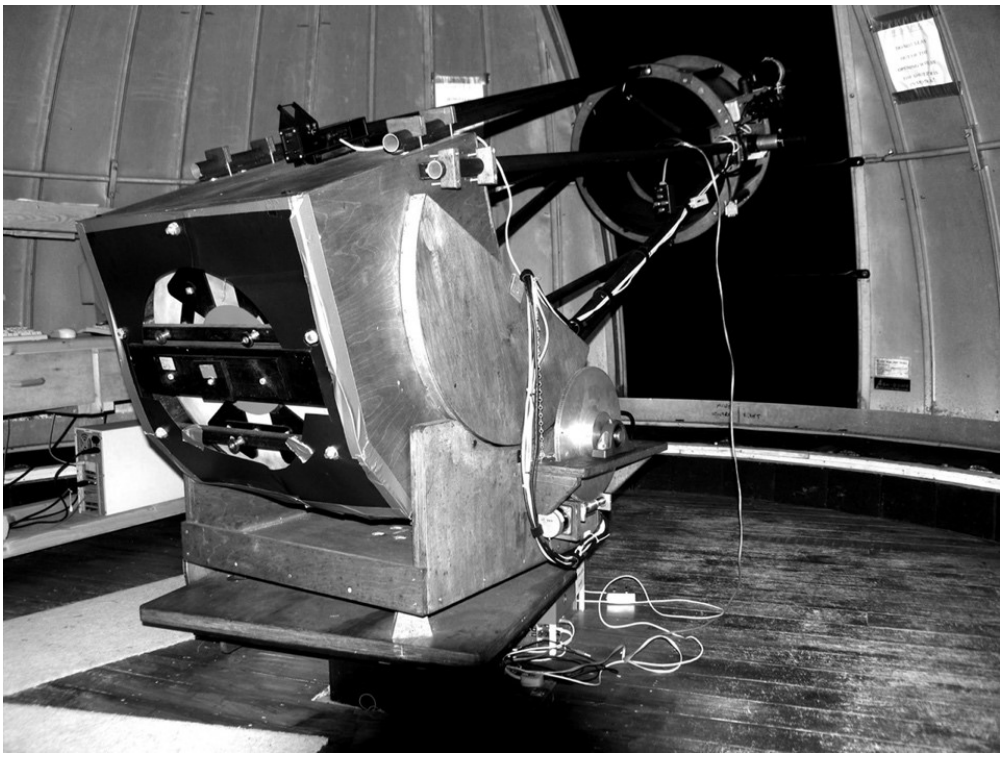
Breckland Astronomical Society

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

EXTRA TERRESTRIAL

Newsletter January 2022



Registered Charity no, 1044478

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

Chris Bailey is the newsletter editor. newsletter@brecklandastro.org.uk

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

Chairman's Notes January 2022

A warm welcome to 2022, a fascinating year yet to unravel! Looking back over 2021, we had a mixed year with the effects of CoVid seriously affecting activity, but on the whole we got out when it was safe enough to do so. We had lots of interest towards the end of the year, it usually picks up a little into autumn term, when space topics are done in schools and scouts groups. It was really lovely to see people on the open nights and inspire some young minds. Thanks to all folks that helped. It is essential to keep everything running smoothly to have a bit of commitment from people. It is both enjoyable and a rewarding experience giving your time up for folk who have just discovered the beauty of heavens. Personally, I never feel I can commit as much as the society needs, as I have much less time these days! But whatever things I do, such as even writing this(!) I feel rewarded for.

Having been chairman a while now, I get a sense of what things work and it is people's time that seems to be key. The most essential job is done by Andy, Treasurer and Membership Secretary, which requires quite a bit of time over the year. Sincere thanks for that and those who did the following things to help the society this year. It is stirling service to science education, and all the more kudos for volunteering.

writing or submitting pieces/articles for the newsletter, however small
keeping the webpage services going
helping with advertising and communication
manipulating documents and files on your computer for hours
talking to potential speakers at events and networking
showing visitors the observatory and the sky
thinking about what is needed for the observatory, loo roll, coffee, etc!
fixing things at the observatory
welcoming and showing people round the observatory.
at the talks, helping with teas and coffees
helping get chairs and tables out
helping lug the projector and screen across from the observatory
helping get keys for the hall and opening up
bringing raffle prizes
donating
and just coming along on a Tuesday night, which I hope we will be able to attend much more safely in 2022.

All the above need time and commitment and are ultimately essential in keeping all our minds stimulated with universal thoughts, as well as the sociable element that I enjoy personally – great minds...

Repeat notice - Bank Account is changing

Andy our dedicated treasurer and membership secretary was been informed a while back that our bank account (HSBC) is now charging us for transactions and a monthly fee. The committee decided to open a new Co-Op account. We will now have to keep the HSBC one until at least January, so your direct debit subscription details will not change. The Co-op one will take a few weeks to open due to high demand. You will get informed the new details via Mailchimp once the application has been finalised.

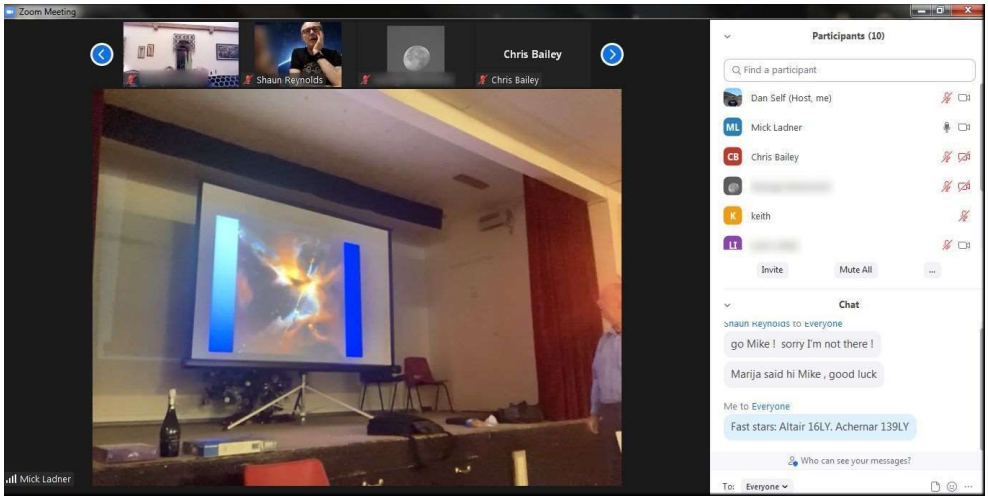
We reinstated Zoom to livestream the last talk, the connection was good as I was watching from home. There were rather wet roads out there and it is a busy time of year for many people. The January talk (14th) will be by Zoom only, as the speaker Andrew Mowbray is going to be doing it from home. That way we can have a more reliable connection, save on the hall cost and stay cosy at home in the coldest month. It will only be for a month though. This coincidentally comes with the necessary restrictions that I've just heard are inevitable (at the time of writing, I have no idea what will be imposed on us).

February we will (aim to) be back in the hall. At the time of writing I have not heard a reconfirmation from our extremely busy February speaker.

Andy and Ed won the BAS 100 in December well done. Please buy more tickets next year for the draw when we get back to the hall, it really helps the society.

Michael (Mike) Poxon – "STAR LIFE"

Star life is a talk Mike usually does with Shaun Reynolds. Shaun had confirmed to Mike that he could make it, hence I advertised it to be a dual talk. However, he apparently had the day wrong and joined us via Zoom from Serbia, on the livestream link intended for watching only, as it had limited sound amplification to the hall. Thanks Mick Ladner for streaming this for us. It was well attended.



It was a talk firstly about star formation via gravity. He showed us some Herbig-Haro objects such as in Hubble's Variable Nebula (Monoceros NGC 2261) and some beautiful pictures of some globules in large emission nebulae like Shaun's pic of the Pelican nebula that he zoomed in to. The dark patches are condensing to form stars and protoplanetary disks, and there are some impressive new high-res observations from the latest big telescopes. He also pointed out that as an observational astronomer star omicron (NO not the variant) Cygni, is a beautiful coloured triple star through binoculars (Mike has written a book on binocular astronomy).

Gravity collapses the star until fusion ignites by sheer pressure and temperature at the centre. This energy output is incredible. Mike brought out some white powder, one gram of salt, which looked suspicious. If you used the formula $E = mc^2$ to work out the amount of energy in that amount of matter, you would get 110 trillion joules. A modest star like out sun is losing 400 tons of mass per second! This is what balances the incredible gravitational pressure and inflates the star to its huge size and temperature. Hence big stars burn faster, and die sooner. The Hydrogen fusion puts the star on the Main Sequence with a characteristic brightness, temperature relation.

Meanwhile planets are forming from the protoplanetary disk.

Examples of new stars are the Pleiades cluster, although the nebulosity there may not be from the original cloud and the trapezium in the Orion nebula.

At the end of a star's life, they run out of hydrogen in the core and the outer layers start to burn forming a red giant. These stars wobble (I asked Mike why) and it is a part of cyclic behaviour of fusion, expansion and cooling, and shrinking – it is what is happening to Betelgeuse now. The smaller stars will collapse to form a white dwarf core and the radiation pressure and momentum blows off the atmosphere as a planetary nebula. If the star is more massive, the Helium formed from fusion will itself start burning to form Carbon, Oxygen, Nitrogen (*sic*), Neon, Silicon, and Iron.

These massive stars can go supernova and in a very, very short time at 25,000 miles per second (!) the atmosphere falls down onto the core, which is hard, and a shockwave rebounds the material outwards. It is in this phase where some heavy elements are formed. However this is now known not to be the main source of the heavy elements in our periodic table – that is from neutron star collisions. Some second and third generation stars can be seen to have heavy (post Fe, iron) elements in their spectrum. One was spotted with strange spectral lines suspected to be Technetium – which could only have been made, apparently by aliens. Hmm, I'm not sure that's evidence of ET civilisation.

Next month we have Andrew Mowbray on Zoom talking about the Moon landings. Look out for the link by email and near the time, on facebook.

Don't forget we would love to feature some of your short pieces for publication in the newsletter. Keep them coming, especially regular features, such as I used to do with Constellation of the Month. Perhaps a feature on space tech.

We may be in for some restrictions regarding travel and gatherings in the new year, in order to protect the NHS. The events we run will be cancelled depending on guidelines. We will keep you up to date on the website, facebook and by email. We will try to meet on Zoom Tuesdays if this is the case as it is great to stay in touch. If in doubt email me on chairman@brecklandastro.org.uk

Dan Self

JOHN'S NEWS BITS
January 2022

NASA's JWST space telescope finally took off successfully at 12.20pm GMT on Christmas day from the Kourou Spaceport in French Guiana.
Faultless nail biting launch through to separation and on to its final destination at the Lagrange 2 position, in about a month's time (watch on y-tube)..
30 years and $10 billion to develop and in partnership with ESA and the Canadian space agency, will replace Hubble although all images taken will be in the infrared.

NASA's IXPE mission, in collaboration with the Italian Space Agency, was launched on a Space X Falcon rocket.
The IXPE observatory will measure the polarisation of x-rays from supernovae remnants of supermassive black holes and other high energy objects. This will augment the scientific discoveries of the Chandra X-ray observatory.
(IXPE: Imaging X-ray Polarimetry Explorer)

As reported in Science Daily, research done by astrophysicists at Boston University has confirmed that the heliosphere protects the solar system from supernova and other interstellar radiation. This protective bubble protects life on Earth.
The heliosphere is the magnetosphere bubble caused by the solar wind and is the outermost atmospheric layer of the sun some 20A.U. radius.

The Kavli Institute of Physics is looking into why more matter as opposed to antimatter was left within a few seconds after the big bang. They hope to detect Q-balls in gravity waves. Q-balls are bosons like the Higgs boson but can form into lumps in the field.

When Q-balls decay they cause fluctuations in the plasma creating violent sound waves which lead to ripples in space-time, these can be detected by gravity wave detectors. This could shed light on the asymmetry that caused matter to exceed antimatter.

Sci-news.com reported that astronomers have evidence that the Sagittarius A* four million solar mass back hole at the centre of the Milky Way is not a sleeping monster but periodically hiccups as stars and gas clouds fall into it. Data collected from multi-wavelength observations from various telescopes such as NASA's Chandra X-ray observatory that the black hole burps out mini-jets every time it swallows a gas cloud.
Comforting to know that we are 27,000 light years from the galactic centre.

Technology.com report NASA has developed a 3-D visualisation tool for exploring comets and asteroids in the Earth's neighbourhood.
This 3-D presentation can be seen on: https://eyes.nasa.gov (no need to download as it is live.

We've all heard of FRB's, now its FBOT's or Fast Optical Bursts. Apparently these are bright blue flashes that come from a galaxy 200 million light years away, designated AT 2018cow with an even more powerful one detected in May 2020.
These bursts are 10-100X brighter than the usual supernovas and emit powerful X-rays pulses every 44ms. It is estimated that the source of this radiation must be greater than 1,000km with a mass of less than 800 Suns.
Theories include a dwarf star being pulled apart by a black hole or a newly formed black hole or a monster black hole shredding a star.

The nuclear fusion reactor experiment outside Didcot in Oxfordshire has been renamed 'Tokamak Energy' with 83 staff. It uses Hi temp. superconducting HTS magnets for nuclear fusion reaching plasma temperature of some 100 million degrees.

The ST40 Compact Tokamak prototype results to date were presented at the Phys.soc Plasma Physics conference..

