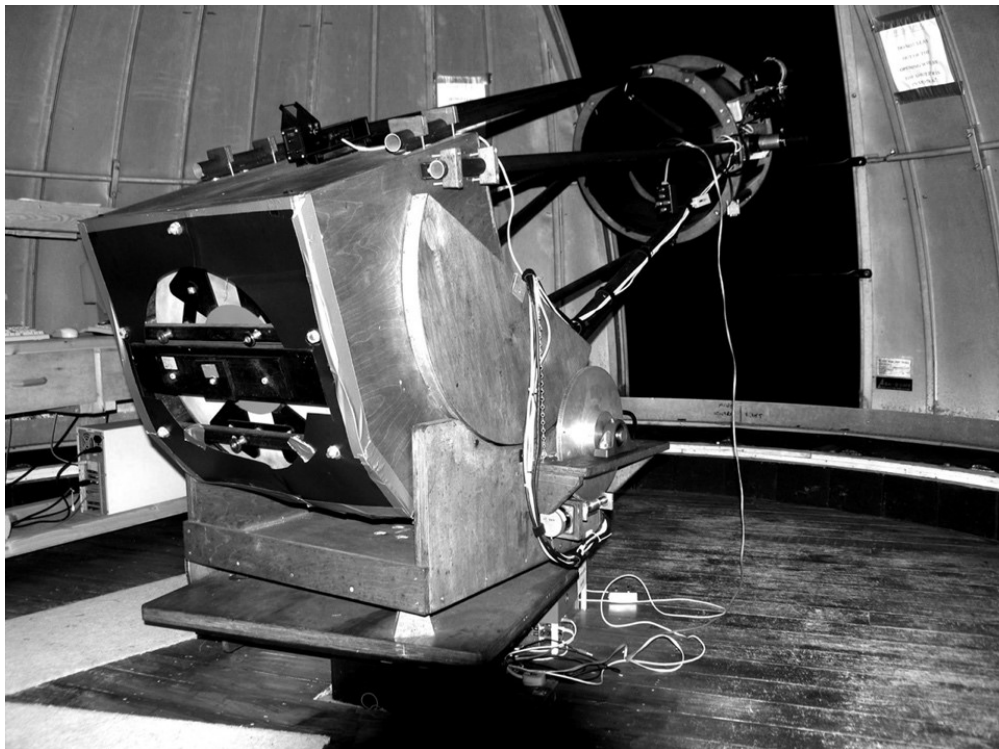




Breckland Astronomical Society

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

EXTRA ***TERRESTRIAL*** **Newsletter March 2023**



Registered Charity no, 1044478

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

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Chairman's Notes March- April 2023

Wishing you all clear Spring skies. Thank you all for paying your subscriptions and buying BAS100 tickets.

A sad announcement for those of you who didn't come to the talks and hear, is that Tony Fox Carter our former chairman passed away after a short period of being diagnosed with cancer. The society sent our condolences and flowers to his widow Betty. Some of us attended his memorial in Hingham and it was good to see she had family supporting her. We let her know what a great legacy he left us with the telescope he built bearing his name. It is indeed a great asset to the community.

Thank you for braving the cold and coming along on winter nights. The open evenings and two talks we've had so far have been well attended and a great atmosphere. We 'even' got to do some observing, but alas our second PC that controls the 20-inch telescope suffered a motherboard failure. The new one has been purchased and we have just installed it thanks to Mark Humphrys.

We have had quite a few groups of youngsters and visitors at the observatory and Peter, Mick, John, Chris and Malcolm have been showing all around, each with some superb talent or skill to impart and inspire. This had led to some generous donations, especially from the Mazda MX5 club. We opened the brand new Tesco-funded Planispheres for the scouts' astronomy badge. Despite the PC failure I have been using the 20 inch manually quite well, with the refractor perched upon it being superb as a finder scope (Orion's sword is stunning in it!). The rate of drift due to the rotation of the Earth in the 20 inch's eyepiece has been an eye-opener to many if not all that looked at the views, whether or not it had drifted out. But we can't wait to get the PC and consequently drives working again. There are still quite some interest in visiting, so any volunteers willing to help would be most welcome; all that's required is a smidgen of knowledge and a friendly bit of company on the open nights.

The 12 inch also packed up. The altitude motor burned out. After a bit of digging, Richard and Keith discovered the consequences of its past fall and dent and thought there may have been a bit of extra frictional load on the altitude drive. We found a new motor online for £5 but it is fiddly to install, and hopefully the same fate won't befall this motor. I guess this is to be expected, given its age and it was dented. Despite this it is still very well aligned and optically near perfect. Frank who donated it to us made us aware of some damage, but with Richard's departure this leaves us with less engineering expertise in case such things happen to another scope. This is really needed in a club like ours in order to keep things maintained, and I know some there is a great deal of knowledge among the readership (ie you). It would be lovely to have a visit and an opinion on a Tuesday such as we had from Mark. It is especially good to learn about the expertise of others.

The Jan and Feb open nights have both been good enough for observing and many visitors have left the place impressed and with increased knowledge, let's hope the skies stay clear for March 24th and April 28th's open evenings.

So what do we have in the sky? If you haven't downloaded Stellarium app (especially on a PC/laptop) please do so, as it is free. Stellarium web now means you can get the basic version online without any installation. It's planetarium software has a much smoother user interface than in-the-sky.org or others out there.

Twilight and Moon times for Mar and Apr 2023

The Moon is out of the way from around 11th March when twilight ends around 19:30 until the 26th of the month when it appears again in the evening and passes the Pleiades and Hyades. And in April the moonless period is between the 8th until the 24th, when twilight ends at 10pm anyway. The crescent moon is beautifully high in the sky

after dusk and earthshine is very visible. The Lunar X is visible April 27th from 19:23 BST (daylight) for the next four hours. Hence Haw Wood star party being planned for mid march.

Planets

Jupiter has just passed Venus and will sink into the twilight during March, leaving Venus blazing as it approaches us and the ecliptic plane appears to tilt northward, reaching higher in our evening sky.

Mercury pops up briefly after sunset for a few days around April 12th, where it is close to very faint Uranus, which is lost in the twilight. Catch it around 20:40 a few degrees above the horizon.

Other solar system objects

Comets

2022 E3 ZTF has put on a reasonable show. It actually stayed as bright as predicted and is now hurtling back in to the outer solar system to spend another 50000 years freezing.

The following comets should be visible also in March and April:

C/2020 V2 ZTF, in Triangulum and C/2019 U5 PanSTARRS moves through Virgo. See charts at aerith.net where you can find some fainter comets or heavens-above.com for the bright ones.

Looking on asteroidoccultation.com an interesting pass by Asteroid 221 Eos at 1am on 5th March (night of Saturday the 4th) occurs over a large range of East Anglia for a 10⁻⁵ magnitude star for a maximum of 9.8 seconds down to 13⁻⁰ (so should dim by 90%). The nearly full moon is very close by in Cancer, but with a big scope or planetary camera this should be a possible measurement. Ironically an old Canon Eos wouldn't be much good for this. These measurements are useful citizen science data for BAA and nowadays automatic telescopes will do the data work up for you. See https://asteroidoccultation.com/2023_03/0305_221_79964.htm

Also on Friday /Saturday 14th/15th April at 00:25 (am BST) Ceres will occult an 11.4 magnitude star, but as the asteroid is 7.5 magnitude it will appear as a very slight magnitude drop of only 0.03m. Not noticeable by eye, but by a planetary camera recording data. A great one for training for planet dips. It will last around a minute but we are at the top edge of its shadow so maybe less, the further north you go up to about 53°N. Ceres's speed relative to us will be about 8km/sec. Ceres is 0.8 arc seconds in diameter. This one is unusual as you should track on the asteroid not the star. See https://asteroidoccultation.com/2023_04/0414_1_80458.htm

Contact the BAA or Tim Haymes (UK) or the European asteroid occultation network EAON if you get data.

Going further out - Double Stars in the Spring Sky

A reminder of these lovely objects to find on even moonlit nights when you want to test your telescope out. Name, magnitudes (brightness) and separations are in this table. You will need a chart such as stellarium to find each stars location and it would help to know the Greek alphabet.

