

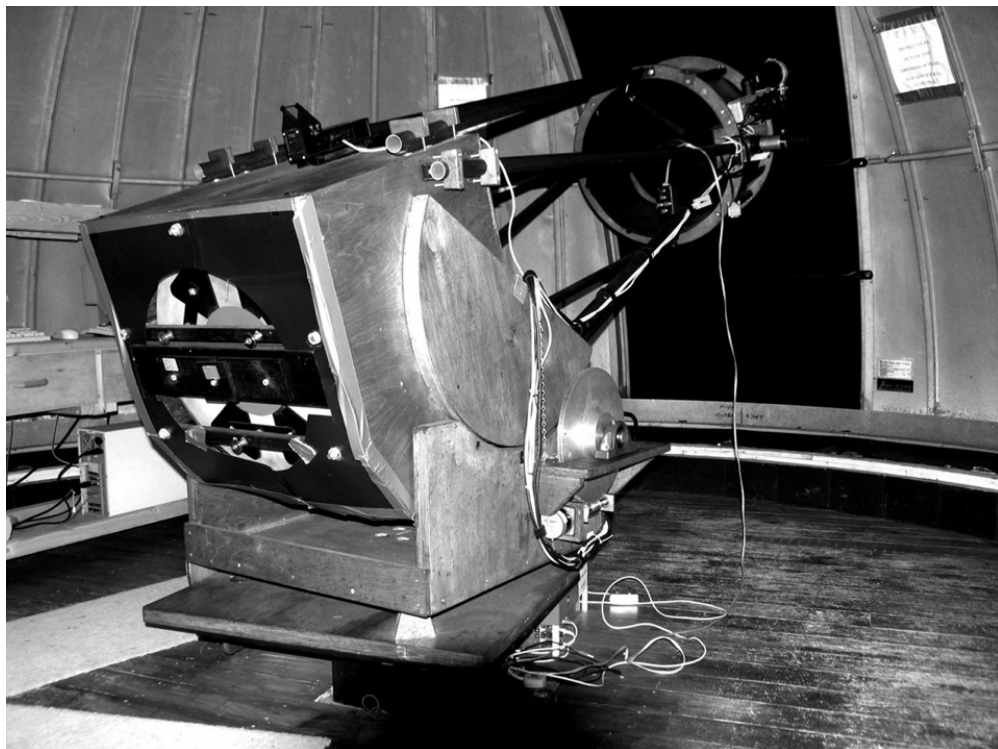


Breckland Astronomical Society

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

EXTRA ***TERRESTRIAL***

Newsletter November 2021



Registered Charity no, 1044478

Chairman's Notes November 2021

Dear all,

While the monthly newsletters provide a lot of tutorials, stimulating information, images and news to keep us well informed, it is difficult to source enough articles and so we may have to return to bi-monthly newsletters as the society always has had since its conception in the 1990s. It was suggested we alternate between main newsletters and a smaller update newsletter if there is insufficient content. Many members (myself included) do not have so much spare time, and equally, many of you readers that may want to contribute may not feel confident your writing would be worth including. We'd welcome anything you deem worthy, at least ask. As you may know I personally get a lot out of doing many forms of astronomy in my spare time, so you can't keep me away from it for long. Hence I enjoy writing to some extent, but like most of us I don't enjoy the pressure of too much commitment.

I would really love to hear from some of you, including facebook group members that aren't paid-up members of the society to come forward with any details about what you are interested in and suggestions for articles. Please email either me with queries on chairman@brecklandastro.org.uk, or send any content directly to the newsletter on newsletter@brecklandastro.org.uk

A bit about the running of the club

The facebook group is growing again, pretty steadily, and it is pleasing to see more interest and posts. It would be lovely to see some of you in person and have some of you contribute to the running costs of the society. We have a fantastic community resource to look after, in the observatory, as well as the education and social benefits we get out of the monthly talks. As with all things, we have some energy charges maintenance and hire costs, and fees, and so we need to keep those covered with the talk entry fees, raffles and BAS 100 club, so joining for just £18 a year really helps with those. The core group that do outreach is really what keeps up the promotion of Science in the Community, but behind the scenes, I do a lot of organising (which I'm not sure I'm always best at dealing with), and Andy has much responsibility in the way the accounts and members details are looked after.

Outreach

Foxwood forest school has been postponed twice due to rain then cloud, we hope to see them outside this month, safely at their field. We have had to postpone a larger party visit, due to rising Covid cases in a small space. Outreach has been and will be for a bit longer, limited to outdoor things or small parties. Open nights can be quite variable in popularity but small parties can safely visit as the observatory is very well ventilated.

For instance, we had 20 people visit the observatory on the August open night, despite it being cloudy. All were told they could return on the next Tuesday if clear, but just one did (It was very interesting chatting to you about your Lunar art!). The September open night only had 3 visitors. Personally I can't think of a better way of spending my Friday evening! But I may be quite unique in that regard ☺

We have had 3 new paid up members, Alan, Matt and Sheila, who came to the October talk and visited the observatory on Tuesdays. You are very welcome to our friendly society, please use our collective wisdom to help achieve your astronomical goals.

Speakers

We got a true world expert in Professor Clive Ruggles, who travelled over from Leicester to give us a talk on Astroarchaeology. We were again split between a modestly filled hall and about a dozen online, with a great livestream. Apparently the signal is occasionally patchy when in the hall, but it doesn't seriously affect the talk comprehension.



The Aboriginal Emu in the Milky Way simulated by Stellarium. Images don't do it justice. The Emu was seen clearly and majestically to the eye by Professor Ruggles while camping in the outback, as he described in his talk, upon being woken by a stunned fellow camper.

Archaeoastronomy is how he preferred the title of his subject, is based around on how past cultures saw the sky. This is not necessarily monuments and not observatories but how the heavens influenced culture. The professor jumped forward through time to 1704 where William Stukeley came up with a theory of Stonehenge. Alignments were noticed pre-light pollution. Normal Lockyer also had a lot to say about this. Then Graham Hancock came up with alignments in Heaven's Mirror, the famous book released around 1990 that we all sort of accepted at the time, and later learned that things make alignments by chance alone!