Water, water everywhere….. ESA's ExoMars Trace Gas Orbiter (TGO) discovers hidden water in Mars' grand canyon, Valles Marineris. The water is hidden below Mars' and was detected by the TGO which mapped the hydrogen, a measure of water content, in the uppermost metre of Mars' soil.

Announced on Dec. 14, NASA's Parker Solar Probe has entered the Sun's atmosphere for the first time in history. It flew through the Sun's upper atmosphere, the corona, and sampled particles and the magnetic field. The approach was a zigzag of between 10 to 20 solar radii from the Sun's surface.

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John Gionis

Comet C/2021 A1 (Leonard)

David Bryant

C/2021 A1 (Leonard) is a long period comet discovered by G. J. Leonard at the Mount Lemmon Observatory on 3rd January 2021 (a year before perihelion) when the comet was 5 AU (750 million km) from the Sun. This was the first comet discovered in 2021 and has a retrograde orbit. On 12th December 2021 the comet was 0.233 AU (34.9 million km) from Earth and on 18th December 2021 it was 0.028 AU (4.2 million km) from Venus. It will make its closest approach to the Sun on 3rd January 2022. On 10th October the comet showed a short but dense dust tail. In early December the comet had a total magnitude (coma and nucleus) of around 6. The first reports of naked eye observations by experienced observers started coming in on 5th December 2021. Much like observing Messier 33, the low surface brightness of the comet can make it difficult to observe near urban areas.

Luke Broom-Lynne

On the morning of 6th December 2021 the comet was about 5 degrees from the star Arcturus. On 14th December 2021 the comet was 14.7 degrees from the Sun and will quickly become better seen from the southern hemisphere.

David Bryant

C/2021 A1 has been inside of the orbit of Neptune since May 2009. Using an epoch of 1950 which is well before the comet entered the planetary region of the Solar System, a barycentric orbit solution suggests the comet has roughly an 80 thousand year orbital period. Therefore the comet had spent the last 40 thousand years inbound from approximately 3,700 AU (550 billion km). After perihelion the comet will be ejected from the Solar System. The barycentric orbit will remain hyperbolic after September 2022.

The nucleus is about 1 km (0.6 mi) across. It's traveling at 158,084 miles per hour (254,412 km/h or 70.67 km/second) relative to Earth.

Chris Bailey

Deep Sky Charts for January 2022

Early in my observational astronomy hobby, I started by star hopping. I used a photocopied library book, and had enlarged charts of the sky from A4 to A3 in my telescope box, with a red bike light and found objects 3 magnitudes below the faintest stars on the chart. It would have been amazing if someone could have found me charts down to 9th magnitude, and I did eventually find a clunky way of producing charts via Redshift software and online comet charts. Oh my hands used to freeze, it was great.

The moon is new at the start of Jan for the Quadrantids, but grows in the first week, to be a 50% phase high in the evening sky by the 10th. Unfortunately, it isn't a month for the Lunar X and V, but February 8th is a good opportunity to catch the effect.

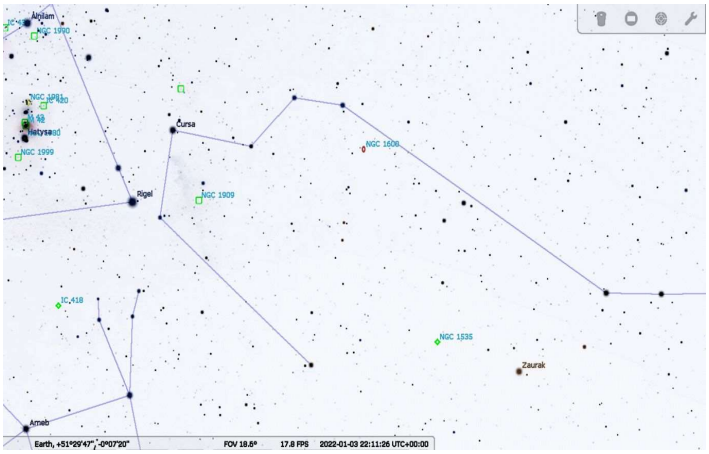
Comet **Leonard** has now disappeared South for us. There was little chance of us seeing it over Christmas, as we are too far north. It seemed to fade a bit, then flare up but it is now flying away again, never to be seen again.

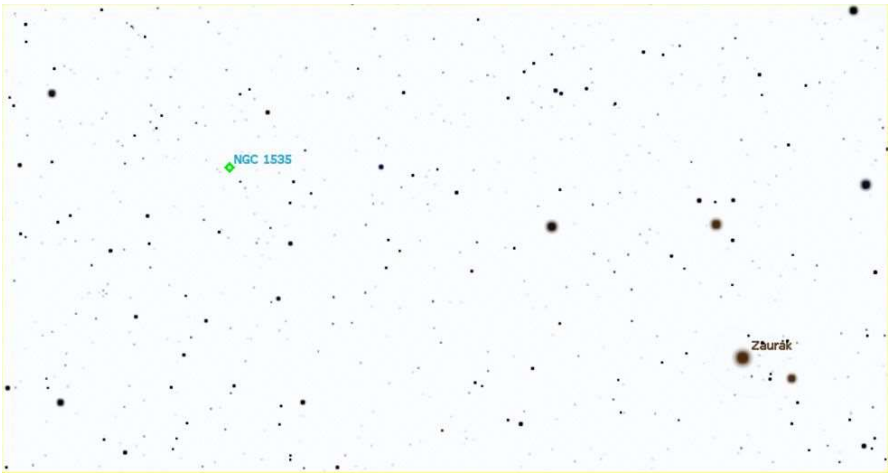
19P/ Borelly The next dark skies will come when the moon has passed full and is a waning gibbous rising at 8pm on the 23rd or 21:10 on Xmas Eve in NE Leo. It rises early due to its northerly declination. After Xmas we wish you many dark nights to try out telescopes, and welcome you to our open night on Thursday 30th December (not the Friday as this is New Years Eve) from 18:30. On this night, we may glimpse comet **19P/ Borelly** in Cetus.

A telescopic target is **67P/ Churyumov-Gerasimenko** (Чурюмов-Герасименко), Rosetta and Philae's comet in Cancer. Please find charts on heavens above or stellarium, the sky etc...

The **Quadrantid meteor shower** is around the 3rd - 4th and is pretty moonless this year. It starts to pick up after midnight slowly and get better towards dawn. Try on whatever night is clearest from the 2nd to the 4th and look for meteors crossing the sky from North to South.

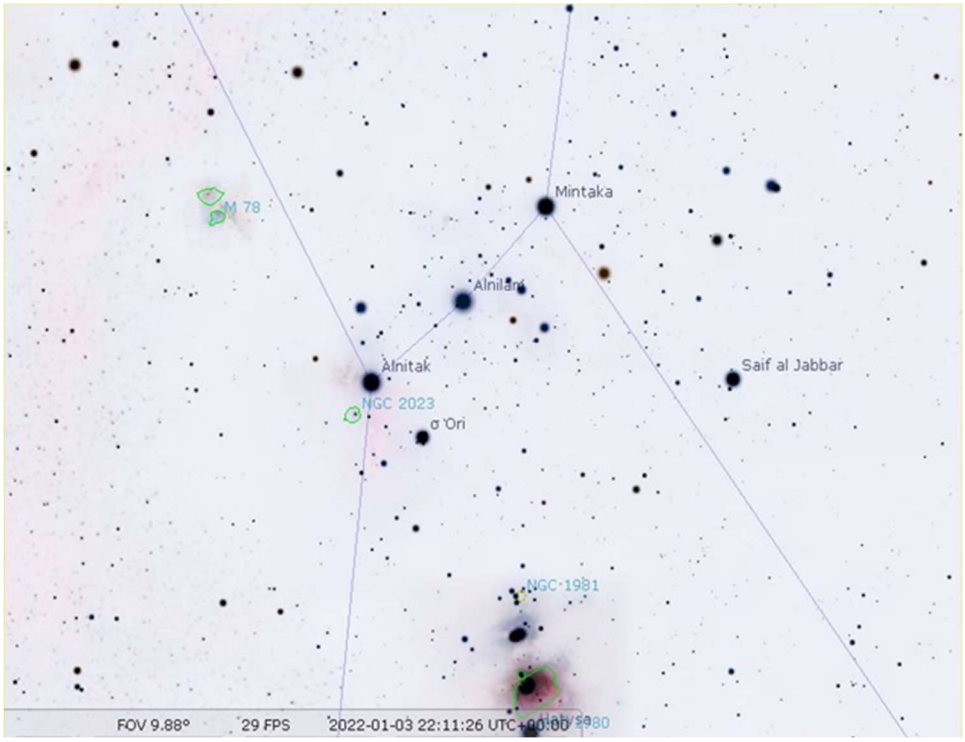
Earlier in the evening, before Orion is too high, Eridanus is highest in the South. There is a bright but fairly tiny nebula in Eridanus, NGC 1535, that you could find with a telescope (even good binocs) and these charts. You'll need to hop via the star Zaurak. If you are trying out a GOTO telescope, simply select Deep Sky> NGC> type in 1535, press enter and...not see anything. This is what usually happens and should not be expected, because the polar alignment and levelling/latitude setting of a telescope is so delicately sensitive. This little green planetary nebula should be bright enough in smallish telescopes. There is usually mist or murky scattered light in the sky and it rarely looks ideal, and when you are trying to search through a fogged-up, image-flipped finder scope things take time. You need a good chart with some patterns to pick out, and allow your eyes to adjust back from chart to the scope. But the intensity of this nebula, when found is good enough to break through a good bit of atmospheric clag.





Going up to Orion you can always check how quickly you can find the Orion Nebula, M42 and have another quick marvel at its amazing filamentary extent and structure. I was amazed I could see the Running Man nebula one night. But, Orion has more to

offer than just this. There are many fainter nebulae. The horsehead in IC 434, is unfortunately only visible by eye under really, really dark skies and even then is one to test the limits of your vision. Even more compelling to try –

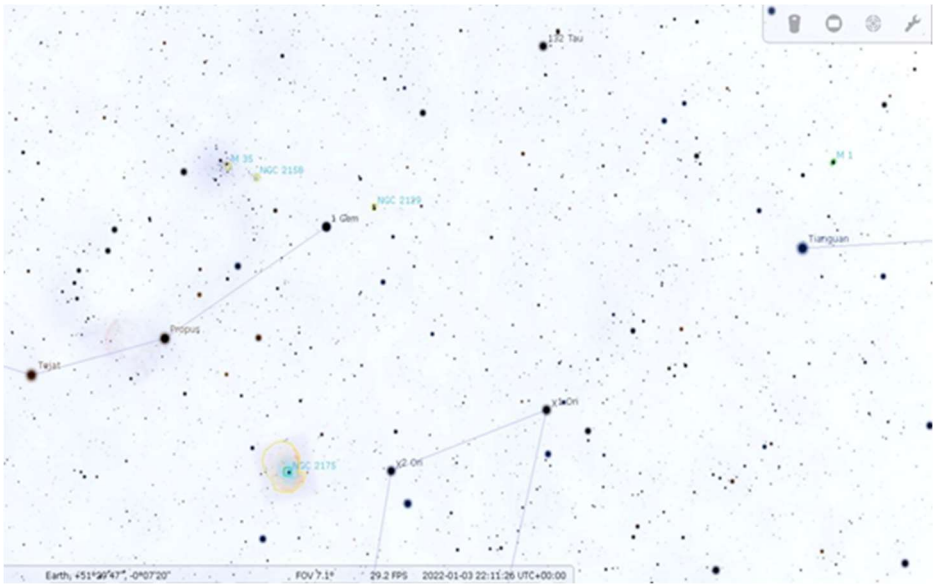


as you would be one of few that have seen it. It requires an Ultra High Contrast filter, and a medium sized telescope. Very little of its light is in the form of blue, scotopic vision stimulating wavelengths, but there is some there. Most people notice a large gap in emission nebula IC 434, that 'hangs' in a filament, a degree or so below the star Alnitak, which must be pushed out of the view, due to glare. If you have a large enough telescope, the Flame nebula is much more visible, and even the smaller blue reflection nebula NGC 2023, which is near the horse's head. I have often seen the Flame nebula in the 20 inch. It more than fills the eyepiece in extent.

The other nebula you'll likely see, but is hard to find, is M78. Sometimes called Caspar the Friendly Ghost nebula or Headlights in the Fog, it is a misty patch around a couple of stars. More distant, lies another patch of reflection nebula that is visible glowing from behind some huge dust clouds. These nebulae lie at least 1250 light years away, and are huge structures within our galaxy, looking outward away from the core of the Milky Way Galaxy.