ζ Cancri (Tegmine)	5.6 ^m , 5.9 ^m , 6.0 ^m	6", 1" (the symbol is zeta, Greek z)
φ (phi) Cancri	6.3 ^m , 6.3 ^m	5.2" 10°E of Pollux
ι Cancri	4.2 ^m , 6.6 ^m	30.5" gold and blue
α Leonis (Regulus)	1.3 ^m , 7.6 ^m	176" far apart but gravitationally connected

γ Leonis (Algieba)	2.6 ^m , 3.8 ^m	4.5"
ξ (xi) Ursae Majoris	4.3 ^m , 4.8 ^m	1.6" 60 year orbit
N Hydrae	5.8 ^m , 5.9 ^m	9.1" low
WNC 4 UMa / M40	9.0 ^m , 9.3 ^m	50"
α Canum Venaticorum	2.9 ^m , 5.4 ^m	19.6" white and pale yellow
ζ^1 Ursae Majoris Mizar	2.4 ^m , 4.0 ^m	14.4" first double to be discovered 1650
α Geminorum (Castor)	1.9 ^m , 2.9 ^m	3.9"
κ Geminorum	3.2 ^m , 8.2 ^m	6.9" orange and blue
38 Geminorum	4.8 ^m , 7.8 ^m	7.3" yellow and purple (supposedly!)
ϵ Hydrae	3.4 ^m , 6.5 ^m	2.7" a third (too close) yellow and blue
38 Lyncis (of Lynx)	3.9 ^m , 6.1 ^m	2.6" green and pink (some say)
54 Leonis (of Leo)	4.5 ^m , 6.3 ^m	6.7" white and bluish, neat asterism
τ Leonis (of Leo)	5.1 ^m , 7.5 ^m	89.7" due North-South, pale yellow and pale blue
24 Comae Berenices	5.1 ^m , 6.3 ^m	20" orange and greenish
39 Boötis	6.3 ^m , 6.7 ^m	2.7" 10 ^o E of Plough, tiny distant spaceship
ϵ Boötis	2.6 ^m , 4.8 ^m	2.7" 10 ^o E of Plough, tiny distant spaceship
ζ Boötis	4.5 ^m , 4.5 ^m	0.1" now not separable until about 2030 or 2040.

BAA Deep Sky Update

Rather than copy out here – Callum Potter has made an extensive Deep Sky report here. There is a section meeting at the Bedford school, Bedford on Saturday 19th March if you look here for tickets. Object of interest is the Abell Galaxy Cluster 1314 in Ursa Major, which includes IC 712, 711, 709 & 0.708, the latter which is noted as the Papillon Galaxy due to radio lobes. At least 50 galaxies are present.

https://britastro.org/section_news_item/deep-sky-update-january-2023

General Photography Opportunity

The Milky Way rises over the Sea early spring mornings. So if you can get out to Haw Wood in March or the East Coast one moonless late night 3-4 am, the Milky Way should rise in a dark sky over a dark sea, which is a sight to behold and an excellent photographic opportunity, especially if you get an interesting foreground feature.

Events

Haw Wood Farm run their Astronomers week from Thursday 16th March until Thursday 23rd with small events at the café on Friday 17th and Saturday 18th it is £18 per pitch per night and book by calling or emailing see hawwoodfarm.co.uk

Open evenings are regularly every last Friday of the month up to and including April 29th. May is too light. Members of course meet every Tuesday.

The Space Oddities programme is still happening Monday Nights on facebook and Youtube, well worth a watch.

Talks – Expanding Universe and the Megaconstellation Threat

In January, we had the expert communicator and affable, friendly chap, Dr Matt Bothwell. He is Public Astronomer at Cambridge University, and is has done research on cosmology, specialising in galaxy evolution across cosmic time.

He introduced the concept of Hubble expansion with some beautifully sharp, clear slides. Distance measurement was the first concept he tackled with the example of Deneb, a star that appears to us like many of the other brighter stars in our summer night sky but happens to lie a hundred times further away than Vega. It must therefore be incredibly bright. This example is well worth telling others (or even pointing it out) especially if relating it to the moment in Father Ted where Ted is trying to explain to Dougall why the cows look as small as his toy cow.

Next we go on to a plot of the Hubble constant H_0 over time and how it came down over time. In the 80s there was some serious flip flopping which eventually settled out, never getting too far beyond standard error bars. However as the error 'bars' (this is the size of the uncertainty on a graph) got smaller when measurements improved a new divergence opened up. This was when they looked at the CMB – the cosmic microwave background and inferred H_0 from the patterns in that radiation. Still to this day it appears to starkly disagree with the measurements made with accurate techniques.

The CMB value of H_0 includes all known physics in order to extrapolate it to our time, but the other value is based on looking for the effect of the physical movement of the Earth around the Sun in combination with using variable stars and supernovae to determine distance. This measurement (called the Cosmic Distance Ladder) is more observationally based. Scientists are checking thoroughly for mistakes as changing the laws of physics is always a bad option. This hasn't stopped suggestions though, such as a curvy universe, variable dark energy, or odd behaviour of dark matter.

The talk was over fairly succinctly at 8:25 but the Questions went on so long I didn't even get mine in in time for coffee at 8:50, and Matt was in constant conversation until 9:30 during that time too. Well done Matt! We had a great clear observing session afterwards.

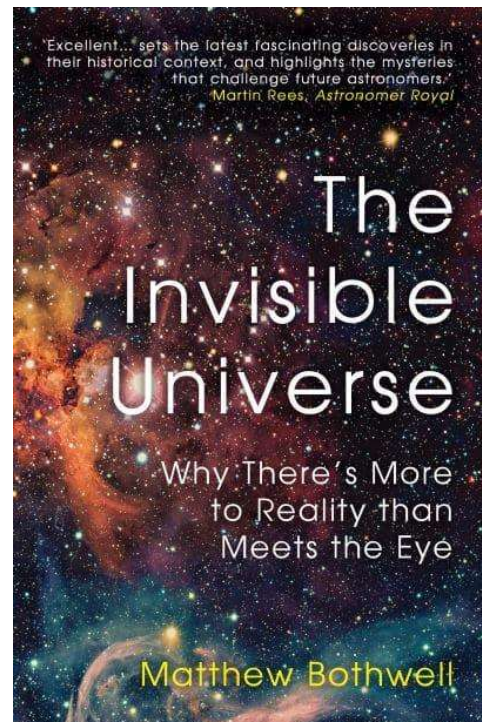
Here is his book advert, a fairly up to date story of the missing part of the Universe. Please buy it from anywhere, it makes no difference to Matt.

On to MEGACONSTELLATIONS. Dr Paul A Daniels has had a great career in developing Imaging Sensors; he worked on ROSAT the X ray satellite. It was a pleasure to have him and have him share some of his expertise with us. He certainly made us realise the importance of this subject.

In recent years a rapid acceleration of satellite launches has occurred, and commerce is applying for more and more licences to fill orbit with them. But, they are damaging to professional astronomy, as well as having a worrying effect on societies around the world and international relations.

Sputnik 1 was launched in 1957, the first artificial satellite. Since then the geostationary belt has started to fill up. These are fairly distant and not easy to notice but can be seen occasionally. The cost then was £100-400 million per satellite in today's money. Today it is £25,000-250,000.

Numbers: So far there have been 6370 rocket launches (end 2022), that have put 15090 satellites up. There are 32290 pieces of debris also, a total mass of 10 000 tons. Of those, there are currently still 5465 in orbit, most in Low earth orbit (LEO) and it is dominated by StarLink, owned by one man, Elon Musk, from one nation, USA.



The radio spectrum is crowded and apportioned by the FCC, they have rules for sharing radio bands. Due to these excessive numbers there is now a new condition to stop Satellite companies hogging the bands, and there is also the issue of collisions, pollution, etc. The FCC has reassessed and denied permission for the majority of Musk's future planned launches as the orbital range varies by 120 km, meaning they can't guarantee their positions in order to avoid collisions. The proposed 42000 is now "JUST" 11908.

Even with small satellites, such as 'cubesats' of 1kg mass, they have 24.5 mega joules of energy at orbital velocity, this is equivalent to 6 kg of TNT, so multiple pieces of small debris can be most damaging. The Russians have deliberately blown one up, a very irresponsible test to carry out. And at one point many years back the US launched loads of needles, to see how reflective they were.

Another point was the amount of rare earth metal wastage that goes into the atmosphere and can't be recycled.

While big telescopes that cost \$ billions suffer trails from the satellites, there were irrecoverable image artefacts, and ghosts, that affected the electronics of these highly sensitive instruments. Paul spoke of new special sensors that activate temporary shutters when one enters the edge of the field, and orbital predictions updated by the hour or at least daily.

In my opinion and I'm sure I'm not alone. It is such a shame to invest so much in a giant telescope only for someone to come along with a commercial company and start scribbling all over it. But things can be done about it and there is hope, a protection organisation has been set up by the International Astronomical Union.

Incredible food for thought thanks Paul and Matt, hope to see you again soon.

Next events

At the time of writing, I have just heard back from Chris Lintott to confirm his visit on March 10th – he is arranging his own diary again, so he must be finding it hectic keeping up. Coming up in April is Andy's talk about Volcanism in the Solar System, a subject he has studied as well as being interested in and I am expecting will be entertaining as well as well-informed.

Society notices

I have put an initial advert out for open evening volunteers at 'Voluntary Norfolk' and not seen anything so far. I will need to define a role description more clearly I think. While we do still have some extremely skilled folk among us, it would be great to see more amateur astronomers with unique expertise and interests they can bring to the observatory in person. The observatory has some excellent and high quality astrophotography equipment which could be and should be getting more use so if anyone is interested please come meet us.

