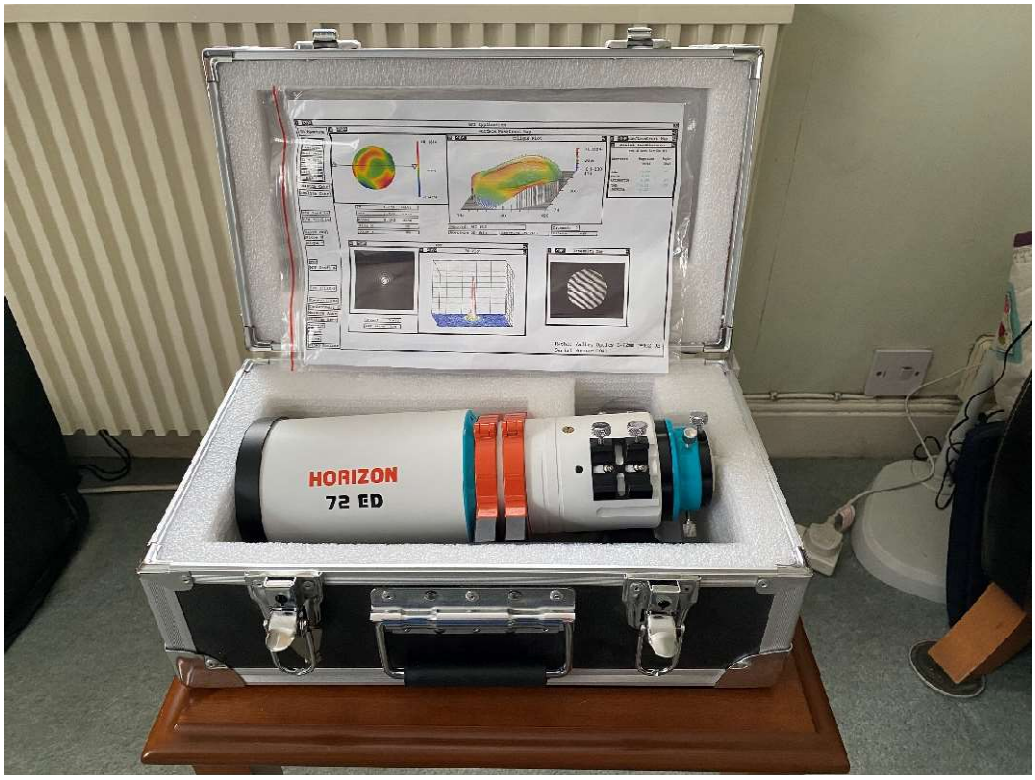
It is suggested that a donation of 5% of the final sale price be given to the Society to assist with funds. If sellers do not wish to make their contact details public then please make this known to me and I will field any enquiries on a box number system. Please send any sales details to me before the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

Rother Valley Optics 72mm ED Doublet Refractor Telescope.

Pin sharp stars, superb for the astrophotography or someone just starting out £500. Pristine condition, not a mark on it.

Further details from j.slight@btopenworld.com




HORIZON
72 ED

Superb Baader CoolCeramic Herschel Wedge Solar Diagonal

(only used twice and so virtually unused) £300 and includes: Ceramic Solar Wedge Filters, 2" – 1 ¼" clicklock adapter, SOL solar finder

Further details from j.slight@btopenworld.com

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 – 2022-2023 7:30pm Great Ellingham Recreation Centre, Watton Road, Great Ellingham, Attleborough, Norfolk **Hall entry £2.50 £1 U18s**		
Friday 13th January	**The expanding Universe**	Dr Matt Bothwell
Friday 27th January	**Open Might**	Observatory
Friday 10th February	**'The Megaconstellation Threat'**	Dr Paul Daniels FAS President
Friday 24th February	**Open Might**	Observatory
Friday 10th March	**Citzen Science and the Zooniverse**	Prof Chris Lintott