It was a funny and eye opening talk.

Lockyer had done more work though, and found other stone circles around UK, and came up with a better estimate of the date of Stonehenge, not just based on chance alignments and extrapolating the deviation of the solstice angles. Lockyer's book was out in 1906 and spoke of Avebury, Boscowen and Long Meg and get many fascinated by the subject. Much later in 1962 Gerald Hawkins popularised this in "Stonehenge Decoded" again making many assumptions and an attention grabbing title. Shortly after this Richard Atkinson an archaeologist was asked to describe Stonehenge for the BBC in 1964 and this became a popular subject again, even Fred Hoyle had uncharacteristically inaccurate opinions on the significance of the stones. Much of this

was based on the 56 'Aubrey' holes around the edge. Atkinson was at one time Professor Ruggles' supervisor.

More fascinating evidence came to light when a tall standing stone in Argyll, Scotland was found to line up between a viewpoint and a gap in the mountains. The Sun only lines up on the solstice, and it even suggests a date, as the solstice angle is shifted by a small but just significant amount.

The tombs at Newgrange, Ireland and Bryn Celli Ddu in Wales shows that death is connected with the sun, as the winter sun shines in at sunrise, but that is wasn't everything. Everything has to point somewhere.

The Professor described world sites, such as the a Mayam book from the 14th century, the Dresden Codex, which had number tables that describe the period of Venus and more. Uaxactún a large theatre in Yucatan shows a clear alignment with sunrise, elaboration of the structure over the centuries of culture changed the alignments so it no longer matched and showed their celebrations evolving away from sun worship.

Professor Ruggles was invited to do a long study of The Nazca lines and found there was no real astronomy connection, it was mountain traditions, perhaps water related.

We finally heard about the 13 towers of Chenquillo, a recent discovery, that were featured in Brian Cox's Wonders series. These showed sunrises throughout the year. There was also a strange set of walls and open corridors that led people to this site which suggests that votive offerings were made or that it was a party site.

The most beautiful places such as Kahikinui, Hawaii, Tahiti, etc appear awe inspiring to any human at night and would certainly encourage art to fit the landscape and sky. In 1000AD Maui had a slightly different view of the Southern Cross to that of today, due to precession of earth's axis, which took it on a journey across the sea to the south. A sight wall , called Pa nana represents where The Southern Cross appears level.

Thank you very much Clive for a really interesting and beautiful talk. Many questions were asked even during the following coffee session.

As for next month....

We want loads of you to come to the Quiz! It is a fun night. The questions have an element of humour to them. Your answers have an element of humour to them. I had planned to get fish and chips but it proved difficult to arrange, so please bring lashings of snacks, biscuits, drinks, table cloths, perhaps even those LED candles (among other decorations) and enjoy a social evening, with a single round of astronomy questions, put together by my brother Leo. My astronomy questions are apparently too difficult... who'd have thought it! We will ventilate, wear masks preferably and heat if needed as before and use tables/teams of 4 as bubbles.

Dan Self

JOHN'S NEWS BITS

November 2021

May need Elon Musk's spaceship sooner than expected. Apparently, in 5 billion yrs. the Sun will run out of nuclear fuel expanding to a red giant and engulfing Earth. But, Earth could run out of oxygen in as little as 1 billion years as reported in the journal "Nature Geosciences". The sun will accelerate the loss of oxygen, an irreversible consequence of the Sun's solar radiation.

NASA to send a robotic rover to the Moon's south pole Nobile crater to look for water in 2023. It will look into how easy it will be to extract water as there is a possible billions of tonnes of lunar ice locked up in the polar regions.

Reported in Space.com, China's Martian Chang'e 5 spacecraft has returned to Earth 3.8 lbs of material from the Oceanus Procellarum region. The material is about 2 billion years old, not as old as was hoped.

Reported in "Science" on October 7, NASA's Mars Reconnaissance Orbiter HiRise camera has confirmed that the Jezero crater was once a huge lake and showed images where a river emptied into the lake some 3.7 billion years ago.

The long standing issue known as the 'cosmological lithium problem' has plagued scientists for years. Theory predicts that in the minutes following the Big Bang there should have been three times more lithium than is actually found.

However, a new study from the centre of Nuclear Studies at the University of Tokyo found that the discrepancy is due to a combination of an overestimation in theory and under-observed in reality. Lithium -7 is the most common isotope was formed by Big

Bang nucleosynthesis (BBN) along with hydrogen, helium and beryllium

Reported on space.com, David Rothery, professor of planetary geosciences at the OU, on October 2nd, Bepi-Columbo swung by Mercury within 124 mile of its surface returning spectacular images. The next swing-by will be on June 23^{rs}, 2022. After a total of 6 loops it will fall into Mercury's orbit. Bepi-Columbo was launched on October 2008 as a joint ESA/JAXA mission.

On Nov. 23rd, NASA will send the DART spacecraft on a collision course with asteroid Didymos at 15,000 mph. this kinetic impact technique will test how much the asteroid's orbit can be diverted should one be headed for Earth. The asteroid is 7 million miles away and the spacecraft will take approx.. one year to get there.

NASA's Lucy mission to explore the Trojan asteroids in Jupiter's orbit was successfully launched on October 16. These asteroids are 'fossils' from the early days of the solar system so the mission was named after Lucy, the fossilised remains of an early human ancestor some 3.2 million years old.

Reported in sci-news.com, astronomers using the 500 metre aperture spherical radio telescope (FAST) have discovered 1,652 intergalactic radio bursts (FR121102) over a 47 day period. The bursts came from a dwarf galaxy in Auriga some 3 billion light years away. The cause is a mystery as there is no hint of periodicity such as from a pulsar or neutron star or from magnetospheres within a magnetar's strong magnetic field. A possible theory is that they are from relativistic shocks outside of the magnetosphere travelling out at the speed of light.