Breckland Astronomical Society are a charity that provides an educational service and inspirational experience the community can access for the price of a short road journey. We have some incredibly kind, loyal members who give lots of effort in our small crew that run the club, and I am a firm believer that, if we can, inspiring others is part of a fulfilling life. Even if it you can spare an evening every month or so. We are always looking for helpers at open nights and events also, so if you can help at one or more of these please contact chairman@brecklandastro.org.uk

Please note Andy's address is no longer Rackheath. Our efforts to change bank accounts resulted in a lot of admin to go through and Andy has taken it upon himself to do a thorough job and the committee need to approve minor additions and changes to the constitution. There is a fair bit of work keeping all in order, much is to be said for Barrie's spreadsheets. He has prepared the accounts for the AGM in May. We made a small profit last year, which was great to hear, despite a surprisingly large energy bill (must be standing charges). We will inform you of new account details when the application has gone through.

We welcome the new members that joined in the last half of 2022. Nice to meet you and see the enthusiasm and hope you drop by again at one of the talks or observatory nights. If you want to renew your subscription with us remotely, you can email treasurer@brecklandastro.org.uk

Dan Self

JOHN'S NEWS BITS

March 2023

On February 3rd, 2023, an international team of researchers at the Max Planck Institute for Astronomy MPA, found an Earth-sized planet in the habitable zone of a red dwarf star. This, possibly closest, habitable exoplanet was found orbiting the red dwarf. Designated Wolf 1069b it is 31.2 light years away in the constellation of Cygnus. The planet is tidally locked to the star. www.earthsky.org

12 new moons have been found around Jupiter giving it the most moons in our solar system. The work was done using telescopes in Hawaii and Chile by scientists at the Carnegie Institute of Science and published by the Minot Planet Centre MPC.

This gives Jupiter a total of 92 planets ahead of Saturn's 83. www.skyandtelescope.org

The JUICE (Jupiter Icy Moons Explorer) mission to Jupiter's moons is due for launch in April 2023 on an Ariane 5 launch vehicle from French guians..

It will make detailed observations of the giant gas planet and its three largest moons Ganymede, Callisto and Europa.

www.esa.int/Science_Exploration/Space_Science/Juice

Reported on Space.com, the JWST has discovered enormous distant galaxies shortly after the big bang that should not exist.

These galaxies are as massive as the Milky Way and are full of mature red stars. Nobody so far can explain how they were formed, you would expect to find baby galaxies with young stars. This conflicts with 99% of models representing early galaxy formation. www.sciencenews.org

Reported in www.phys.org, scientists have found first evidence that black holes are the source of Dark Energy, the missing 70% of the universe.

Measurements of ancient and dormant galaxies show black holes were growing far more than expected. Black holes as a source of dark energy were originally predicted in Einstein's theory of general relativity. This conclusion was reached by a team of 17 researchers in nine countries.

Reported in technology.org, an international team of astronomers from NASA's JWST have been looking at a region in space some 4 billion LY's away known as Pandora's Cluster.

This is three galaxy clusters coming together to form a mega cluster. Source Yale University.

<https://webbtelescope.org>

ESA is developing a satellite, Arrakis, that will investigate Dark Matter. and what it's made of. Expected launch will be in early 2030's.

DM is unevenly distributed over the universe forming a cosmic web. Some clumps are populated by dwarf galaxies whilst others are made entirely of DM.

In the standard model of cosmology, DM particles are assumed to be 'COLD' i.e.. made up of slow WIMPS. If DM is WARM, the particles are faster and lighter, e.g. sterile neutrinos. Arrakis will investigate which model is correct.

www.cosmos.esa.int

Reported in www.space.com The largest 2D map of space has been created using data based on a pioneering six-year study according to NRO (National Optical Astronomical Observatory). It will contain one billion galaxies containing over a billion stars each.

The data came from DESI, the Dark Energy Spectroscopic Instrument.

The objective is to identify around 40 million galactic targets that can be used to precisely map the expansion history of the universe over the last 12 billion years.

The SpaceX Starship has cleared live tests of the 33 Raptor engines ready for a March 2023 launch.

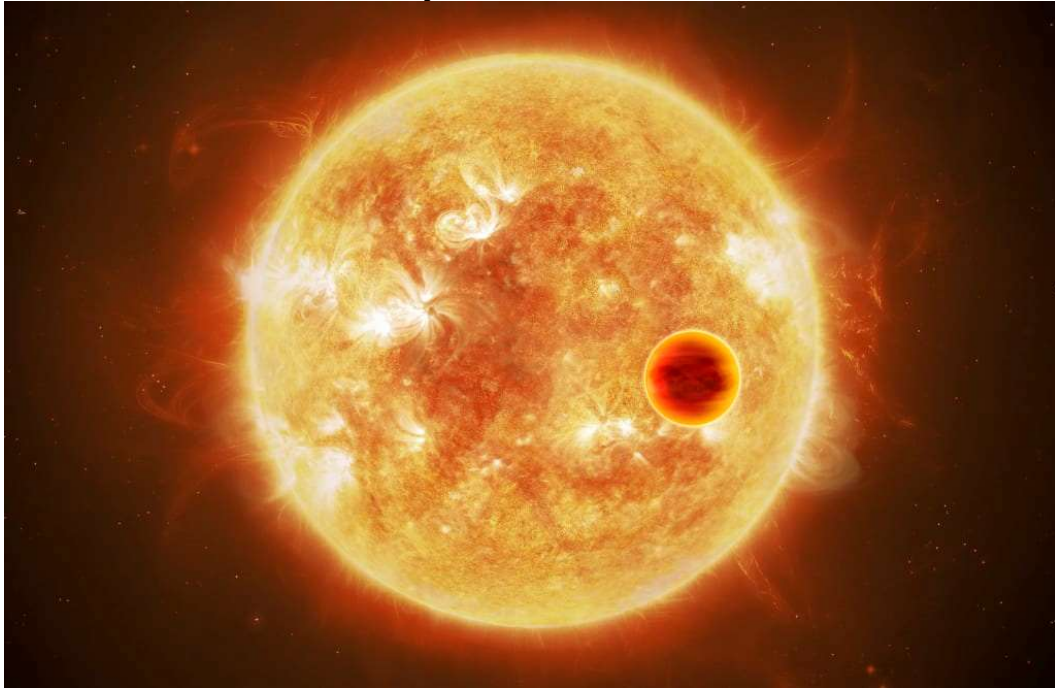
SpaceX's Starship and Super Heavy rocket is the most powerful space vehicle ever developed. It can carry 150 metric tonnes into Earth orbit and will initially be used to launch satellites much further as well as future space telescopes larger than JWST. www.spacex.com

John Gionis

A hot Jupiter that can be seen by amateurs

Observing an exoplanet suffering freakish extremes of temperatures using small commercially available telescopes

By [Andrew Scott](#)



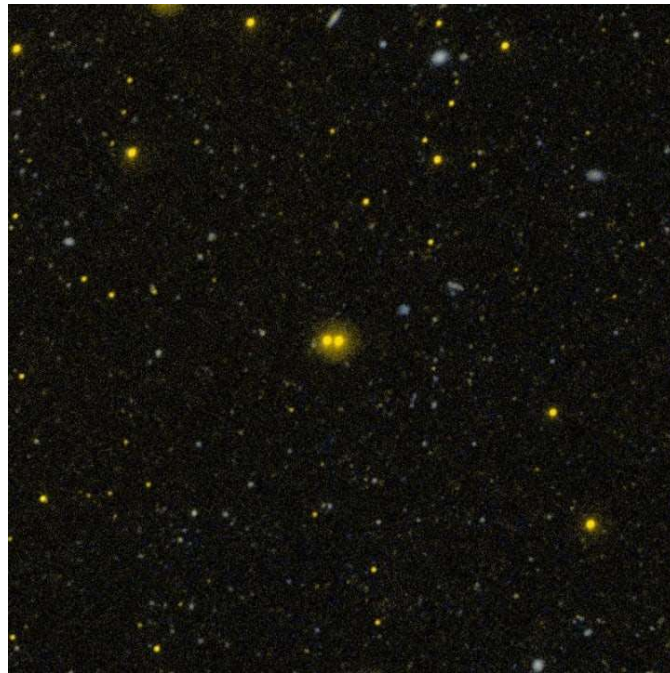
A hot planet transits in front of its parent star / Wikimedia Commons

Are monster telescopes in world class facilities and gigantic super-expensive detectors and instruments always needed to do some real science on a planetary system outside of our solar system? After all, I showed in [this article](#) that in order to pick out the really faint signals from an exoplanet that would otherwise be lost in the glare of its parent star, professional grade equipment would be needed, of such a scale to dwarf a person standing next to it.