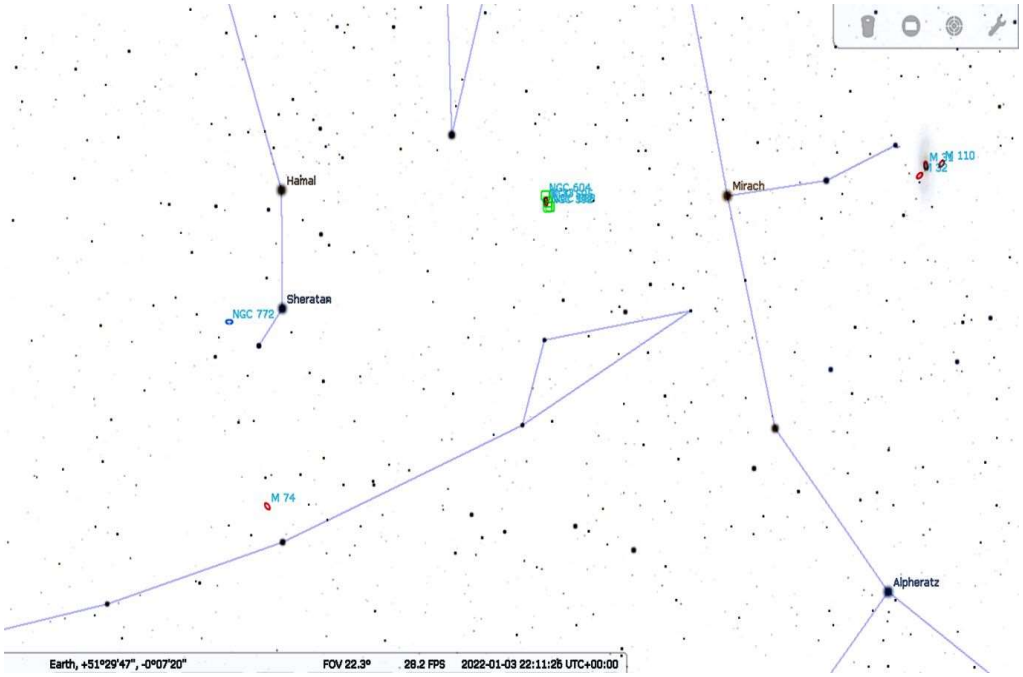
Going up to Gemini – there is also a zone of interesting galactic objects at the 'top' of Orion. Of course there is no universal up in space.

M35 is a **lovely** bright object that fills the eyepiece in a medium sized (6”) telescope. There is a little cluster NGC 2158 just in or out of the field, depending on your telescope size. Viewing clusters might seem boring as they are just a load of random white dots, but the sheer depth of brightness, from intense bright coloured stars to faint white speckling really seems to give your eye many more dimensions to behold. If you keep going off in the direction of NGC 2158, you may find IC 2157 a loose faint grouping of stars.



A quick note on the Moon this month. It becomes a beautiful crescent phase, from January 5th – 7th but is below the ecliptic making it low in the SW after sunset. By the 8th Jan it is becoming intrusive to deep sky observations. Its orbit rapidly takes it further below the Eastern horizon night-on-night from the 21st, making the 22nd onwards good nights for deep sky observing (below) again.

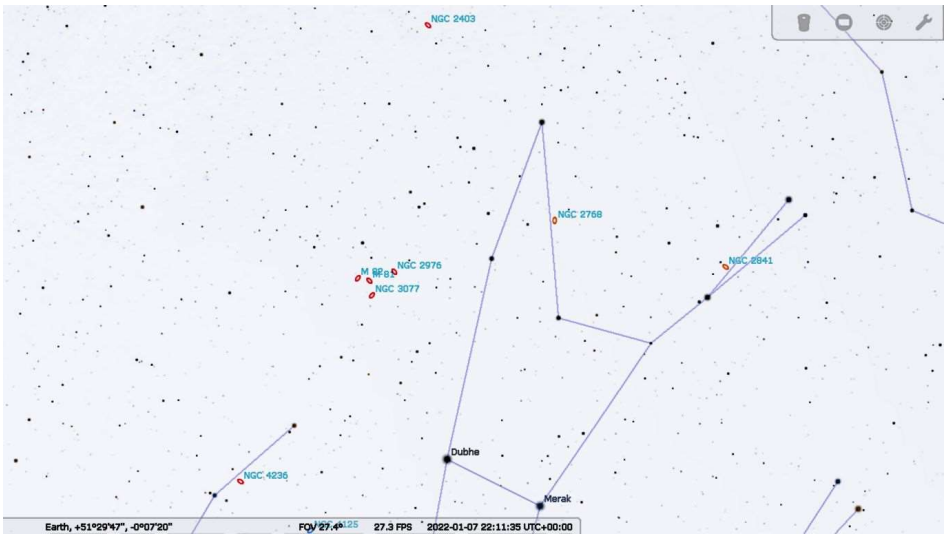
If you look over to the high **Western Sky**, especially early on, you will see the Square of Pegasus, and Andromeda above it. The faint constellation Pisces goes around the left of the square and contains a bright but very diffuse galaxy, M74. It usually appears to me even from a dark site, as a central fuzz in my 8 inch telescope. Fortunately it is easy to find near the bright star in Pisces. It is rather like M101. On really clear nights, you can make out some beautiful large spiral structure to fill the eye piece! It is also directly in a line from the 2 bright stars Hamal and Sheratan – which are in the bright asterism in Aries. There is also the fainter galaxy NGC 772 just south of Sheratan.

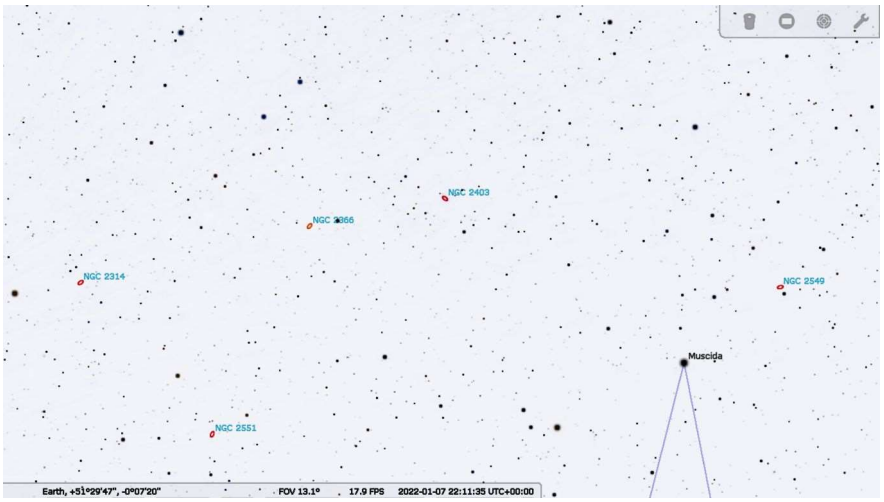


Of course the well-known galaxies, M33 and M31 (Triangulum/Pinwheel and Andromeda) are on show high in the sky. M33 is especially diffuse and flocculant, and is fairly underwhelming by eye, unless the sky is really good. You may be able to make out the giant star cloud within it, NGC 604. Just think how amazing it is to see a nebula 2.7 million light years away! M31 – is a big brightish object, with an almost stellar core. It is our nearest big galaxy and excellent to practice star hopping with. You should also seek out the two satellite galaxies around it, although they may lie just outside your eyepiece view. They look very different! One is very concentrated, the other diffuse.

The Plough is rising again, especially later in the night in the North East. You can find some fairly close, brightish galaxies there, M81 and M82, Bode's "Nebula" and the Cigar galaxy. The term nebula here harks back to a time before photographic or large-aperture astronomy, when these objects were seen essentially as pretty swirls of gas out in space somewhere, and not recognised as stellar cities, separated by vast expanses of black outer space. They are a tricky find to me, by star hopping but it is always eventually possible, providing pesky cloud doesn't thwart you, in a 3 inch upward telescope. The smaller telescopes may fare just as well, due to the lower magnification. However, with the medium sized ~ 8 inch telescopes, you should be able to find NGC 3077, Coddington's Nebula and NGC 2976 also, which are

neighbouring galaxies. An idea is to give it a go at drawing the pair (this is tricky, red- for other galaxies in this area if you are feeling confident.

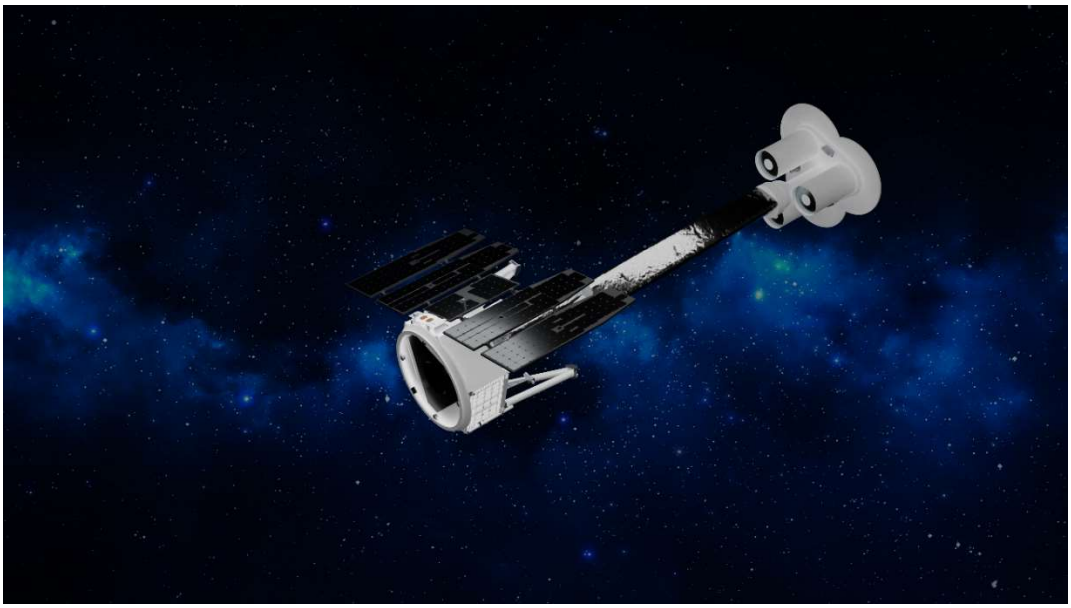




I just think it is amazing that we can buy a piece of kit and take it to see the extreme distant universe from some field near where we live, even from some of your back gardens. Also, for those imagers out there, I would like to see images of things like these NGC galaxies that I haven't seen before! I love an unusual image. Rather than a flurry of snow, I'd rather see a flurry of galaxy images over the Christmas break.

Dan Self

NASA’s Imaging X-ray Polarimetry Explorer



NASA’s Imaging X-ray Polarimetry Explorer (IXPE) mission is the first satellite dedicated to measuring the polarization of X-rays from a variety of cosmic sources, such as black holes and neutron stars.

Credits: NASA

NASA’s Imaging X-ray Polarimetry Explorer, or IXPE, is a space observatory built to discover the secrets of some of the most extreme objects in the universe – the remnants of supernova explosions, powerful particle streams spit out by feeding black holes, and more.

IXPE is NASA’s first mission to study the polarization of X-rays from many different types of celestial objects. Measuring the polarization of X-rays traces the story of where this light came from, including the geometry and inner workings of its source.

IXPE is set to launch Dec. 3 on a Falcon 9 rocket from NASA’s Kennedy Space Centre in Florida.

Science

X-rays are a form of high-energy light. They originate from places where matter is under extreme conditions – violent collisions, enormous explosions, 10-million-degree temperatures, fast rotations, and strong magnetic fields. They carry detailed information about the powerful phenomena that produce them. But Earth’s atmosphere blocks cosmic X-rays from reaching the ground, so they can only be collected by telescopes in space.

Polarized light carries unique details about where the light comes from and what it passes through. Light is made up of interconnected waves of electric and magnetic fields that interact with each other in a way that makes them oscillate, or vibrate, at right angles to the path the light is travelling. The vibrations can be up-and-down, side-to-side, or anywhere between. Polarized light is made up of electric fields that vibrate in just one direction.

Light from a typical bulb, for example, produces electric fields that vibrate every which way. If the light is scattered or reflected by particles or surfaces, the light can become polarized – with vibrations aligned in just one direction.

IXPE builds on the discoveries of NASA's Chandra X-ray Observatory and other space telescopes by measuring the amount and direction of polarization of X-ray light. IXPE's polarization measurements will help scientists answer questions such as:

- How do black holes spin?
- Was the black hole at centre of the Milky Way actively feeding on surrounding material in the past?
- How do pulsars shine so brightly in X-rays?
- What powers the jets of energetic particles that are ejected from the region around the supermassive black holes at the centres of galaxies?

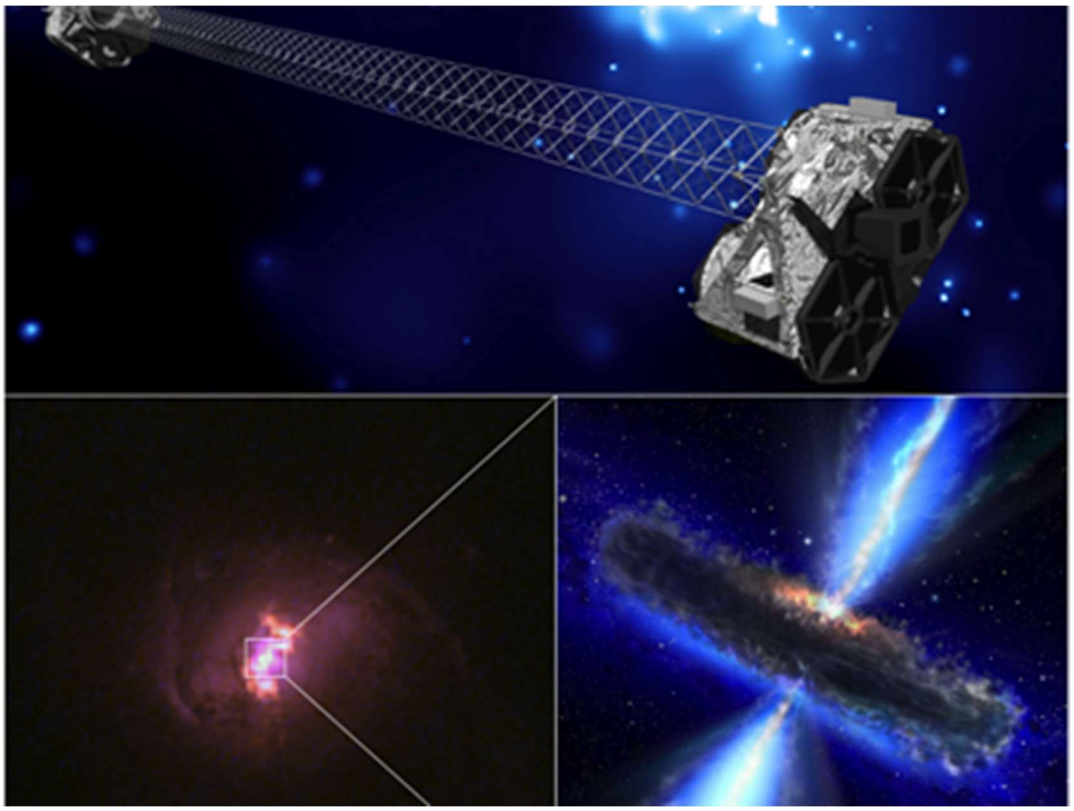
IXPE will also serve as a unique tool to study the laws of nature in extreme conditions that we cannot recreate in a laboratory on Earth. IXPE's polarization measurements might even hold clues to longstanding questions about the rules that govern high-energy physics on both a large scale and a very small, or quantum, scale.