Finally, Captain Kirk of Star Trek, sorry, William Shatner, was be sent to near space (minus warp drive) on Jeff Bezos' Blue Origin on Oct. 14..

John Gionis

Lucy: The First Mission to the Trojan Asteroids

Time capsules from the birth of our Solar System more than 4 billion years ago, the swarms of Trojan asteroids associated with Jupiter are thought to be remnants of the primordial material that formed the outer planets. The Trojans orbit the Sun in two loose groups, with one group leading ahead of Jupiter in its path, the other trailing behind. Clustered around the two Lagrange points equidistant from the Sun and Jupiter, the Trojans are stabilized by the Sun and its largest planet in a gravitational balancing act. These primitive bodies hold vital clues to deciphering the history of the solar system.

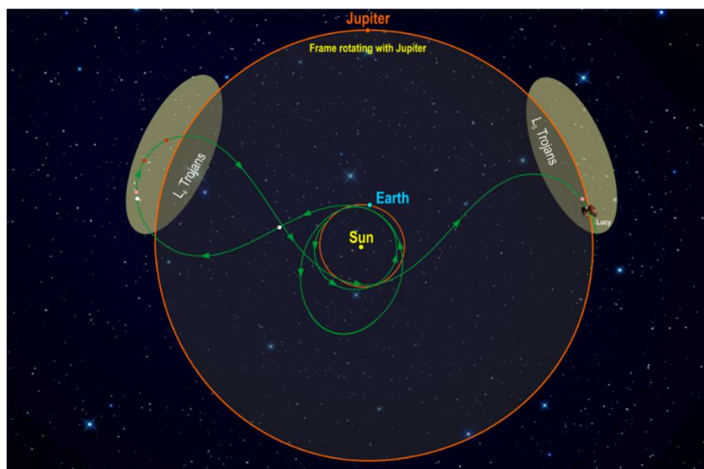
Lucy will be the first space mission to study the Trojans. The mission takes its name from the fossilized human ancestor (called “Lucy” by her discoverers) whose skeleton provided unique insight into humanity's evolution. Likewise, the Lucy mission will revolutionize our knowledge of planetary origins and the formation of the solar system.



NASA's Lucy mission, the agency's first to Jupiter's Trojan asteroids, launched at 5:34 a.m. EDT Saturday on a United Launch Alliance (ULA) Atlas V rocket from Space Launch Complex 41 at Cape Canaveral Space Force Station in Florida and, with boosts from Earth's gravity, will complete a 12-year journey to eight different asteroids — a Main Belt asteroid and seven Trojans, four of which are members of "two-for-the-price-of-one" binary systems. Lucy's complex path will take it to both clusters of Trojans and give us our first close-up view of all three major types of bodies in the swarms (so-called C-, P- and D-types).

About an hour after launch, Lucy separated from the second stage of the ULA Atlas V 401 rocket. Its two massive solar arrays, each nearly 24 feet (7.3 meters) wide, successfully unfurled about 30 minutes later and began charging the spacecraft's batteries to power its subsystems.

Lucy sent its first signal to Earth from its own antenna to NASA's Deep Space Network at 6:40 a.m. The spacecraft is now traveling at roughly 67,000 mph (108,000 kph) on a trajectory that will orbit the Sun and bring it back toward Earth in October 2022 for a gravity assist.



This diagram illustrates Lucy's orbital path. The spacecraft's path (green) is shown in a frame of reference where Jupiter remains stationary, giving the trajectory its pretzel-like shape. After launch in October 2021, Lucy has two close Earth flybys before encountering its Trojan targets. In the L4 cloud Lucy will fly by (3548) Eurybates (white) and its satellite, (15094) Polymele (pink), (11351) Leucus (red), and (21900) Orus (red) from 2027-2028. After diving past Earth again Lucy will visit the L5 cloud and encounter the (617) Patroclus-Menoetius binary (pink) in 2033. As a bonus, in 2025 on the way to the L4, Lucy flies by a small Main Belt asteroid, (52246) Donaldjohanson (white), named for the

discoverer of the Lucy fossil. After flying by the Patroclus-Menoetius binary in 2033, Lucy will continue cycling between the two Trojan clouds every six years.

Credits: *Southwest Research Institute*

The dark-red P- and D-type Trojans resemble those found in the Kuiper Belt of icy bodies that extends beyond the orbit of Neptune. The C-types are found mostly in the outer parts of the Main Belt of asteroids, between Mars and Jupiter. All of the Trojans are thought to be abundant in dark carbon compounds. Below an insulating blanket of dust, they are probably rich in water and other volatile substances.

No other space mission in history has been launched to as many different destinations in independent orbits around our sun. Lucy will show us, for the first time, the diversity of the primordial bodies that built the planets.

Named for the fossilized skeleton of one of our earliest known hominin ancestors, the Lucy mission will allow scientists to explore two swarms of Trojan asteroids that share an orbit around the Sun with Jupiter. Scientific evidence indicates that Trojan asteroids are remnants of the material that formed giant planets. Studying them can reveal previously unknown information about their formation and our solar system's evolution in the same way the fossilized skeleton of Lucy revolutionized our understanding of human evolution.



Lucy Specifications:

Width: 46.75 ft (14.25 m)

Height: 23.6 ft (7.2 m) or 12.4 (3.8m) when solar panels are stored)

Depth: 9.12 ft (2.78 m)

Diameter of Solar Panels: 23.9 ft (7.3 m)

Dry Mass (unfueled): 1810 lbs (821 kg)

Wet Mass (fueled): 3417 lbs (1550 kg)

Power: 504 watts at the furthest encounter

Lucy will measure more than 46 feet (14 meters) from tip to tip, but most of that is the huge solar panels (each over 24 feet (almost 7 meters) in diameter) needed to power the spacecraft as it flies out to the orbit of Jupiter. All of the instruments, and the 6.5-foot (2-meter) high gain antenna needed to communicate with Earth, will be located on the much smaller spacecraft body.