What if that were not the case? What if tuning up an average Meade or Celestron with some fairly mid-grade off the shelf detectors in your own back yard was enough to pick up the signal from a real planet outside our solar system? What if this is all possible from a city location, where dark skies aren't a realistic prospect?

Well, this is precisely what [a small team of astronomers did](#), from the suburbs of London, England, over a decade ago, when small telescopes and detectors weren't as good as they are now.

Let's take a look together at the system they chose to study.



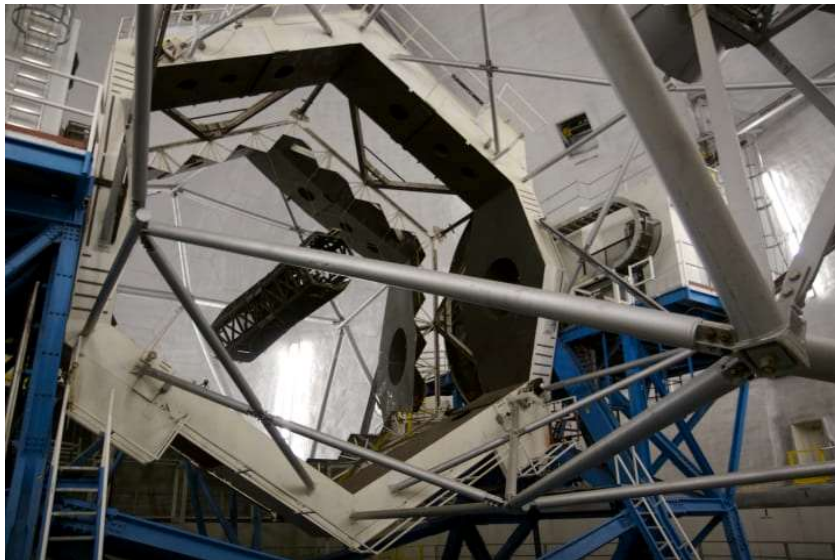
HD 80606 and HD 80607 / NASA/GALEX/WikiSky

The two stars in the image above are called 'HD 80606' and 'HD 80607' because they were assigned these IDs by a team working at Harvard College Observatory in the early 20th century, funded by the widow of Henry Draper, a pioneering late 19th Century astronomer, and among the first to attempt the classification of the stars.

Both of them golden yellow, a little more orange than our Sun would appear to be, they are reckoned to be separated by a distance of about one thousand two hundred times the Earth - Sun distance. We can be pretty sure of this as they are both close enough for their *parallax* to be measured, giving a distance of about two hundred and seventeen light years, or roughly sixty six times further away than a star would need to be to have a parallax angle of one arc second.

These numbers might appear to be small, and indeed they place this system in our cosmic backyard - the same 'neighbourhood' of the galaxy (even the same street!), but the distances are still huge. It takes light only one second to travel three hundred million meters. That's three hundred thousand kilometers, or about one hundred and eighty six thousand miles, every second. But that light has to travel that two hundred and seventeen *years* to reach us.

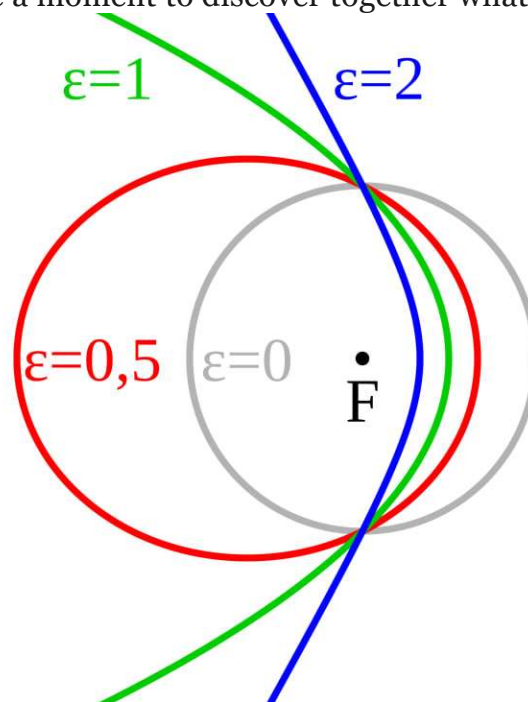
A close study of these stars' light intensity per wave-length (as seen through a *spectroscope*), combined with well developed mathematical models of how stars work, has shown us that each star is around about, maybe slightly less than, the mass of our own sun. At their separation, they would then take very approximately thirty thousand years to orbit each other (though no-one has measured this!).



The ten meter primary mirror of Keck 1 / Wikimedia Commons

One of these stars - HD 80606 - is orbited by a planet. First discovered as a part of a 1999 survey of nearby stars like our Sun, the planet was detected initially using the giant ten meter Keck 1 telescope by noticing that the star's *radial velocity* changed over time. A 'radial velocity' is the motion of the star toward or away from the observer, along the radius of a circle that follows the sky, in the direction of the star. Changes in this radial velocity are relatively quick and easy to measure, with a very large telescope.

Given the designation 'b' to distinguish it from its parent star 'a', follow-up observations soon revealed from the way the star's radial velocity behaved over time that the planet was in a highly *eccentric* orbit. Let's take a moment to discover together what this means for the planet.



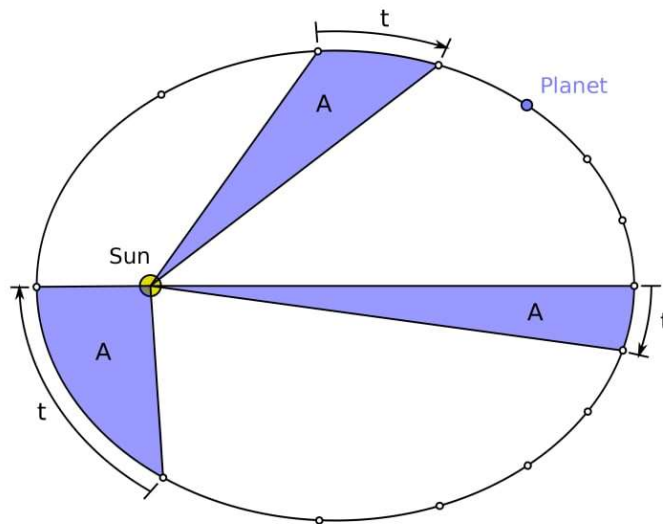
Ellipses of various eccentricity / Wikimedia Commons

A perfect circle (grey, above) has an *eccentricity* of zero. If we 'squash' the circle at the top and bottom then it will no longer be a circle. An ellipse is a special kind of squashed circle. Imagine tying two bits of string to two pins stuck into a piece of card along a horizontal line. Now attach both bits of string to a pencil, and draw round both pins as far as possible to form a continuous line. This is an ellipse, and each of the pins is called a *focus*.

A simple way of thinking about the eccentricity of an ellipse is as the distance from the center of the ellipse to one focus, divided by the distance from the center of the ellipse to the edge. The red line shows an ellipse for which this ratio is one divided by two, or a half. It can be seen immediately that the line of the ellipse is close to the focus 'F' above at one end of the ellipse, and quite far away at the other end. (*Technically, the shape for which the eccentricity is exactly one is called a 'parabola' as shown by the green line; for an eccentricity of greater than one it is called a 'hyperbola' as shown by the blue line, but these two shapes can't be drawn in this way*).

An exoplanet orbiting a star in an elliptical orbit is a special application of the above - only one of the focus points of the ellipse is occupied - by the star - and the other one is empty. So we can imagine HD 80606 at point 'F', and planet 'b' following the line of the ellipse all the way around as it orbits its parent star.

One of the really amazing things about planet 'b' was that when it was first discovered it was observed to have an eccentricity of about 0.93 - at the time the most eccentric exoplanet ever discovered. This means that the ellipse the planet follows as it orbits its star is really squashed - and the minimum distance of the planet from the star is really very small indeed compared to the opposite side of its orbit. So close to the star, in fact, that it almost 'grazes' the surface! So as the planet coasts past the star at one end of its orbit, it must get really hot. It doesn't do so for long, though, because of the way in which planetary orbits work.