A SpaceX Falcon 9 rocket launches with NASA's Imaging X-ray Polarimetry Explorer (IXPE) spacecraft onboard from Launch Complex 39A, Thursday, Dec. 9, 2021.

Observatory

IXPE carries three identical telescopes. Each telescope includes a set of cylindrical mirrors, or optics, and a sensitive detector. The mirrors collect X-rays from celestial objects and focus them onto the detectors, which make an image of the incoming X-rays and measure the polarization. All three mirror sets are separated from their corresponding detectors by a deployable 12-foot (3.7-meter) boom.

Soon after launching, IXPE deployed its solar arrays and began commissioning of the spacecraft. After about a week, IXPE will have extended its boom. About a month after launch, IXPE will be ready to begin its two-year science mission. IXPE's "first-light" target will be the supernova remnant Cassiopeia A, which was also Chandra's first-light observation. IXPE will study approximately 40 celestial objects during its first year in space, with more detailed follow-up observations during the second year.



Team

IXPE is an international collaboration between NASA and the Italian Space Agency. Hundreds of engineers and scientists from more than 12 countries worked together to make IXPE a reality. The mission is led by principal investigator is Dr. Martin C. Weisskopf at NASA's Marshall Space Flight Centre. Ball Aerospace is the main industry partner.

Courtesy NASA.

Geminids Meteor Shower

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.

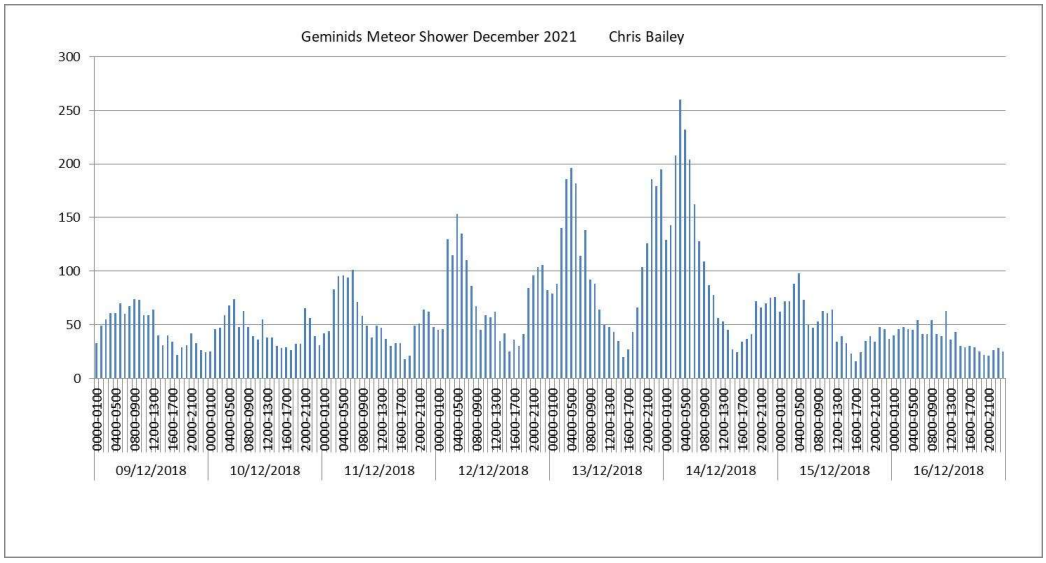
The discovery of Phaethon was a highlight of a long story. In the 1950s it was suggested that the parent comet was once in a very different orbit. It was thought to be possibly connected to the big comet of 1680 on a parabolic orbit. Later Comet discoverer L'ubor Kresak' suggested that the orbit of the 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 2021 shower

Visual observations were compromised by the Moon phase approaching full at the peak of the shower. High pressure building over the UK caused a great deal of overcast weather. I observed several before the peak but did not manage to image any clearly.

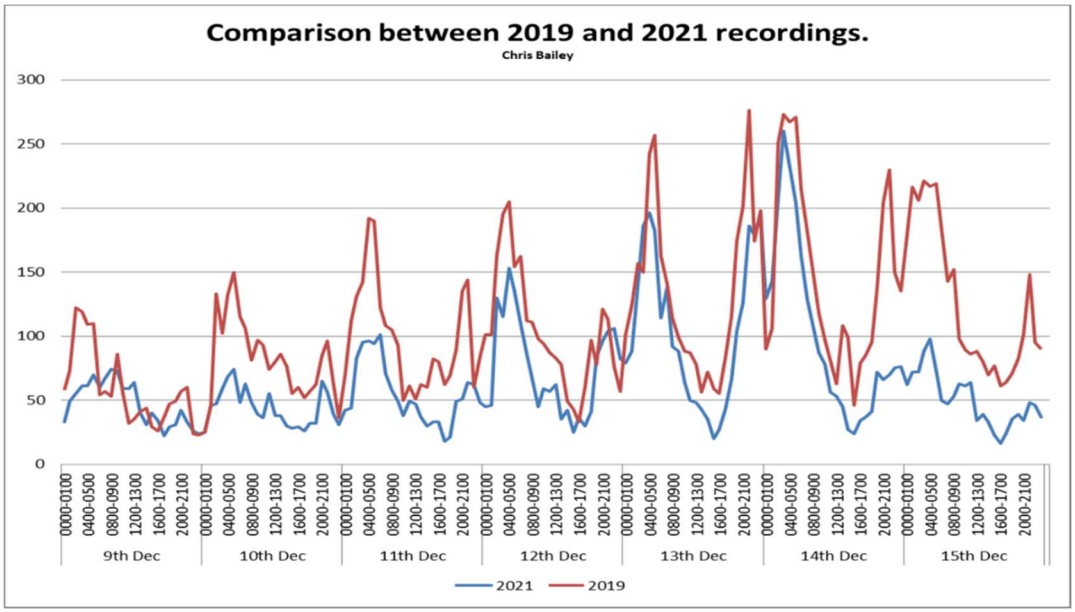
Radio observations were again centred on forward scatter radar using the GRAVES transmitter near Dijon France. One problem that is building with time is the serious interference and false echoes from Starlink Satellites. Automatic counting of the echoes is no longer possible (I have tried for comparison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

Below are the results obtained for the period 9th to 16th December 2021.



It is always good to compare the recordings from different years. I cannot find the figures for 2020 so have used 2019. 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. I'm not sure what happened in 2020 but if those figures turn up I will add them in the future. 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.



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!!

From Flare to SID

Flare Characteristics

Solar flares are tremendous explosions on the surface of the Sun. In a matter of just a few minutes they heat material to many millions of degrees and release as much energy as a billion megatons of TNT. They occur near sunspots, usually along the dividing line (neutral line) between areas of oppositely directed magnetic fields.

Flares release energy in many forms - electro-magnetic (Gamma rays and X-rays), energetic particles (protons and electrons), and mass flows. Flares are characterized by their brightness in X-rays (X-ray flux). The biggest flares are X-Class flares. M-Class flares have a tenth the energy X-Class flares and C-Class flares have a tenth of the X-ray flux seen in M-Class flares. The National Oceanic and Atmospheric Administration (NOAA) monitors the X-Ray flux from the Sun with detectors on some of its satellites.

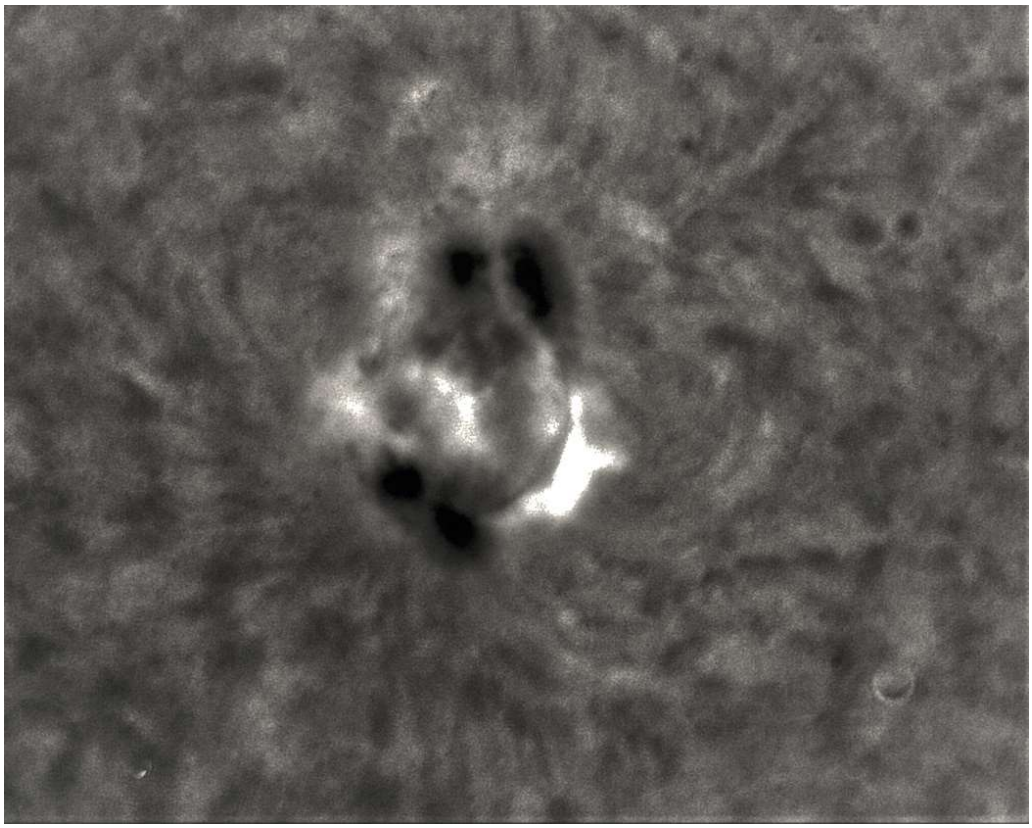
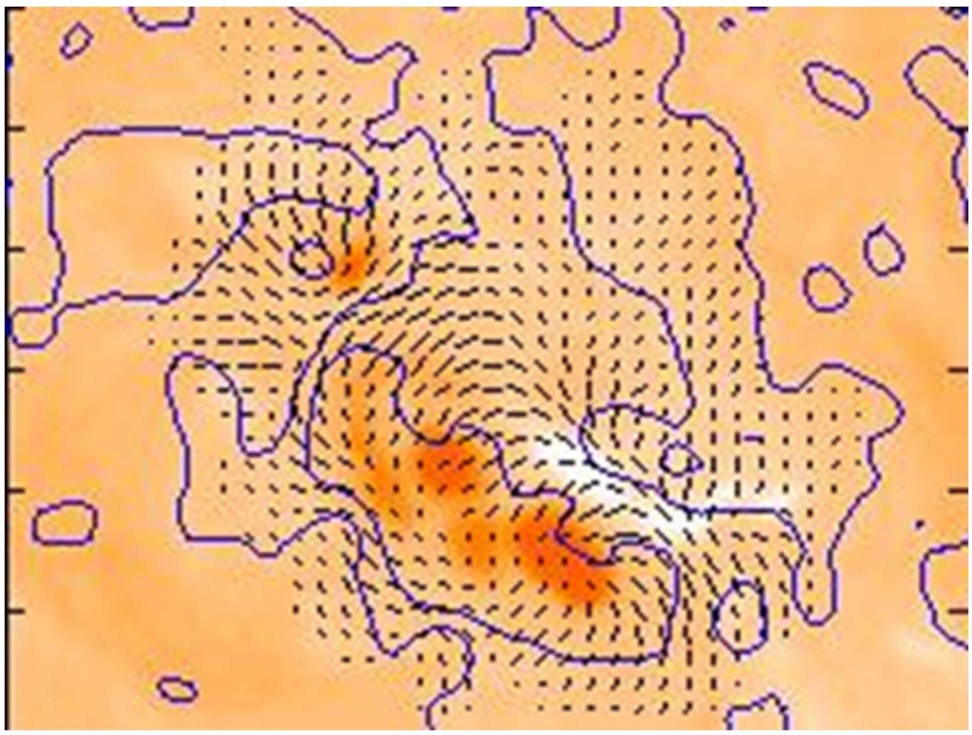