Lucy Thermal Emission Spectrometer (L'TES) – an instrument built by Arizona State University in Tempe, Arizona, that will measure the surface temperature of the Trojan asteroids by observing the thermal infrared spectrum, helping to understand the physical properties of the surface material.



Lucy LOnG Range Reconnaissance Imager (L'LORRI) – a high resolution, panchromatic visible camera made by the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. L'LORRI will provide the most detailed images of the surface of the Trojan asteroids.



L'Ralph – an instrument provided by NASA's Goddard Space Flight Center in Greenbelt, Maryland, that consists

of two parts:

- L'Ralph Linear Etalon Imaging Spectral Array (LEISA), an infrared imaging spectrometer that will reveal the absorption lines that serve as the fingerprints for different silicates, ices and organics that may be on the surface of the Trojan asteroids, and
- L'Ralph Multi-spectral Visible Imaging Camera (MVIC), that will take color images of the Trojans to help determine their composition



All images and text courtesy of NASA



Comet C/2017 K2 PANSTARRS

You may have seen headlines eg The Daily Express's "Largest Comet Ever Seen" and corresponding headline: Expert Claims Giant Comet is Hurling Towards Milky Way. This article is dumbed down and even clearly wrong in its title. It refers to comet C/2014 UN271 Bernardinelli-Bernstein which was discovered at 20 AU out from the Sun (unheard of) and is going to pass 10.1 AU from us on 5th April 2031. Scientifically interesting, but not much to be concerned or excited about, visually, anyway.

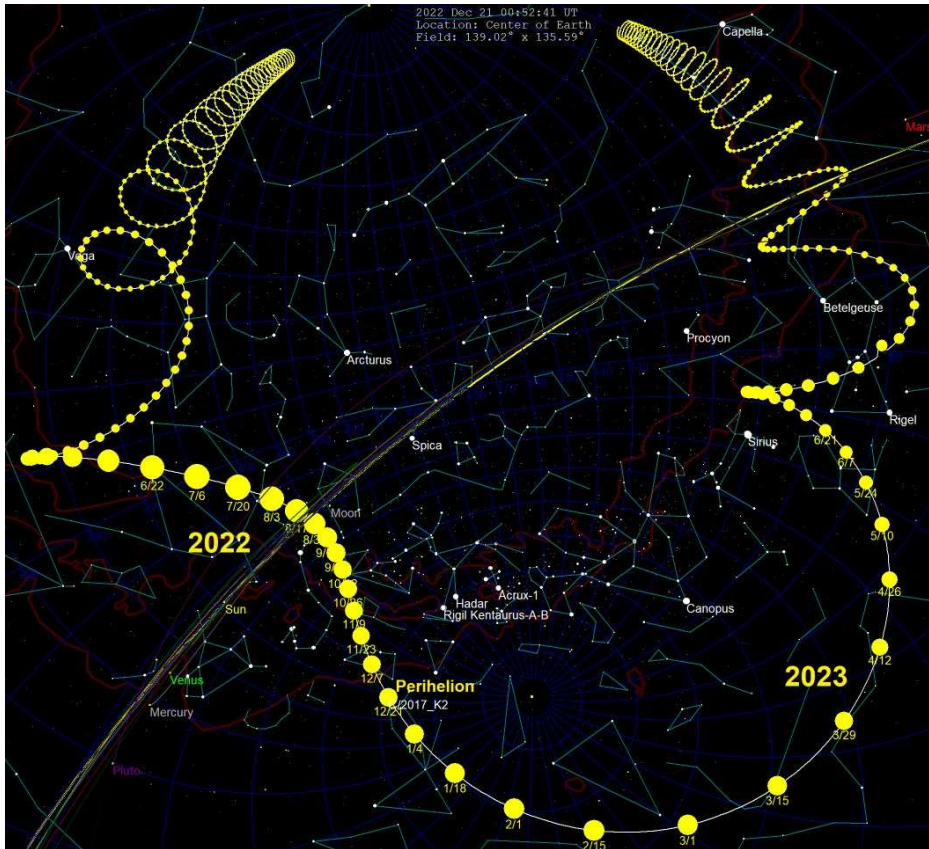
Another more visually interesting comet on a similar path with a large size is C/2017 K2 PANSTARRS. These are called Oort Cloud comets and as such 'K2' has a hyperbolic orbit, meaning it flies in from almost outside the Sun's gravitational influence zone for millions of years, and flies out again in a similar way. However, K2's path is being perturbed slightly at the moment by Jupiter and Saturn and will exit the solar system on an approximately 26,000 year orbital path.

K2 was discovered in May 2017 at a distance of 16 AU, and its path was traced back, consequently images of it were found from 2013, firming up its orbit. Currently the *error* in its distance from the sun is 2000km, amazing as it is nearly a billion km away.

Hale Bopp surprised astronomers with its brightness in 1995 when it was seen glowing brightly beyond Jupiter's orbit, but that was discovered visually by amateurs. This has been spotted with a highly sensitive detection system. and so has been spotted much further out, but is not predicted to comet to perihelion so close to the sun as Hale Bopp and will not put on such a good show, well not to us in the Northern Hemisphere. K2's nucleus may be almost as big as Hale Bopp's nucleus, as two estimates put it at 14-80km and the other suggests probably under 18km. While Hale Bopp came from the Southern Hemisphere, reached perihelion in the North and returned South, K2 does the opposite.

It is currently in the direction of Draco and about 13-14th magnitude, so many of you could get an image of it if desired. You could contribute a magnitude estimate to the BAA perhaps, For as long as humans have been civilised, it had always been in the constellation of Ursa Minor, and it has only just now crossed Draco, into Hercules and Lyra, spiralling with a widening parallax circle. If you are planning to observe it, catch it before Hercules gets too low. Next year, when it emerges in the morning sky it will be heading from Aquila into Ophiuchus and plunges down into the Southern Hemisphere by August, reaching perhaps 7th magnitude or so, passing 1.8 AU from Earth, before it flies away to perihelion on the other side of the Sun. Its path, as shown by this Wikipedia graphic, is a fantastic chart showing how it won't reappear until winter 2023 near Orion.