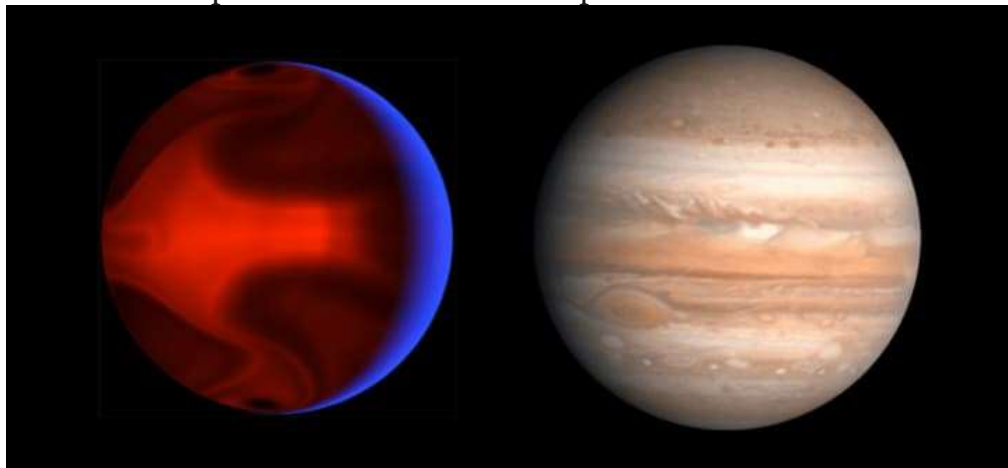


A planet orbiting a star sweeps out equal areas in equal time / Wikimedia Commons

In the diagram above, we're replacing the 'Sun' with the parent star of our exoplanet, HD 80606. We've already covered Kepler's first law above (planets move in ellipses). Now, the the diagram above shows per Kepler's second law that a line connecting the planet with the star sweeps out equal areas in equal time. What does this mean? Well, the orbital period of HD 60606 'b' has

been measured as approximately one hundred and eleven days, so let's say that each marked point on the ellipse above represents a ten day interval. Per Kepler's second law, the area 'A' remains constant throughout the orbit of the planet. But the distance moved by the planet in the ten day interval when it is closest to the star is much longer than when it is further away. So this means that the planet 'b' is moving much more quickly when it is closest to the star - it does not hang around in the danger zone for very long.

This illustration shows what can be expected for a planet of mild eccentricity. But HD 80606 'b' has a really extreme eccentricity of 0.93, which means while it approaches its parent star and really roasts, it zips past and soon cools down afterwards. Let's see what this would mean for an observer at the top of the cloud level of the planet as it zooms around the star.

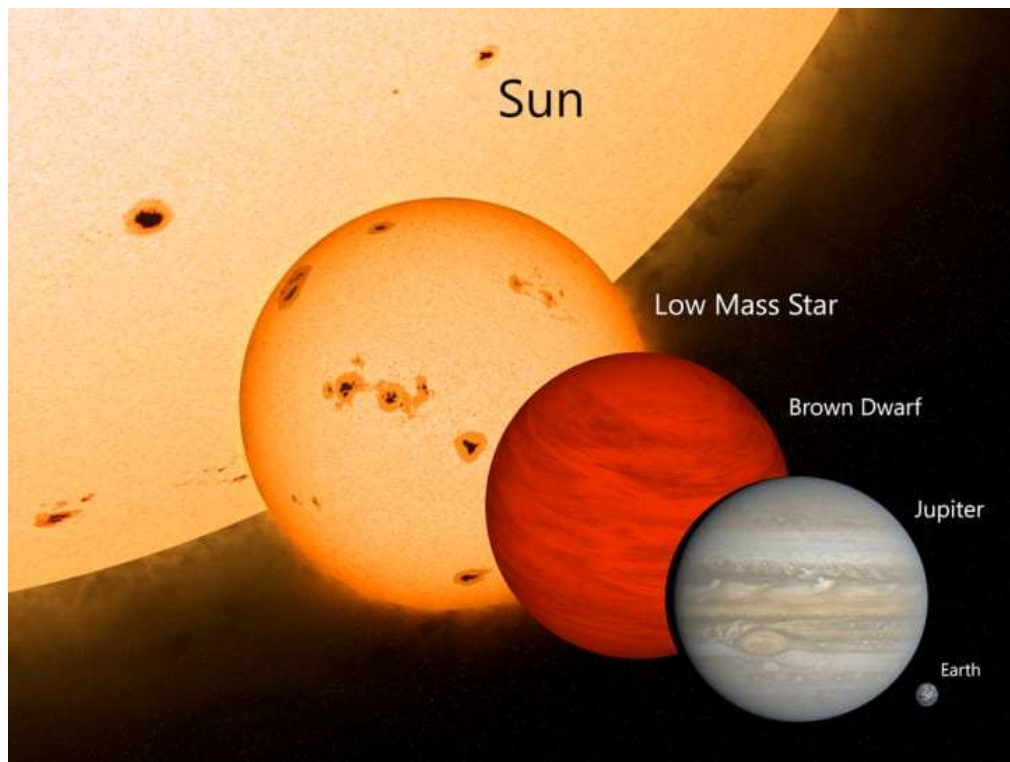


Artist's impression of storms on the night side of HD 80606 b, at closest approach, with Jupiter for comparison / Wikimedia Commons

They would see the planet's star swell in size to thirty times its apparent diameter on the other side of the orbit. In just six hours, as the planet approaches its closest point to the star, the temperature at the top of the clouds ascends from around five hundred Celsius (already toasty!) to an astonishing one thousand two hundred Celsius! Such an extreme temperature contrast drives immensely powerful storm winds of eighteen thousand kilometers per hour, many times the speed of sound. Any observer on the night side of the planet would not be safe either: these winds, when coupled with the Coriolis effect from the rotating planet, generate fearsome hurricanes that only die away once the planet recedes and starts to cool.

The planet, on closest approach, zooms past no more than three percent of the Earth - Sun distance. Thankfully, the horrendously challenging environment experienced in the atmosphere doesn't last long, as at the time when the planet is closest to the star, it is moving very quickly.

Follow-up observations of HD 80606 b after initial discovery revealed some more remarkable information.

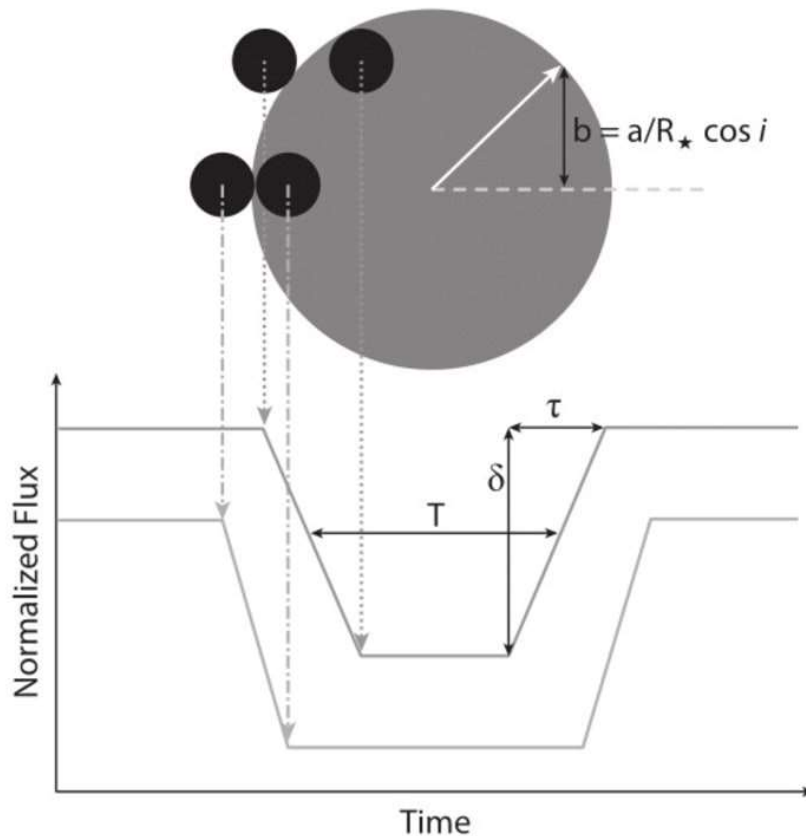


A low mass star, a brown dwarf and Jupiter, shown to scale, with Earth and Sun for comparison / Wikimedia Commons

Planet masses are usually expressed as multiples of Jupiter's mass. Jupiter doesn't really emit any light of its own: it reflects light from the Sun. As larger planets accumulate more mass, the central density - and temperature - of the planet increases. Beyond a certain point - thirteen Jupiter masses - the 'planet' starts to glow. Not due to any self-sustaining nuclear reactions, but more due to gradual gravitational squeezing of the core which makes it very hot. Beyond eighty Jupiter masses, nuclear fusion can start in the core, and what was a planet becomes a low-mass star.

The exoplanet HD 80606 b is definitely a planet, of about four times the mass of Jupiter. It would need to be three times more massive than that to be a brown dwarf. One surprising thing about this though is that the diameter of the planet hardly increases at all as more mass is added. Indeed, observations have shown (see below) that the diameter of the planet is very approximately the same as Jupiter's; maybe a little larger.

Also remarkable is the *inclination* of the planet's orbit relative to the plane of rotation of the star. A bit like the orbit of Pluto, HD 80606 b rotates around its star at an angle. It is possible that the combination of the planet's high eccentricity and high inclination could be explained by an interaction between the other star in the binary, HD 80607, and the planet: every so often, the other star 'pulls' the planet slightly further out from what was initially a nice circular orbit a safe distance from its star, via a effect known as the *Kozai mechanism*. Gradually, over time, the point of closest approach is driven closer and closer to the star, until today when it is periodically fried while zipping past. No-one really knows what the underlying reason is though: more research is needed.