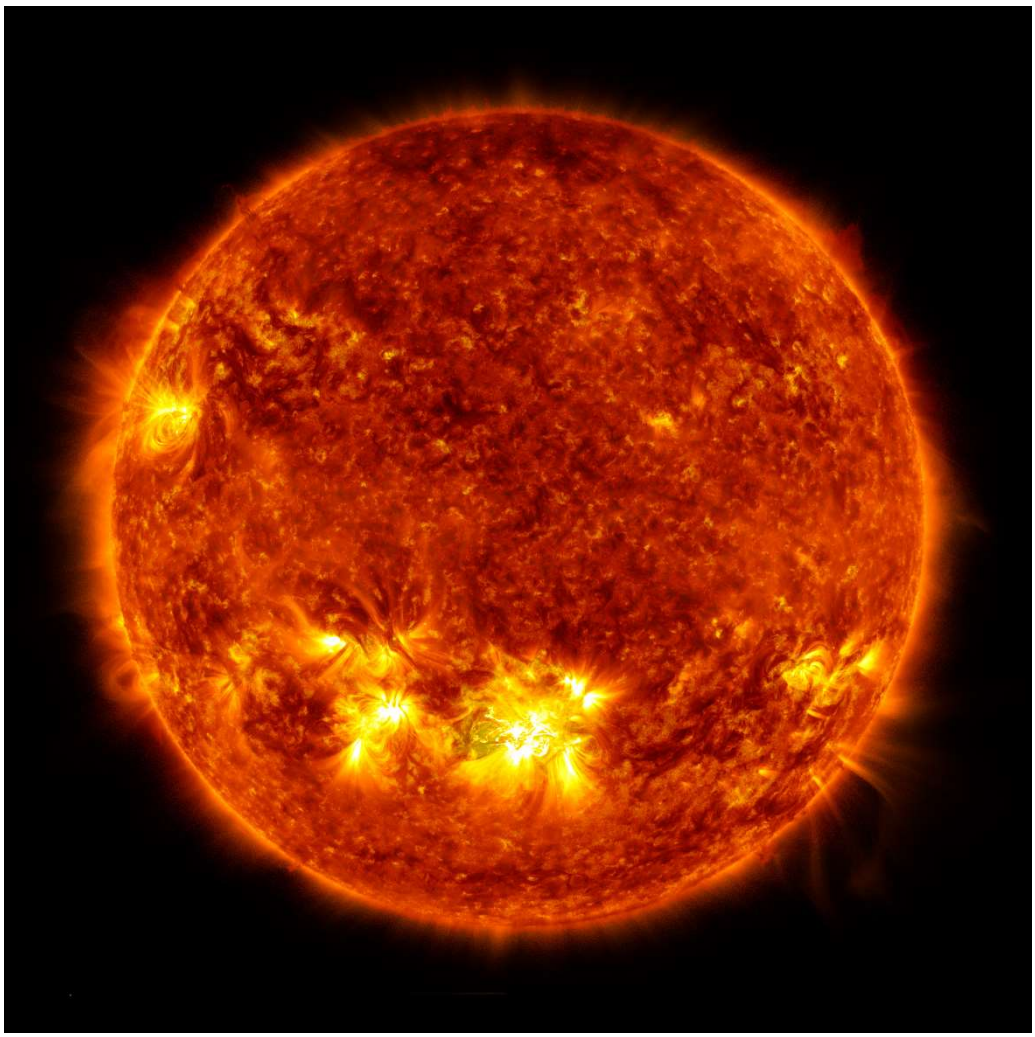
Image Chris Bailey

Flares and Magnetic Shear

The key to understanding and predicting solar flares is the structure of the magnetic field around sunspots. If this structure becomes twisted and sheared, then magnetic field lines can cross and reconnect with the explosive release of energy. In the image below the blue lines represent the neutral lines between areas of oppositely directed magnetic fields. Normally the magnetic field would loop directly across these lines from positive (outward pointing magnetic field) to negative (inward pointing magnetic field) regions. The small line segments show the strength and direction of the magnetic field measured with a Vector Magnetograph. These lines and line segments overlie an image of a group of sunspots with a flaring region. The flare (the bright area) lies along a section of a neutral line where the magnetic field is twisted (or sheared) to point along the neutral line instead of across it. It has been found that this shear is a key ingredient in the production of solar flares.



Solar flares are powerful bursts of radiation. Harmful radiation from a flare cannot pass through Earth’s atmosphere to physically affect humans on the ground, however, when intense enough, they can disturb the atmosphere in the layer where GPS and communications signals travel.



An X1.0 class solar flare flashes in centre of the Sun on Oct. 28, 2021. This image was captured by NASA's Solar Dynamics Observatory and shows a blend of light from the 171 and 304 angstrom wavelengths.

Credit: NASA/GSFC/SDO

X-Ray Absorption in the Atmosphere:

Absorption by the Earth's atmosphere restricts ground-based observations to radio, near infrared, and visible wavelengths. X-rays are absorbed high above the Earth in the following way:

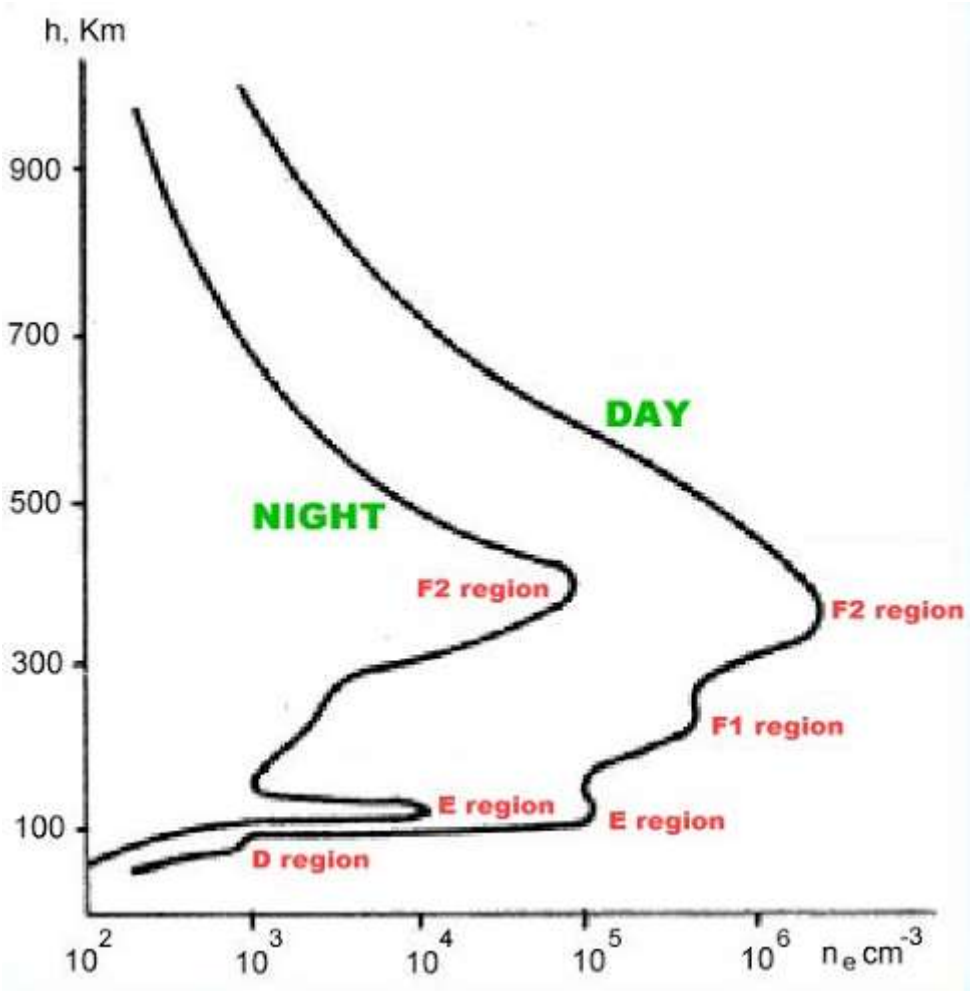
X-ray photons - tiny high-energy packets of electromagnetic radiation - are absorbed by encounters with individual atoms. Even though the atoms in the atmosphere are widely spaced, the total thickness of the atmosphere is large and the total number of atoms is enormous. An X-ray photon passing through the atmosphere will encounter as many atoms as it would in passing through a 5 meter (16 ft) thick wall of concrete! Therefore it is not practical to do X-ray observations from the Earth's surface. But we can observe the effects in the upper atmosphere.

Therefore, when a solar flare occurs on the Sun a blast of intense ultraviolet and X-ray radiation hits the day-side of the Earth after a propagation time of about 8 minutes. This high energy radiation is absorbed by atmospheric particles, raising them to excited states and knocking electrons free in the process of photo-ionization. The low altitude ionospheric layers (D and E region) immediately increase in density over the entire day-side.

The ionospheric disturbance enhances very low frequency (VLF) radio propagation. Observers on the ground can use this enhancement to detect solar flares; by monitoring the signal strength of a distant VLF transmitter, sudden ionospheric disturbances (SID) are recorded and indicate when solar x-ray flares have taken place.

To understand the SID effect it is essential to remember how Earth's ionosphere is created and structured. One may see the ionosphere as a shell of electrons and electrically charged ions (atoms and molecules) that surrounds the Earth, stretching from a height of about 60 km to more than 1000 km. The main constituents of the ionosphere are neutral atoms and molecules. However, the charged nature of the ionosphere is due to production of plasma (electrons, ions) primarily by solar ultraviolet radiation. This again means that the ionosphere is 'produced' during the day and is 'reduced' during the night due to recombination processes of

electrons and ions. Ionization depends primarily on the Sun and its activity. The amount of ionization in the ionosphere varies greatly with the amount of radiation received from the Sun.

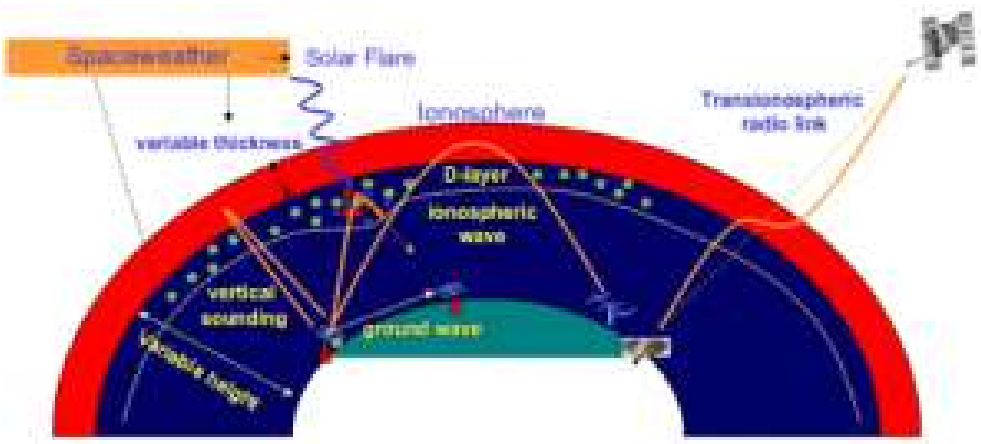


The structure of the ionosphere (layers or regions) is related to the neutral gas species populating those regions and the energy of the radiation penetrating the Earth's upper atmosphere. The higher energized the radiation is, the lower it may penetrate and produce electrons and ions. The electron density profile (image above) shows the different ionospheric regions during day (production of electrons) and night (recombination of electrons). The image below shows the layers of the ionosphere during night and during day.

The radio signal from the VLF transmitter reaches the receiver by two paths. One of these runs along the ground and is called the "**ground-wave**", the other is via "reflection" from the ionosphere, called the Ionospheric-wave, often known as the "**Sky-wave**". These two paths are of different lengths, and lead to the formation of an interference pattern. The different path lengths for the two signals means that the phases of these signals will differ at the receiver. The phase difference depends on the distance between transmitter and receiver and could lead to a **cancellation** or to a **reinforcement.**

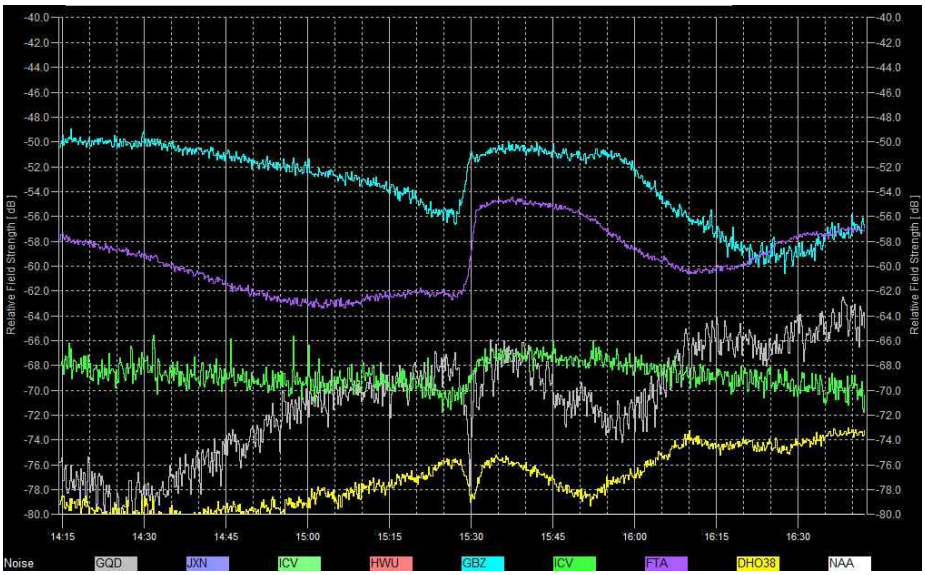
In daytime the **Sky-wave is attenuated by the absorbing part of the D-layer**, while the ground-wave component of the signal progressively weakens as the receiver becomes further from the transmitter.