Check out this link for more



information or find charts on heavens-above.com,
<http://www.aerith.net/comet/catalog/2017K2/2017K2.html>

Dan Self

NASA's Webb Space Telescope Arrives in French Guiana After Sea Voyage



NASA's James Webb Space Telescope successfully arrived in French Guiana Tuesday, after a 16-day journey at sea. The 5,800-mile voyage took Webb from California through the Panama Canal to Port de Pariacabo on the Kourou River in French Guiana, on the northeastern coast of South America.

The world's largest and most complex space science observatory will now be driven to its launch site, Europe's Spaceport in Kourou, where it will begin two months of operational preparations before its launch on an Ariane 5 rocket, scheduled for Dec. 18.

Once operational, Webb will reveal insights about all phases of cosmic history – back to just after the big bang – and will help search for signs of potential

habitability among the thousands of exoplanets scientists have discovered in recent years. The mission is an international collaboration led by NASA, in partnership with the European and Canadian space agencies.

“The James Webb Space Telescope is a colossal achievement, built to transform our view of the universe and deliver amazing science,” said NASA Administrator Bill Nelson. “Webb will look back over 13 billion years to the light created just after the big bang, with the power to show humanity the farthest reaches of space that we have ever seen. We are now very close to unlocking mysteries of the cosmos, thanks to the skills and expertise of our phenomenal team.”

After completing testing in August at Northrop Grumman's Space Park in Redondo Beach, California, the Webb team spent nearly a month folding, stowing, and preparing the massive observatory for shipment to South America. Webb was shipped in a custom-built, environmentally controlled container.

Late in the evening of Friday, Sept. 24, Webb traveled with a police escort 26 miles through the streets of Los Angeles, from Northrop Grumman's facility in Redondo Beach to Naval Weapons Station Seal Beach. There, it was loaded onto the MN Colibri, a French-flagged cargo ship that has previously transported satellites and spaceflight hardware to Kourou. The MN Colibri departed Seal Beach Sunday, Sept. 26 and entered the Panama Canal Tuesday, Oct. 5 on its way to Kourou.

The ocean journey represented the final leg of Webb's long, earthbound travels over the years. The telescope was assembled at NASA's Goddard Space Flight Center in Greenbelt, Maryland, starting in 2013. In 2017, it was shipped to NASA's Johnson Space Center in Houston for cryogenic testing at the historic “Chamber A” test facility, famous for its use during the Apollo missions. In 2018, Webb shipped to Space Park in California, where for three years it underwent rigorous testing to ensure its readiness for operations in the environment of space.

“A talented team across America, Canada, and Europe worked together to build this highly complex observatory. It’s an incredible challenge – and very much worthwhile. We are going to see things in the universe beyond what we can even imagine today,” said Thomas Zurbuchen, associate administrator for NASA’s Science Mission Directorate in Washington. “Now that Webb has arrived in Kourou, we’re getting it ready for launch in December – and then we will watch in suspense over the next few weeks and months as we launch and ready the largest space telescope ever built.”



A Custom-Made “Suitcase”

As a one-of-a-kind machine, Webb required a colossal, specially designed “suitcase” known as STTARS, short for Space Telescope Transporter for Air, Road and Sea. STTARS weighs about 168,000 pounds (76,000 kilograms). It is 18 feet (5.5 meters) high, 15 feet (4.6 meters) wide, and 110 feet (33.5 meters) long — about twice the length of a semi-trailer.

This custom container was outfitted for any extreme or unexpected conditions Webb could have encountered during travel. In designing, building, and testing STTARS, engineers carefully tested how to best protect the container from heavy rainfall and other environmental factors



After Webb is removed from its shipping container, engineers will run final checks on the observatory's condition. Webb will then be configured for flight, which includes loading the spacecraft with propellants, before Webb is mounted on top of the rocket and enclosed in the fairing for launch.

"Webb's arrival at the launch site is a momentous occasion," said Gregory Robinson, Webb's program director at NASA Headquarters. "We are very excited to finally send the world's next great observatory into deep space. Webb has crossed the country and traveled by sea. Now it will take its ultimate journey by rocket one million miles from Earth, to capture stunning images of the first galaxies in the early universe that are certain to transform our understanding of our place in the cosmos."



The James Webb Space Telescope is driven to Guiana Space Centre from the port.

For more information about the Webb mission, visit:
<https://www.nasa.gov/webb>

All images and text Courtesy of NASA

BAA Deep Sky Section Update

As we subscribe to the BAA, we get their monthly updates as well as their well-produced magazines which you can see many of at the observatory. This Deep Sky Section has many participants across the country. Here is Callum's report for September, delayed a little further to us. Most of which could equally be visible next September and some of which could still be visible at Haw Wood Farm on Saturday November 6th.

This is a belated update for September - I recently got back from my holiday in Orkney, so a lot to catch up on and apologies to anyone I have not got back to yet. Although there was some broadband at our holiday rental, it was very much at the end of the line so limited comms to some extent. I did not take much astro-gear away with me, as it was around the full Moon period, and did not really want to jinx the weather. However, the first night at our cottage without any clouds the night sky was spectacular - I'm not sure I have experienced as dark a sky since my youth when camping in the Cairngorms. The milky way stretched from horizon to horizon. I wish I had taken some astro-gear and my SQM. I did have my DSLR and tripod though, so managed a few shots with a fish-eye lens, just to capture the moment. There had been some minor geomagnetic activity earlier in the day too, and although there was a hint of aurora to the north visually the camera did capture it well, though just the general green glow of the quiescent arc.

That was the only cloud free night that we had sadly, apart from the night of full moon. Otherwise the weather was quite good apart from a couple of blustery days.