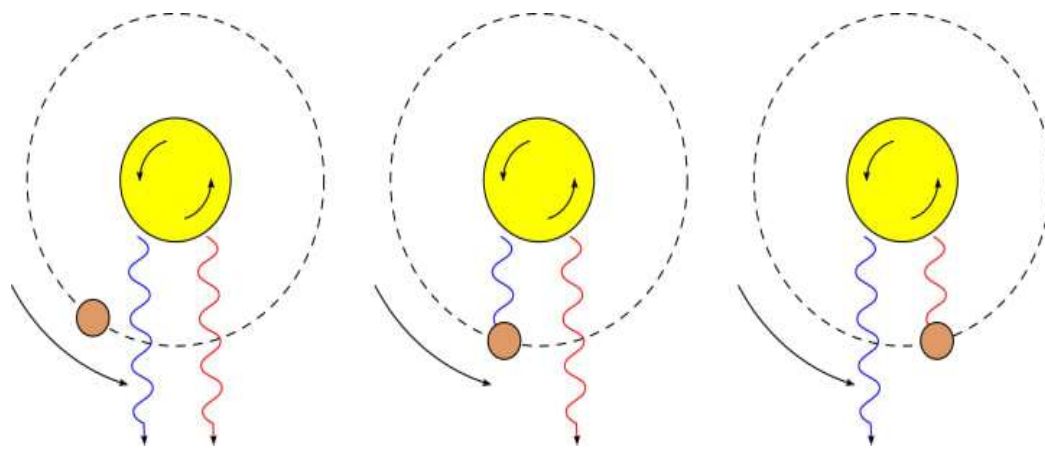


An exoplanet (small black circle) transiting in front of a star (large grey circle) / Wikimedia Commons

There's one more incredibly neat thing about this system - it transits in front of its parent star, partially eclipsing some of its light. It is this characteristic that makes it so accessible to amateur observers, helped of course by the parent star being 'relatively close' and of ninth magnitude in the sky.

As the planet passes in front of the star, some fraction of the light of the star is temporarily blocked. The changes in the brightness of the star over time is called the *light curve*. As the planet is relatively small compared to the star, the loss of light isn't that great (no more than one percent or so) but that change is more than enough to be picked up by today's modern sensitive detectors on small-ish amateur telescopes.

There's a lot that can be learned from the transit of the exoplanet in front of HD 80606. The slope or gradient of the ingress (left hand side) and egress (right hand side) of the planet in front of the star measures the size of the planet relative to the star. If we know the size of the star (from its spectral type) then we know the size of the planet. That enables us to work out the density, showing whether this is a rocky planet, or a gas giant. Measuring the length of time the transit lasts, as well as precisely when it starts and ends, enables us to plot the orbit more precisely, and to constrain the inclination of the system. As well as of course to measure the mass of the planet more precisely.



The Rossiter-McLaughlin effect, as the planet passes in front of the star / Wikimedia Commons

A fundamental question needing to be addressed first is how do we know the temporary dimming of the star's light is due to a planet passing in front of it. One independent way in which we can confirm this is what is happening is by measuring the way in which the precise wavelength of spectral lines change as the planet transits the star. Most stars rotate, some more than others. As the planet begins its transit, it blocks some of the light from the limb of the star on the left, coming towards us. As that light would appear to be blue-shifted (via the *Doppler effect*) then the net result is we see a red-shift in the spectral lines. The same thing happens in reverse as the planet completes its transit. Measurements of the light from HD 80606 during a transit show not only this effect happening, but also that the planet is orbiting *prograde* (in the same direction) relative to the star's rotation.

The small team of observers were able to record this very small change in the light of the star, from a location literally right next to a six lane highway in a busy urban location with Bortle 7 skies. Skies in which the light pollution reaches all the way to the zenith, clouds (when present!) are brilliantly lit, and it is almost possible to read a newspaper by ambient skylight.



An eight inch Celestron Schmidt Cassegrain / Wikimedia Commons

They were able to observe most of the transit that occurred on the night of 14 February 2009, including the egress, using two telescopes that they cross-correlated with each other. The first one was like the picture shown above, but somewhat larger, at a fourteen inch aperture.



Meade LX200 Schmidt Cassegrain / Wikimedia Commons

The other, that was used more as a backup, was more or less like the Meade LX200 shown above.

Images of the field in which HD 80606 and HD 80607 sit were taken repeatedly over the night - ten second exposures every twenty seconds on the larger telescope, and thirty seconds with an additional five second read time on the smaller telescope.

The team used standard image reduction techniques using software similar to that which an amateur could download and install. This included treatment with bias frames, darks and flat

fields to ensure their images were as free from systematic artefacts and read-out noise as possible.

They then used similar software to 'draw' a circle around HD 80606, as tightly as possible, to exclude any contamination from its nearby binary companion, and carefully measured the light within this circle. The number they arrived at was plotted on a graph of 'brightness' versus time to achieve the light curve of the star as the exoplanet completed its transit and egress.

For consistency checking - to make sure that the small variations they were seeing weren't due to some other effect, like thin wispy cloud, they also recorded the brightness of several other stars in the frame, including that from the companion HD 80607 that we know doesn't change intrinsically.

From these observations, the team were able to measure the egress duration, the total duration of the transit, the ratio of diameters of the exoplanet and the star, the inclination of the orbit of the planet relative to the line of sight, and therefore the planetary radius, to within one percent.

Quite a remarkable achievement, using amateur equipment in a city site next to a highway. And a truly remarkable exoplanetary system.

Let's face it, if they can do it, so can you.

The Many Names of the Pleiades



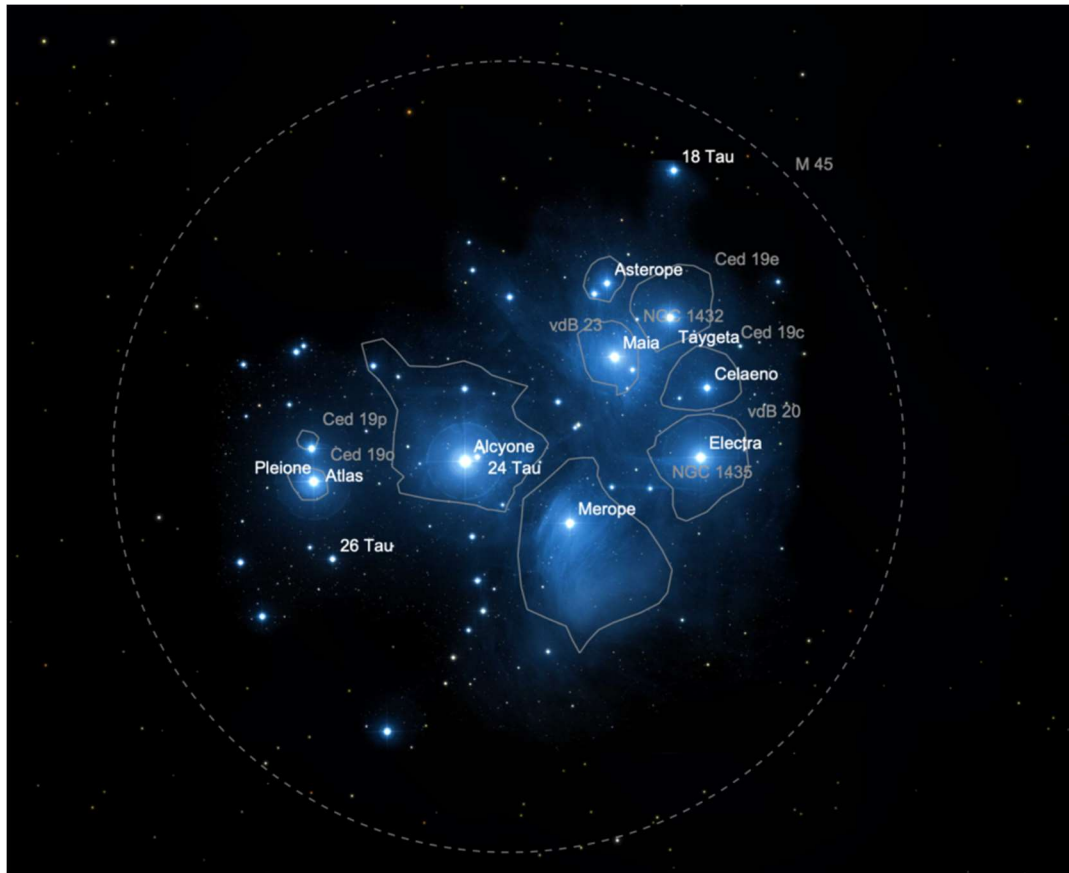
Chris Bailey

The Pleiades star cluster in the constellation Taurus is one of a handful of objects in the heavens that never fail to amaze and inspire even the most experienced observers. As beautiful in an inexpensive pair of binoculars as in images from big professional telescopes, this star cluster presents visual observers an especially lovely sight with stars of an unearthly blue ensconced amid a faint frost of nebulosity. If there were more objects like it in the night sky, there would be a lot more amateur astronomers in the world.