After dark the D-layer, which is mainly ionised by Solar Ultra Violet rays, quickly disappears and with it all the absorbing ionization. "Reflection" now occurs from the lower part of the E-layer at around 90 km to 100 km altitude. The result of this is that once the mid-point of the path is in shadow at 100 km altitude, the **signal strength will usually increase** significantly, while the ground wave signal stays exactly the same strength. Thus night-time reception is marked by large and rapid swings in signal strength as the two, now more nearly equal strength, signals swing in and out of phase.



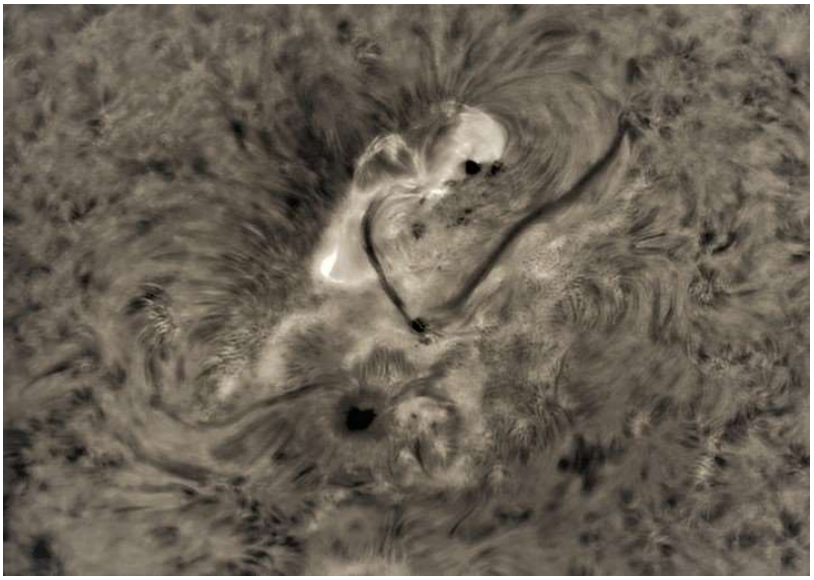
When the Sun is active, strong solar flares can occur that will hit the sunlit side of Earth with hard X-rays. The X-rays will penetrate to the D-region, releasing electrons that will rapidly increase absorption, causing a High

Frequency (3 – 30 MHz) radio blackout. During this time Very Low Frequency (3 – 30 kHz) signals will be reflected by the D layer instead of the E layer, where the increased atmospheric density will usually increase the absorption of the wave and thus dampen it, thus the Sky-wave is more powerful and leads to a rapid increase of the signal strength at the receiver. As soon as the X-rays end, the sudden ionospheric disturbance (SID) or radio black-out ends as the electrons in the D-region recombine rapidly and signal strengths return to normal.



Chris Bailey

In the above example for 28th October there are the traces of 5 stations effected by a solar flare event that arrived at about 1526z There effect is not the same for each station as the phase shift change will depend on the original situation. The flare event peaked at around 1530 and then the signal decayed back to their original values reaching the same levels as before the event. As this was towards the end of the daylight day some had already started to change and therefore the return is to the level where it would have been if there had not been a flare event. This is clearest on the top 2 traces. The end of the event can be estimated at around 1610z.

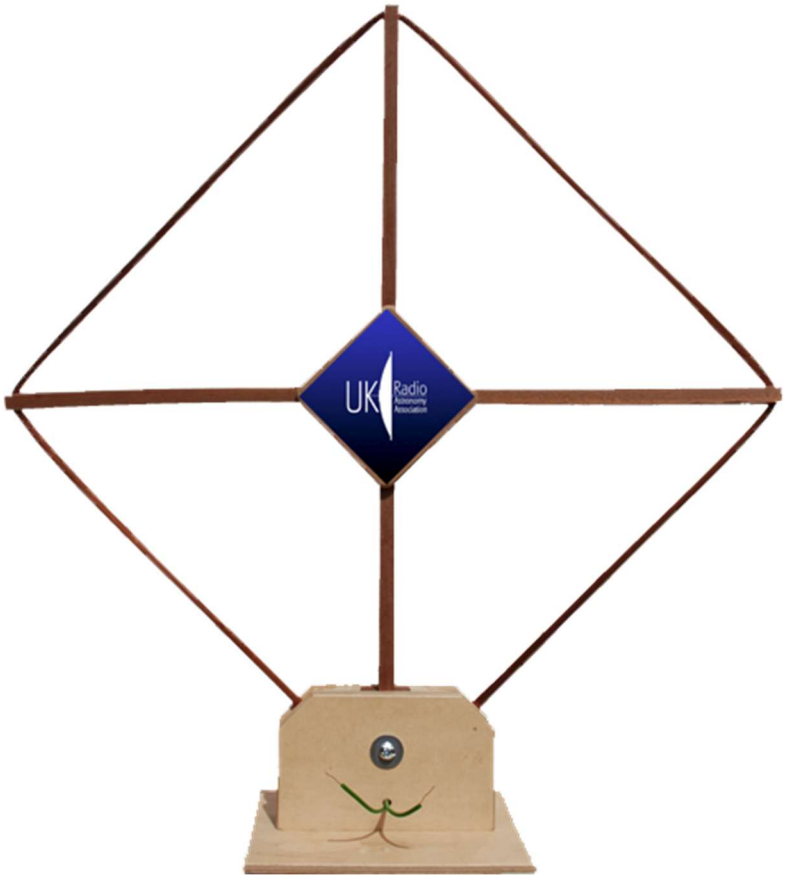


AR 2891 on 28th October showing start of flare.

SIDs cannot occur at night as the x-rays are only received on the daylight side of the Earth. If the VLF transmitter is very distant than it is possible that there may be more than on skip in the skywave and then it is possible to get an effect after dark at the receiver if at least one skip is on the daylight side, but these are usually very hard to positively identify.

Receiving and recording SIDs:

The equipment required to monitor for SIDs is fairly straight forward. Due to the long wavelength (10Km to 100Km) fractional dipoles are not practical. The best method is to use a loop type antenna with multiple windings making up the loop. The disadvantage is that it is very directional and therefore possibly two set at 90 degrees has an advantage. I have one that I made which has 130 turns on a square structure 0.8M across installed in my loft. This gives good reception of most of the European stations and NAA in the US.



Due to its location, it is not possible to photograph my antenna without disconnecting so the above is a similar loop which is available from the BAA via UK Radio Astronomy.

Receiver:

VLF receivers are available at very high cost. It is also possible to obtain an upconverter which changes the input signal so that it can be detected on a normal communication receiver (or Software Defined Radio)

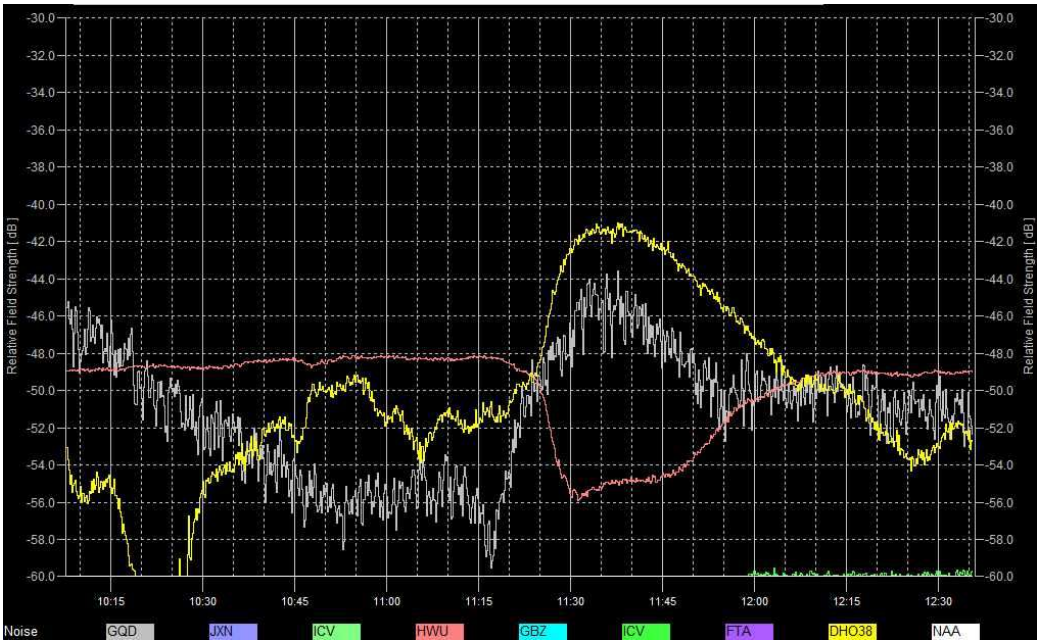
Luckily there is a much cheaper method. The frequencies we are interested are between 1 and 14Khz. As these are just electronic signals, they can be handled by audio equipment. It is possible to feed the antenna into the microphone input of a computer and this is often used. There may be issues with matching, but these can be overcome,

and there is also a danger of overloading the sound card if close lightning overloads the system. A better system is to use an external analogue to digital converter which connects via a USB port. I use a Behringer UMC204HD unit which has very low noise and high bandwidth as shown below.

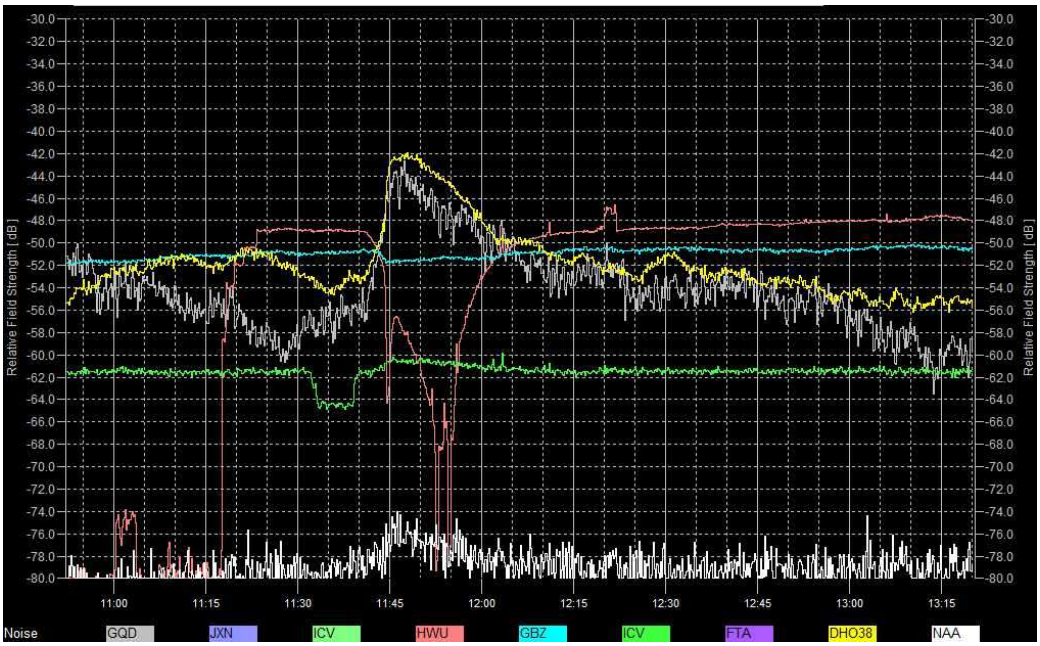
Recently I have added a preamp unit to better match the gain and reduce the noise level.

As mentioned previously some form of protection should be made for close lightning strikes. The easiest way is to use a lightning surge protector which automatically takes the lightning surge to earth.

The computer used is an older spare computer that is a stand-alone and runs on Windows 7 which is more than adequate. The program is Speclab which records 10 stations (I actually run 9 stations and a broad band noise channel to assist with the monitoring of external noise.) Noise comes from various sources; the worst I tend to get is the microwave (transformer) and the variable speed central heating pump. Both of these are easily identified and do not normally cause a major problem.



Chris Bailey 20th December 2021



Chris Bailey 21st December 2021

HWU (Pink trace) shows unusual phase inversion.

Calling all amateur and professional astronomers!

The International Astronomical Union (IAU) is the major professional organization for astronomers throughout the world, with nearly 12,000 members in 90 countries. The IAU is working to foster stronger relations between the large community of amateur astronomers in many countries and professional astronomers.

The IAU Pro-Am Working Group sees many mutual benefits for professional and amateur astronomers alike through greater collaboration. To this end, we have initiated a survey to explore interest and potential barriers. Please consider taking a few minutes to complete the survey before January 31, 2022 at:

LINK to the IAU announcement: https://www.iau.org/news/announcements/detail/ann21064/

LINK to Survey: https://www.surveymonkey.com/r/IAU_ProAm

Your feedback will be very helpful as we consider how best to move forward. Any questions should be directed to the IAU Pro-Am Working Group Secretary Yuko Kakazu at IAU.proam@gmail.com.

Thank you for taking the time to share your thoughts. **PLEASE share** this notice and the link to survey with members of your organization or others who may be interested.