On October 23rd there was a short Zoom meeting instead of the usual Webb Society annual meeting – see their website (www.webbdeepsky.com)

I also noticed that dates for 2022 shows are starting to appear. The Practical Astronomy Show in Kettering is scheduled for March 19, and The International Astronomy Show is set for October 14th and 15th at Stoneleigh Park near Coventry.

Object of Interest

Thanks to all that had a go at September's object, NGC 7094. I had nice visual observation reports from Andrew Robertson and Jim Latham, and images from Paul Downing. [Incidentally Paul is upgrading his Planewave 12.5 inch to a 14 inch - so if you would be interested in purchasing, please get in touch with Paul (or via me if you don't have his email address)]

For October I thought of something maybe a little easier - so my suggestion for this month is NGC 7479, the 'Superman' galaxy in Pegasus. It is called the Superman galaxy due to its distinctive 'S' shape reminiscent of the superman logo. It's quite easy to find in Pegasus at magnitude 11 and about 4 x 3 arc-minutes in size. There a few images in BAA Members Albums – here is one by Peter Edwards (see galaxy image).

Many thanks to Neil Webster who sent in a pair of lovely images of the eastern and western portions of the Veil Nebula. And also to Manolo Rodriguez for a splendid image of the area around Sadr.



I'm sure there is much more I should be writing about, but I'll try to be more organised for the October update before the end of the month.

Till then - clear, dark skies,

Callum

Callum Potter
Director, Deep Sky Section
British Astronomical Association

Members Astrophotography

Dan Self



67P Chury-Gera-L 8x30sec ATIK 20" Observatory telescope



Europa Ganymede 8" SCT



224 7 1/2 sec images 8" SCT F5 ZWO Planetary camera



Faint Galaxy Cepheus NGC6951 LRGB ATIK 20" observatory telescope
4X4 Binning



Gamma Cas LRGB Atik 20" observatory telescope



Gyul-LRGB ATIK 20" Observatory telescope



NGC40 Bow Tie in Cepheus ATIK 20" Observatory telescope LRGB



NGC40 LRGB Crop

John Geonis



M33, Triangulum galaxy NGC 598, imaged on my 10" SNT with a Canon 500D.

24 images stacked with DeepSkyStacker and photoshop.

Additional processing by Dan Self using Maxim.

M33 is the third-largest member of the Local Group of galaxies after Andromeda and the Milky Way



Jupiter imaged with an Atik Zwo120 Asi on the society's 20"
1000 frames processed with Registax6 and photoshop

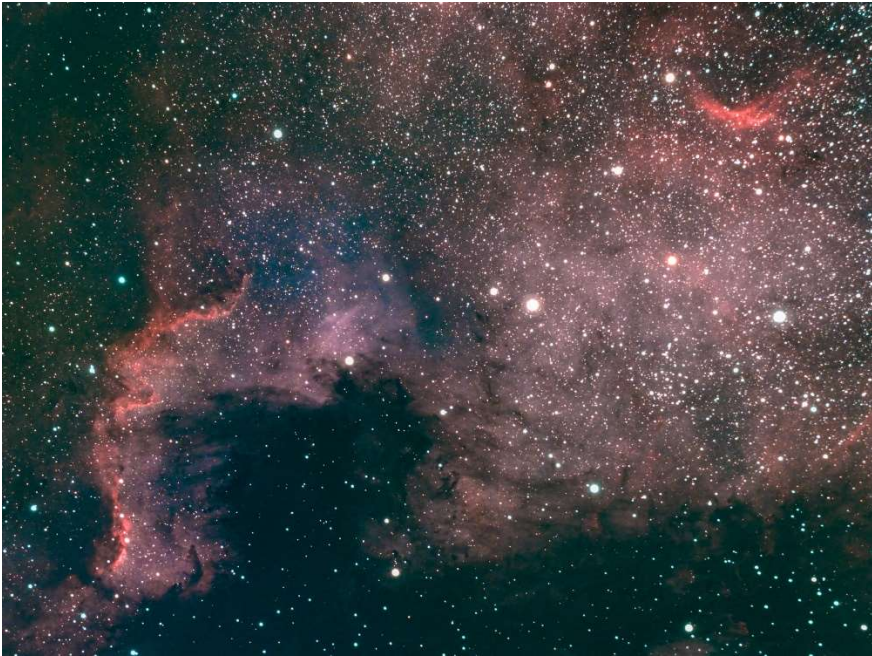
Rachael Wood



ZWO294 mc pro L-eNhance Optolong filter

Skywatcher Evostar ED80 Total integration time: 5hrs

Mick Ladner



NGC7000 The North American Nebula.

60 x 180 sec lights @ -5 plus darks and flats.

Processed with PI and LR



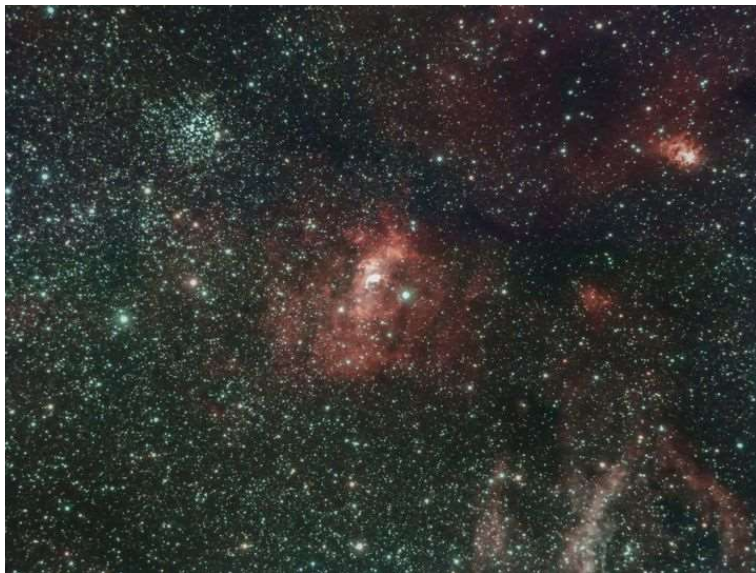
The Helix Nebula.