The Most Famous Star Cluster

Sometimes called the Seven Sisters, the Starry Seven, and the Seven Atlantic Sisters, the stars of this small dipper-shaped cluster take their names from the ancient Greek god Atlas, his wife Pleione, and their seven daughters. The star Atlas marks the handle of the dipper-shaped cluster. The stars Alcyone, Maia, Electra, Taygeta, and Merope form the small bowl. Near Atlas lies Pleione, his wife of mythology. The fainter star Sterope (sometimes called Asterope) forms an

equilateral triangle with Maia, and the star Celaeno lies between Taygeta and Electra. In the Mediterranean world, the cluster took its name from *pleiad*, the ancient Greek word for sail since its appearance in the morning spring sky heralded the beginning of sailing season.



The star names of the Pleiades

Most naked-eye observers can see six stars of magnitude 3.0 through 5.5 in the Pleiades – Atlas, Alcyone, Merope, Maia, Electra, and Taygeta. However, many ancient cultures from Europe to Japan to Australia once claimed to see seven stars here. The Greek poet Aratus in the 3rd century B.C. wrote, “*Their number seven, though the myths oft say, and poets feign, that one has passed away.*” Some speculate that Pleione, a short-term variable star, may have shone brighter in classical times. A more recent explanation, based on star motions measured with the European *Gaia* space telescope, suggests Atlas and Pleione were long ago more widely separated and easier to resolve into two distinct stars with the naked eye. It may be, however, the confusion about the number of stars in the Pleiades may come down to a matter of the visual acuity of the observer. Modern stargazers with very dark sky and excellent vision can spot nine or ten stars in total. Some claim to see as many as 18!



Roger Hyman

As such a prominent star cluster, one that lies near the ecliptic, the Pleiades has been known since the dawn of history by cultures all over the world. A study of the mythologies based on these stars and their appearance in literature around the world make for fascinating reading. Some examples:

- Polynesian peoples called them *matarii* or *matariki* ("little eyes") and held they were once a single star split into six during a battle among the gods
- Medieval northern European cultures, including the Vikings, presumably occupied with the essentials of life rather than poetry, called them the 'Hen and her Chicks'
- Kiowa and Cheyenne of the American great plains believed these stars were seven maidens placed into the sky and protected from harm by the Devil's Tower (in Wyoming)
- Finnish and Lithuanian stargazers saw them as a sieve or net (in Tolkien's *The Hobbit*, they were called "The Netted Stars")
- The Quechua and other cultures in the Andes called them the 'Storehouse' since their appearance in the morning sky (in May) coincided with harvest time
- In Japan, these stars were called *subaru*, which means unity (the Subaru car company was named when five smaller firms merged into a larger sixth firm, Fuji Heavy Industries).



Malcolm James Dent



Michael James Wilson.

Seeing The Pleiades

The Pleiades is visible in the evening hours from December through April, and observing the cluster requires no particular knowledge or experience. Spectacular with or without optics, the Pleiades look best in a small wide-field telescope at low magnification that can take them all in with enough surrounding sky to frame them nicely. An 80mm refractor shows about 80-100 stars. Look for close pairings of stars, especially Asterope, Atlas and Pleione, Taygeta, and a faint pairing near the centre of the bowl. Any decent pair of binoculars will also give a spectacular view.

Physically, the Pleiades are quite young. With an age of 100 million years, the cluster still contains many bright blue and blue-white stars. There are a few more evolved stars that have swelled and turned yellow or orange. A white and orange pair, ADS 2755, can be seen in the bowl of the dipper. And a 6th-magnitude orange star is visible about 0.3° north of the bowl.

Look also just south of Alcyone for a lovely chain of stars that turns south-southeast.

The last two stars in the chain appear orange or yellow orange. The first star in the chain is the fine double star Struve 450 ($\Sigma 450$). The primary is magnitude 7.3 separated by 6.1" from the 9th-magnitude secondary. A small scope at 75-100x should split the pair nicely. The star Sterope is also a widely-split pair, just barely split without optics by keen-eyed observers. Taygeta is also a wide double. The primary is magnitude 4.3, while the secondary, some 69" north, shines at magnitude 8.3. Any telescope at low power can split this pair.

Images of the Pleiades shows a beautiful lacework of nebulosity around these stars, a result of the cluster passing by chance through a cloud of interstellar dust. Visual observers can see hints of this nebulosity in dark and pristine sky with a small telescope. The easiest patch of nebulosity appears around the star Merope. The Merope Nebula, or NGC 1435, appears frosty-white and just barely brighter than the background sky. It's sometimes confused with the effect of dew on a telescope's objective lens or mirror or eyepiece, so to make sure you're really seeing the nebula, move the telescope from the Pleiades to the Hyades and back. If you see nebulosity around the stars of the Hyades, you have a dew problem. If you see a faint glow only around Merope, you're seeing something real.

Like all open star clusters, the Pleiades will get buffeted and tugged by gravity from passing stars and gas clouds. Over the next few hundred million years, its stars will get pushed out of the cluster and make their way around the Milky Way alone

Studying the Edge of the Sun's Magnetic Bubble

Our corner of the universe, the solar system, is nestled inside the Milky Way galaxy, home to more than 100 billion stars. The solar system is encased in a bubble called the heliosphere, which separates us from the vast galaxy beyond – and some of its harsh space radiation.

We're protected from that radiation by the heliosphere, which itself is created by another source of radiation: the Sun. The Sun constantly spews charged particles, called the solar wind, from its surface. The solar wind flings out to about four times the distance of Neptune, carrying with it the magnetic field from the Sun.

"Magnetic fields tend to push up against each other, but not mix," said Eric Christian, a lead heliosphere research scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "Inside the bubble of the heliosphere are pretty much all particles and magnetic fields from the Sun. Outside are those from the galaxy."

To understand the heliosphere, start by breaking apart the word, suggests David McComas, professor of astrophysical sciences at Princeton University in New Jersey. "Heliosphere" is the combination of two words: "Helios," the Greek word for the Sun, and "sphere," a broad region of influence (though, to be clear, scientists aren't sure of the [heliosphere's exact shape](#)).

The heliosphere was discovered in the [late 1950s](#), and many questions about it remain. As scientists study the heliosphere, they learn more about how it reduces astronauts' and spacecrafts' exposure to radiation and more generally, how stars can influence their nearby planets.

A balloon in space

Some radiation surrounds us every day. When we sunbathe, we're basking in radiation from the Sun. We use radiation to warm leftovers in our kitchen microwaves and rely on it for medical imaging.

Space radiation, however, is more similar to the radiation released by radioactive elements like uranium. The space radiation that comes at us from other stars is called galactic cosmic radiation (GCR). Active areas in the galaxy – like supernovae, black holes, and neutron stars – can strip the electrons from atoms and accelerate the nuclei to almost the speed of light, producing GCR.

On Earth, we have three layers of protection from space radiation. The first is the heliosphere, which helps block GCR from reaching the major planets in the solar system. Additionally, Earth's magnetic field produces a shield called the magnetosphere, which keeps GCR out away from

Earth and low-orbiting satellites like the International Space Station. Finally, the gases of Earth's atmosphere [absorb radiation](#).