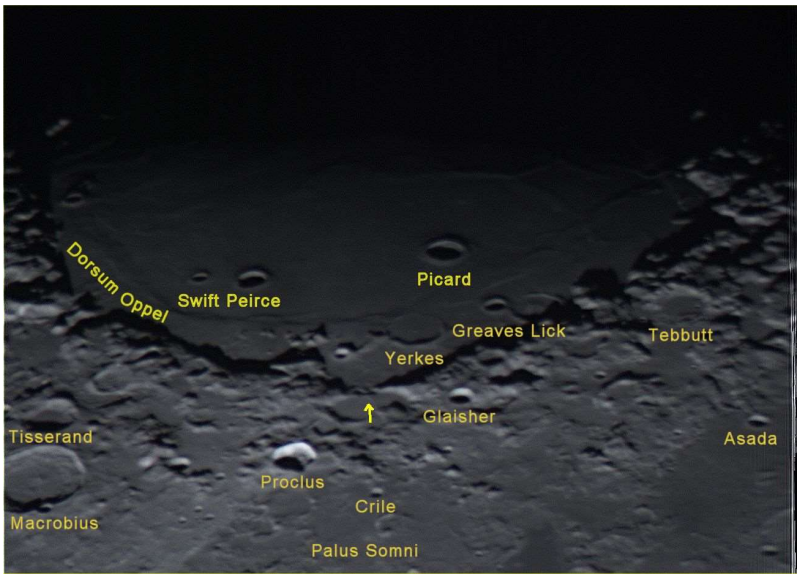
IAU Pro-Am Working Group

- **Aniket Sule**, HBCSE-TIFR, Mumbai, India – Chairperson
- **John Hearnshaw**, University of Canterbury, Christchurch, New Zealand – Co-Chairperson
- **Tim Spuck**, Associated Universities Inc. – Deputy Chairperson
- **Yuko Kakazu**, Subaru Telescope & NAOJ TMT Project - Secretary
- **Lina Canas**, IAU Office for Astronomy Outreach
- **Beatriz Garcia**, Institute of Technologies for Detection and Astroparticles-ITeDA (CNEA, CONICET, UNSAM)
- **Moein Mosleh**, Shiraz University, Iran
- **Antonia Varela Perez**, Instituto de Astrofísica de Canarias & Starlight Foundation

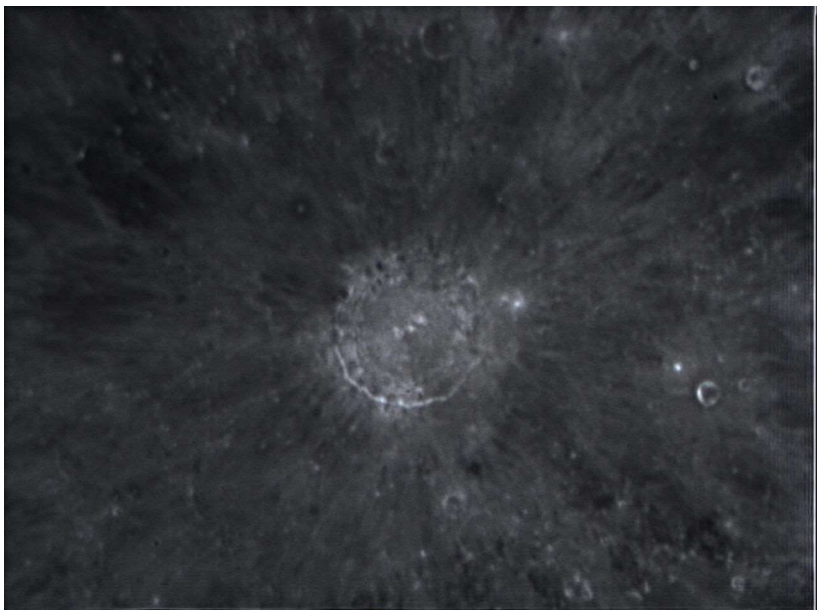
- **Clementina Sasso**, Osservatorio Astronomico di Capodimonte, Naples, Italy
- **Mayra Lebron**, University of Puerto Rico, San Juan, Puerto Rico
- **Kaz Sekiguchi**, National Astronomical Observatory of Japan
- **Boonrucksar Soonthornthum**, National Astronomical Research Institute of Thailand
- **Ilya Usoskin**, IAU EC liaison

Members Astro-photographs.

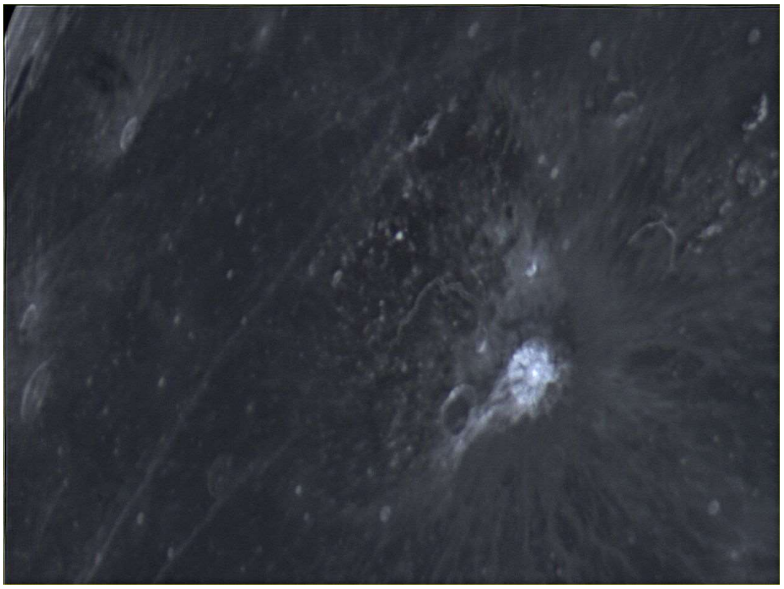
Dan Self



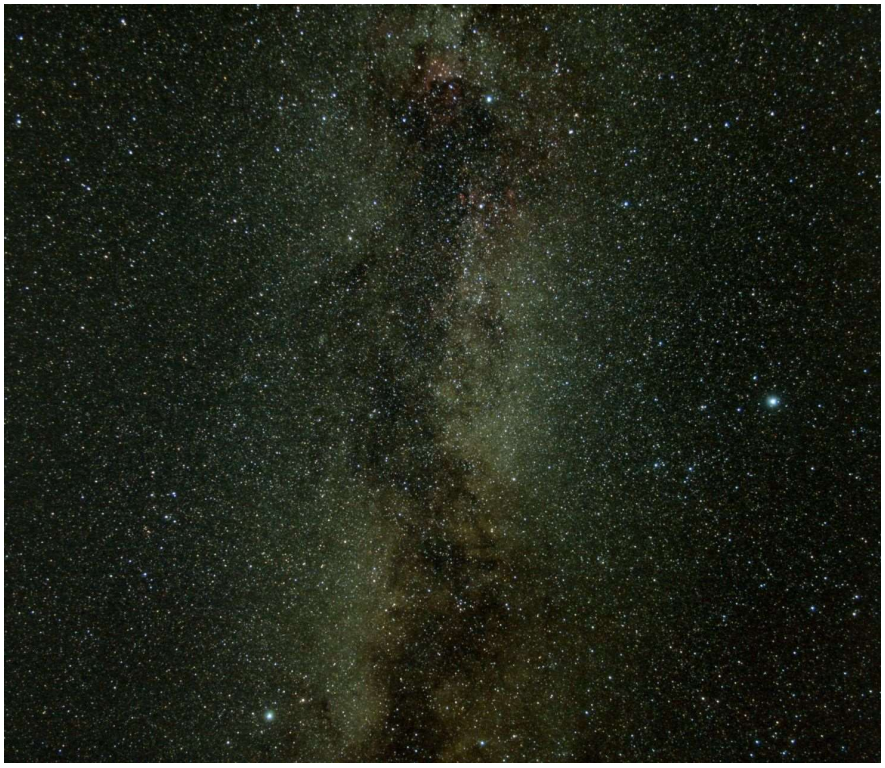
Mare Crisium Waning Gibbous Moon



Copernicus and Rays. Registax

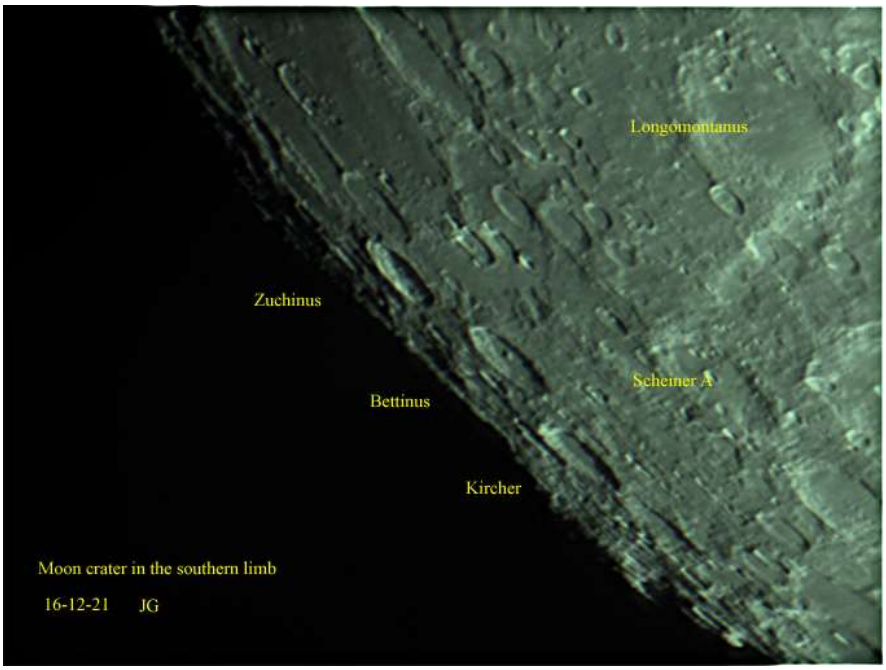


Aristarchus, The Lunar City, Registax 6

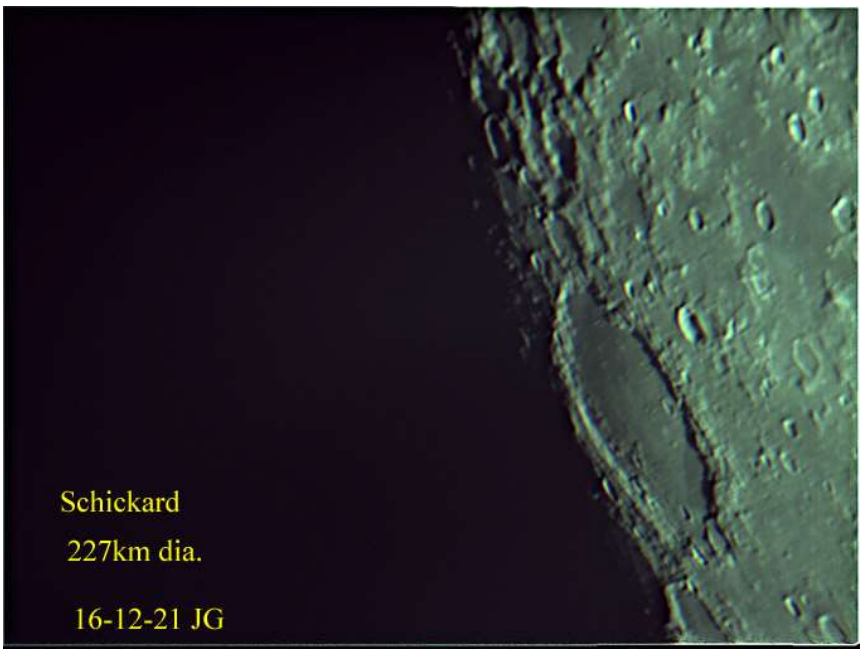


Milky Way overhead 14Xmin from Sept Cropped

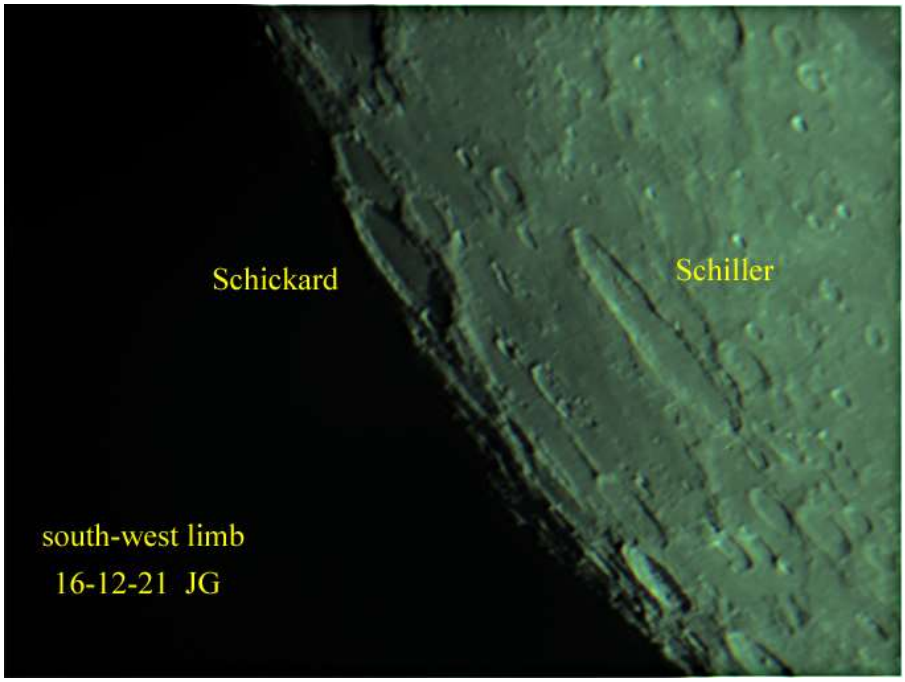
John Gionis



10 inch SNT and a ZWO 120 with x3 Barlow.