35 x 180 second lights plus darks and flats

This one does show the Nebulosity to the upper left of the Helix



The Elephant Trunk Nebula.



Bubble Nebula

NGC7635, M52 is upper left The Lobster Claw is lower right and Sh2-159 is upper right

Neil Wilson



Triangulum Galaxy M33 captured with the 9.25 EdgeHD fitted with a 0.7x focal reducer and Altair 26C colour camera.

45 x 3 min light frames 40 x flat frames 40 x dark flat Stacked in DSS and processed with Photoshop



Captured with the 9.25 EdgeHD, this is NGC 2146. A barred spiral galaxy in the constellation of Camelopardalis.

The galaxy has a diameter of approximately 80000 light-years and is 70 million light-years away



Cat's Eye Nebula

Celestron EdgeHD 9.25" with 0.7x focal reducer and Altair 26C colour camera.

Pier mounted AZ-EQ6 Mount.

Stacked in DSS and processed with Photoshop



Pleiades.

Skywatcher 80DS Pro + 0.8x focal reducer. Altair Hypercam 26C

Skywatcher EQ5 Pro

Stacked in AstroPixelProcessor and Tweaked with Photoshop.



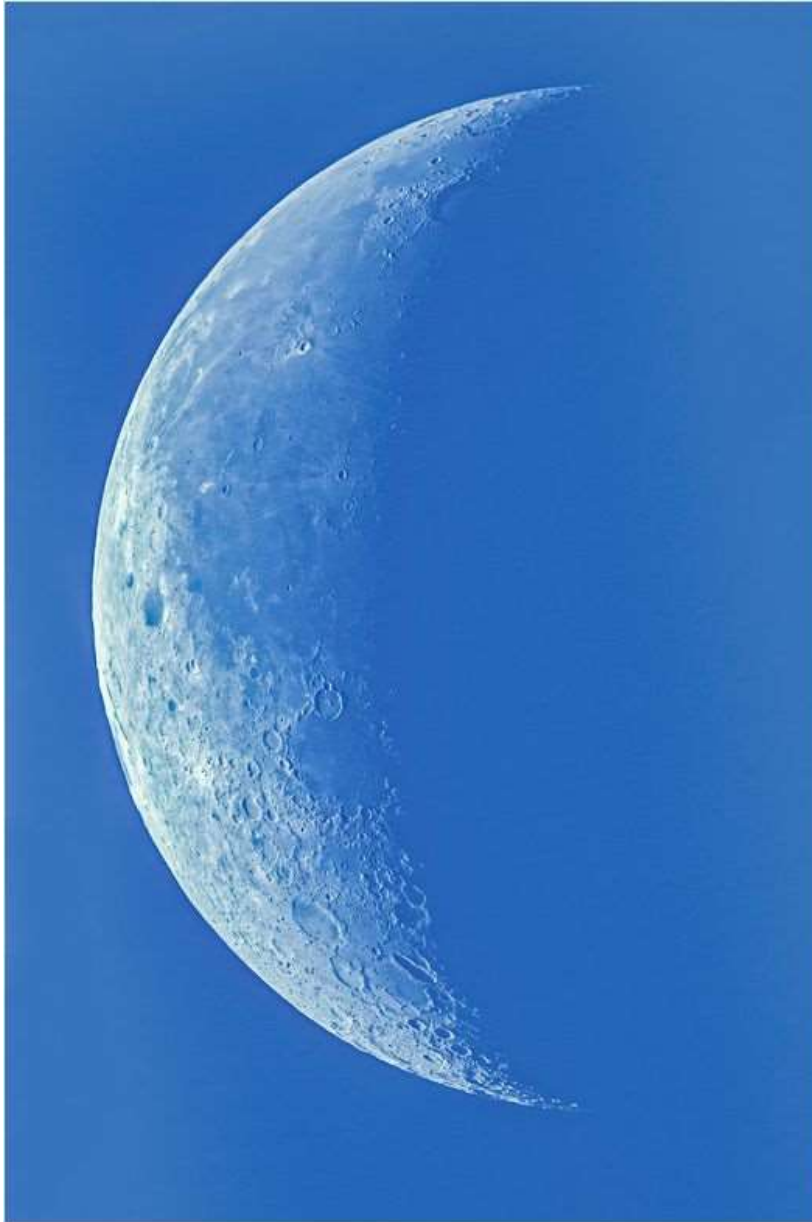
'Silver Sliver' (NGC 891) tonight.

NGC 891 is an unbarred spiral galaxy located in Andromeda and is one of the best examples of an edge-on galaxy.

Celestron EdgeHD 9.25 + 0.7x focal reducer. Altair Hypercam 26C

35 x 3 min light frames 20 x 3 min Dark frames.

Roger Hyman



William optics GT71 and ZWO ASI462mc with UV/IR filter to get the colour. Processed and captured with ASI Studio 1.5.2, AS!3 and Photoshop 2021. Video was 60 seconds and used 50% of the 2500 frames.