10 inch SNT and a ZWO 120 with x3 Barlow.



10 inch SNT and a ZWO 120 with x3 Barlow.

Roger Hyman

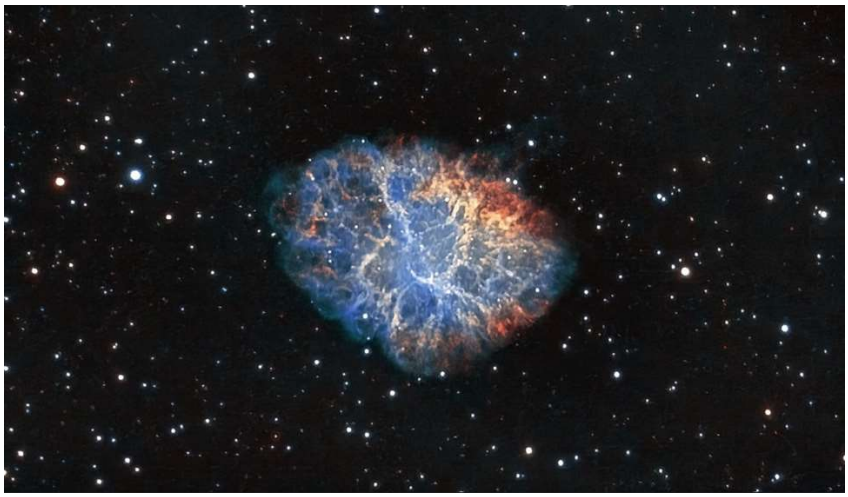
60 x 30 second exposures, GT71, 68AIII reducer and Altair 183C Pro camera. Captured using SharpCap 4.0 and processed with APP, Photoshop 2022 and Topaz DeNoise and Sharpen AI. 30 darks, flats and dark flats also used to help.

GT71 with 68III 0.8x reducer/flattener, ZWO ASI462mc camera. SharpCap Pro 4.0 processed in Photoshop 2022 and Topaz Sharpen AI.

Bode's Galaxy and the Cigar Galaxy are M81 and M82, respectively, in the Messier Catalogue. They are a pair of galaxies that can be found in the constellation of Ursa Major.

23 x 120 second exposures from my William Optics GT71 with 68III reducer/flattener and Altair Astro 183C Pro camera unguided on a Celestron CGX mount. Captured using SharpCap Pro 4.0 and processed with APP and Photoshop 2022. 20 x darks, flats and dark flats

Andy Weller



Celestron C11 XLT With a OSC Astro Camera and Dual narrow band filter

Pleiades was 35 x 60 seconds at 800 ISO, Mirrorless camera (Fujifilm XE-3) Telescope GT71

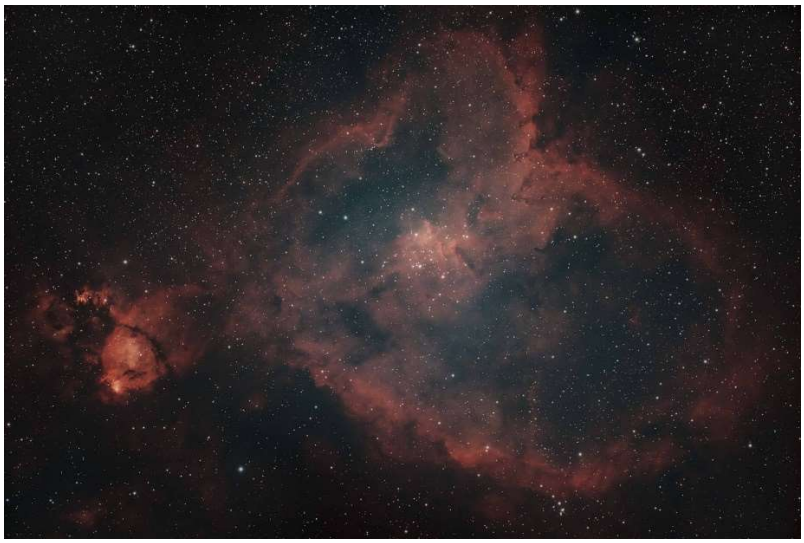
Michael Wilson

IPhone 13 Pro. 1x3 second exposure

Neil Wilson

Skywatcher AZ-EQ6 Mount. Celestron EdgeHD 9.25". Hyperstar V4

Altair Hypercam 26C. Altair tri-band filter. 100 x 10 second light frames. No calibration frames



Celestron 9.25" EdgeHD. Hyperstar V4. Skywatcher AZ-EQ6 Mount.

Altair 26C colour camera. Altair tri-band filter. 45 x 40 second exposures.

No Darks or flats. Stacked in AstroPixelProcessor Tweaked with Photoshop.

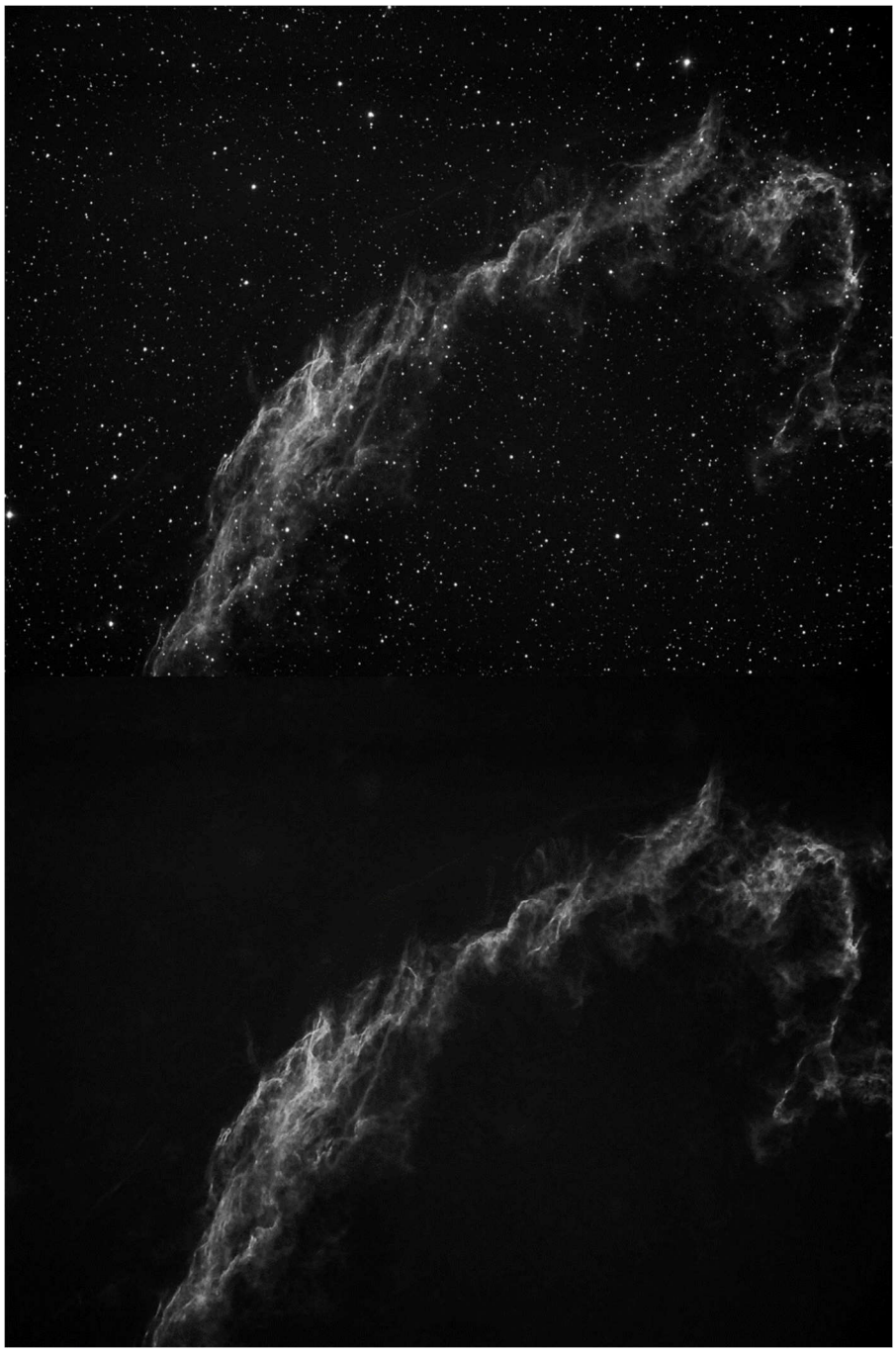
Mick Ladner

Soul Nebula IC1848 2 1/2 hours of 180 sec exposures.

Heart Nebula

Malcolm James Dent

Luke Broom-Lynne



2.5-hour capture of the Veil Nebula from the last clear night (weeks ago!). Atik 383L, HA filter, 200mm f/5 Newtonian.

Invitation to Gresham Lectures

Dear Local Astronomy Society
I thought you and your members might be interested in these free public astronomy lectures held online by Professor Katherine Blundell and Professor Roberto Trotta in 2021-2.

ASTRONOMY

Cosmic Revolutions by Professor Katherine Blundell

gres.hm/cosmic-revolutions

This series will expound in context and in detail some key realisations about cosmic history that are now regarded as fundamental in the modern understanding of how the cosmos came to be, and of our place in it.

Structures in the Universe

Wednesday, January 19, 2022 6:00 PM gres.hm/structures-universe

Museum of London/ Online Or watch later

How did the cosmos transition into space characterised by galaxies in a plethora of different shapes of great beauty? This lecture will consider what happens when groups of galaxies interact with one another and what happens when these galaxies collide and merge.

Magnetic Universe

Wednesday, February 23, 2022 6:00 PM gres.hm/magnetic-universe

Museum of London / Online Or watch later

Magnetic fields have mysterious effects that can be dramatically counterintuitive, and they are ubiquitous throughout the Universe and can have influence on large scales. This lecture will explore how some of the exotic and energetic phenomena in the Universe can only be explained in terms of these magnetic fields that pervade space.

Planetary Universe

Wednesday, March 30, 2022 6:00 PM gres.hm/planetary-universe

Museum of London / Online Or watch later

How can new worlds be discovered, and how many exo-planets might be out there? What does today's technology in astronomical observatories now enable, and what is it that holds us back from finding what is actually out there? What hinders us from pushing forwards the frontiers of space science?

Life in the Universe

Wednesday, June 1, 2022 6:00 PM gres.hm/life-universe

Museum of London / Online Or watch later

How can life form in the Universe, and what are the necessary ingredients for habitability so that planets can sustain life? Can we expect life elsewhere in the solar system, or on exo-planets? This lecture offers a broader perspective from astrobiology, astrochemistry, and astrophysics on the habitability or otherwise of other planets beyond Planet Earth.

The Frontiers of Knowledge by Professor Roberto Trotta gres.hm/frontiers

We have progressed far in our understanding of the Universe, and yet so much is still tantalisingly unknown. What explains the accelerating expansion of the Universe? Can physics mend the broken Cosmic Distance Ladder? What is the future for life on our planet?

The Broken Cosmic Distance Ladder

Monday, January 31, 2022 1:00 PM gres.hm/cosmic-distance

Barnard's Inn Hall/ Online Or watch later

Measuring distances to astronomical objects outside our Galaxy is a surprisingly hard challenge: it wasn't until 1929 that Edwin Hubble obtained proof that Andromeda is indeed a galaxy in its own right. Today, astronomers extend distance measurements in the cosmos to the edge of the visible Universe, building up a 'cosmic distance ladder' made of several rungs. This talk will explore a major conundrum of contemporary astronomy: as observations have become more precise, the distance ladder appears today to be broken.

The Future of Life on Earth

Monday, May 9, 2022 1:00 PM gres.hm/future-life

Barnard's Inn Hall/ Online Or watch later

Although life is probably widespread in the universe, our pale blue dot, Earth, is the only known place harbouring intelligent life. Even if we manage to stave off extinction by climate change, avoid a nuclear apocalypse and the dangers of runaway AI, biological life on our planet will eventually come to an end in about 5 billion years' time. What are the astrophysical dangers to life on Earth, and the prospects for life's survival into the distant future?

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

www.brecklandastro.org.uk

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

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 –Spring 2022 7:30pm Great Ellingham Recreation Centre, Watton Road, Great Ellingham, Attleborough, Norfolk **Talk entry £2.50 u18s £1.** Free livestream available in January.		
Friday, January 14th	**The Moon – Did we Go? Yes!**	Andrew Mowbray via Zoom
Friday, January 28th	**Public Open Night**	Observatory
Friday, February 11th	**The Zooniverse**	Professor Chris Lintott
Friday, February 25th	**Public Open Night**	Observatory
Saturday, March 2nd	**Star Party (main night)**	Hosted by Haw Wood Farm.
Friday, March 11th	**Beneath The Night**	Stuart Clark, author
Friday, March 25th	**Public Open Night**	Observatory
Friday, April, 8th	**From the Big Bang to the Periodic Table**	Dr Richard Miller, Miller-Klein Assoc.
Friday, April 29th	**Public Open Night (last of the season)**	Observatory
Friday, May 13th	**The Moon (+AGM)**	Jerry Workman
* 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		