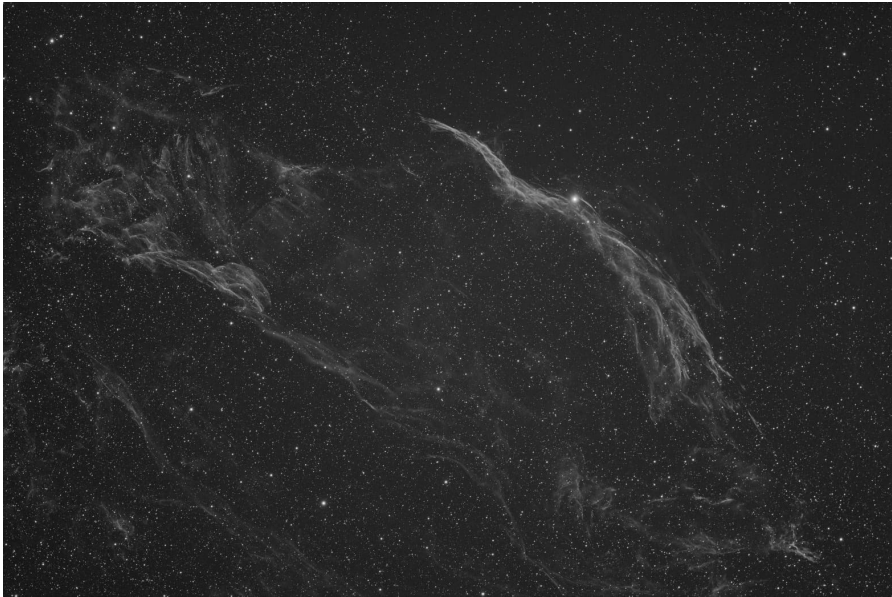


. William Optics GT71 with ZWO ASI 462mc and UV/IR cut filter.
Captured and processed with ASI Studio 1.5.2, ASI3, Photoshop 2021
and Topaz Sharpen AI.

Malcolm James Dent



4 hours total 12 x 5 L,R,G & B



Western Veil in O3

Luke Broom Lynne



Double shadow transit of Ganymede and Callisto
200mm Newtonian, 3x Barlow, ASI 120mc-s camera.

Michael Wilson



iPhone 13 Pro 1x30 second exposure

Edited in Photoshop Express app/Apple iPhone image editor



Milkyway overhead. Once again I was amazed at how I not only captured the Milkyway, but the North America nebula and even the Andromeda galaxy!

IPhone 13 Pro 1x30 second exposure

Edited in Photoshop Express app/Apple IPhone image editor

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.

We also have a one-off lecture by Professor Andrew Coates on Mars Missions 2021 - Early Discoveries, on Mon 20 Sep 1pm-2pm <https://www.gresham.ac.uk/lectures-and-events/mars-2021>

With very best wishes

Lucia Graves

ASTRONOMY

Cosmic Revolutions by Professor Katherine Blundell

[gres.hm/cosmic-revolutions](https://www.gresham.ac.uk/lectures-and-events/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.

Atomic Universe

Wednesday, November 3, 2021 6:00 PM [gres.hm/atomic-universe](https://www.gresham.ac.uk/lectures-and-events/atomic-universe)

Museum of London/Online Or watch later

Subsequent to the Hot Big Bang, as the Universe expanded and cooled, atoms formed and, later still, decoupled from radiation. This lecture will cover the intellectual revolutions in relatively recent history that paved the way to our modern understanding of the formation, existence and interactions of atoms.

Structures in the Universe

Wednesday, January 19, 2022 6:00 PM [gres.hm/structures-universe](https://www.gresham.ac.uk/lectures-and-events/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](https://www.gresham.ac.uk/lectures-and-events/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](https://www.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](https://www.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](https://www.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?

Einstein's Blunder

Monday, November 15, 2021 1:00 PM [gres.hm/einsteins-blunder](https://www.gres.hm/einsteins-blunder)

Barnard's Inn Hall/ Online Or watch later

When Albert Einstein tweaked his newly invented equations of General Relativity in 1917, he had one goal in mind: to find a solution that described a closed, static, eternal universe. He therefore minted a new universal constant to make it work. After Hubble's discovery of the expansion of the universe in 1929, Einstein reportedly declared it his "greatest blunder". In 1998 observations of distant exploding stars brought Einstein's "blunder" back into consideration: Einstein might have been right the first time around.

The Broken Cosmic Distance Ladder

Monday, January 31, 2022 1:00 PM [gres.hm/cosmic-distance](https://www.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 <i>(The visit leader must identify any additional hazards relevant to the planned activity where applicable)</i>	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.



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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.

A DASH member, Chris Brown, is downsizing his Telescope collection, and has an Orion Optics(UK) VX12 F4, 1/10th Pwave with new Moonlite focuser. OTA only (Optical Telescope Assembly). Photos attached, (no Mount or tripod included.)

The Tube with the upgraded focuser cost around £2100, and would like in the region of £1700 for this very well looked after Tube assembly. If you are interested, Contact dashastro.info@gmail.com and we will put you in touch. Apparently the 1/10th Pwave is important and an upgrade to the standard VX10





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 6.8° 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 (SN11003041)
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 – Winter 2021 Spring 2022

7:30pm Great Ellingham Recreation Centre, Watton Road, Great Ellingham, Attleborough, Norfolk

Entry £2 u18s £1. Free livestream available.

Friday, October 8 th	Archaeoastronomy – A Brief History	Professor Clive Ruggles (Leics. Alum)
Friday, October 29 th	Public Open Night	Observatory
Saturday November 6 th	Star Party (main night)*	Haw Wood Farm
Friday, November 12 th	Quiz Night (Telescope raffle)	Chairman BAS
Friday, November 26 th	Public Open Night	Observatory
Friday, December 10 th	“Star Life” (note calendars for sale)	Michael Poxon and Shaun Reynolds
Friday, December 31 st	Public Open Night	Observatory
Friday, January 14 th	The Moon – Did we Go? Yes!	Andrew Mowbray (remote)
Friday, January 28 th	Public Open Night	Observatory
Friday, February 11 th	The Zooniverse	Professor Chris Lintott
Friday, February 25 th	Public Open Night	Observatory

Friday, March 11 th	TBA	
Saturday, March 2	Star Party (main night)*	Haw Wood Farm
Friday, March 25 th	Public Open Night	Observatory
Friday, April, 8 th	From the Big Bang to the Periodic Table	Dr Richard Miller, Miller-Klein Assoc.
Friday, April 29 th	Public Open Night (last of the season)	Observatory
Friday, May 13 th	The Moon (+AGM)	Jerry Workman
<p>* 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</p>		