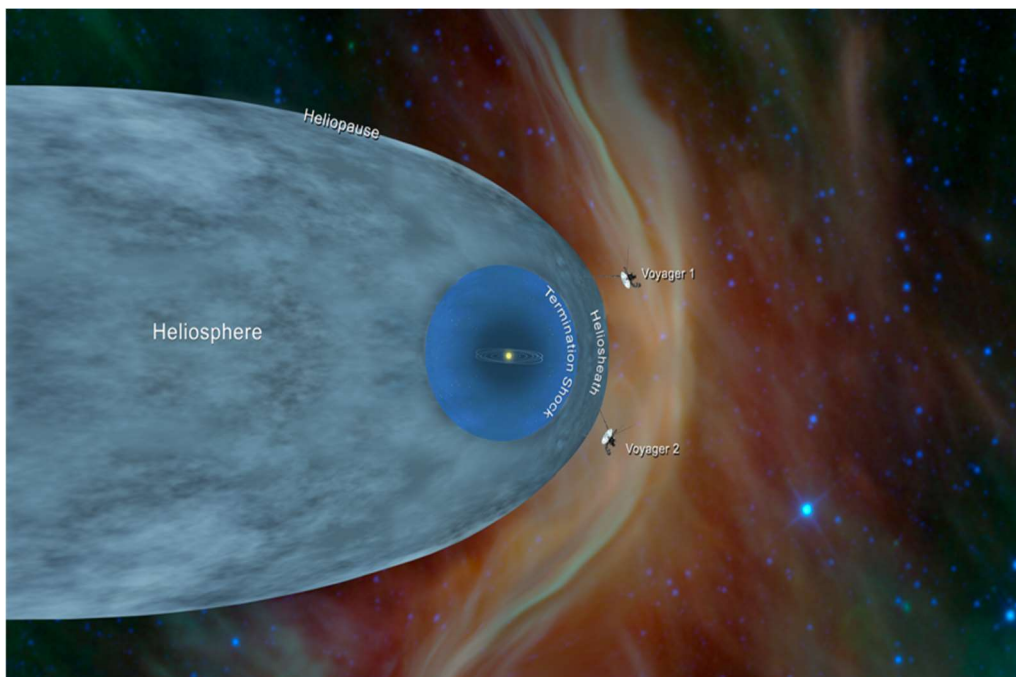
When astronauts head to the Moon or to Mars, they won't have the same protection we have on Earth. They'll only have the protection of the heliosphere, which fluctuates in size throughout the Sun's 11-year cycle.

In each solar cycle, the Sun goes through periods of intense activity and powerful solar winds, and quieter periods. Like a balloon, when the wind calms down, the heliosphere deflates. When it picks up, the heliosphere expands.

"The effect the heliosphere has on cosmic rays allows for human exploration missions with longer duration. In a way, it allows humans to reach Mars," said Arik Posner, a heliophysicist at NASA Headquarters in Washington, D.C. "The challenge for us is to better understand the interaction of cosmic rays with the heliosphere and its boundaries."

Anatomy of the heliosphere

There is some debate about the precise shape of the heliosphere. However, scientists agree that it has several layers. Let's look at the layers from inside outward:



This illustration shows the position of NASA's Voyager 1 and Voyager 2 probes, outside of the heliosphere, a protective bubble created by the Sun that extends well past the orbit of Pluto.

Credits: NASA/JPL-Caltech

- **Termination shock:** All of the major planets in our solar system are located in the heliosphere's innermost layer. Here, the solar wind emanates out from the Sun at full speed, about a million miles per hour, for billions of miles, unaffected by the pressure from

the galaxy. The outer boundary of this core layer is called the termination shock.

- *Heliosheath*: Beyond the termination shock is the heliosheath. Here, the solar wind moves more slowly and deflects as it faces the pressure of the interstellar medium outside.
- *Heliopause*: The heliopause marks the sharp, final plasma boundary between the Sun and the rest of the galaxy. Here, the magnetic fields of the solar and interstellar winds push up against each other, and the inside and outside pressures are in balance.
- *Outer Heliosheath*: The region just beyond the heliopause, which is still influenced by the presence of the heliosphere, is called the outer heliosheath.

How we study the heliosphere's outer reaches

Many NASA missions study the Sun and the innermost parts of the heliosphere. But only two human-made objects have crossed the boundary of the solar system and entered interstellar space.

In 1977, NASA launched [Voyager 1](#) and [Voyager 2](#). Each spacecraft is equipped with tools to measure the magnetic fields and the particles it is directly passing through. After swinging past the outer planets on a grand tour, they exited the heliopause in 2012 and 2018 respectively and are currently in the outer heliosheath. They discovered that cosmic rays are about three times more intense outside the heliopause than deep inside the heliosphere.

However, the picture the Voyagers paint is incomplete.

“Trying to figure out the entire heliosphere from two points, Voyager 1 and 2, is like trying to determine the weather in the entire Pacific Ocean using two weather stations,” Christian said.

The Voyagers work with the Interstellar Boundary Explorer (IBEX) to study the heliosphere. IBEX is a 176-pound, suitcase-sized satellite launched by NASA in 2008. Since then, IBEX has orbited Earth, equipped with telescopes observing the outer boundary of the heliosphere. IBEX captures and analyzes a class of particle called energetic neutral atoms, or ENAs, that cross its path. ENAs form where the interstellar medium and the solar wind meet. Some ENAs stream back toward the center of the solar system – and IBEX.

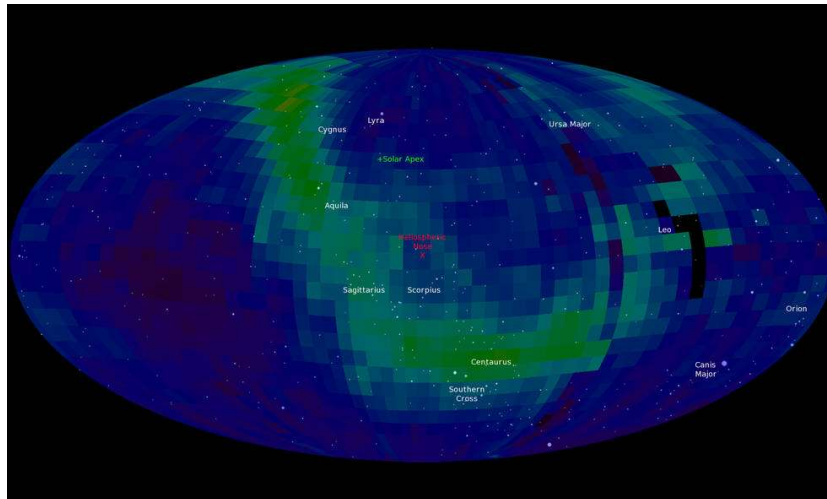
“Every time you collect one of those ENAs, you know what direction it came from,” said McComas, IBEX’s principal investigator. “By collecting a lot of those individual atoms, you’re able to make this inside out image of our heliosphere.”

In 2025, NASA will launch the Interstellar Mapping and Acceleration Probe (IMAP). IMAP’s ENA cameras are higher resolution and more sensitive than IBEX’s.

Mysteries abound

In 2009, IBEX returned a finding so shocking that researchers initially wondered if the instrument may have malfunctioned. That discovery became known as the **IBEX Ribbon** – a band across the sky where ENA emissions are two or three times brighter than the rest of the sky.

“The Ribbon was totally unexpected and not anticipated by any theories before we flew the mission,” McComas said. It’s still not entirely clear what causes it, but it is a clear example of the mysteries of the heliosphere that remain to be discovered.



NASA's Interstellar Boundary Explorer, or IBEX, studies the heliosphere from its orbit around Earth. IBEX's first-ever skymap showed a surprising feature dubbed the "IBEX ribbon."

Credits: NASA/IBEX

“Our Sun is a star like billions of other stars in the universe. Some of those stars also have astrospheres, like the heliosphere, but this is the only astrosphere we are actually inside of and can study closely,” said Justyna Sokol, a research scientist at Southwest Research Institute in San Antonio, Texas. “We need to start from our neighborhood to learn so much more about the rest of the universe.”

By Alison Gold

NASA's Goddard Space Flight Center, Greenbelt, Md.

Gresham College Lectures

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

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

[The End of Life on Earth](#)

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

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

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

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

[The End of the Universe](#)

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

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

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

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

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

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

Leo Taylor

Communications Intern

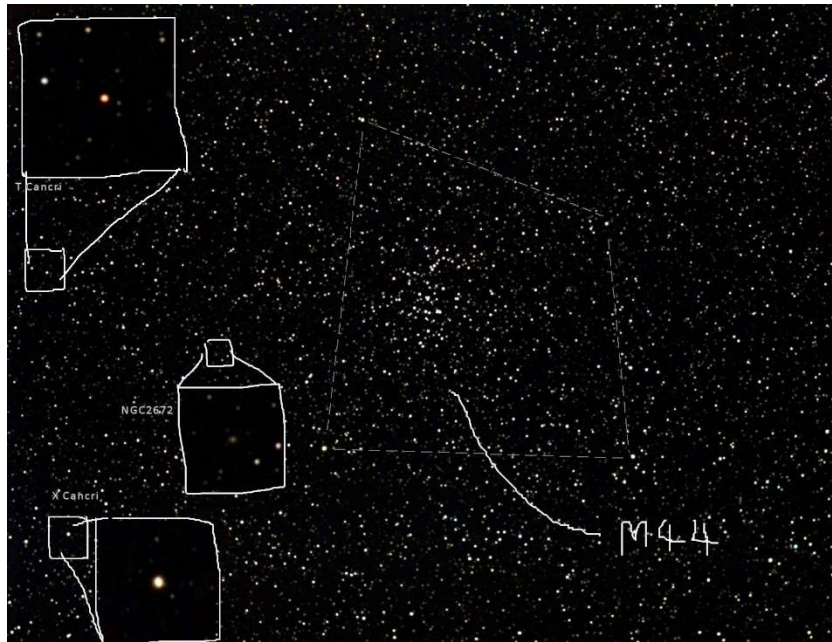
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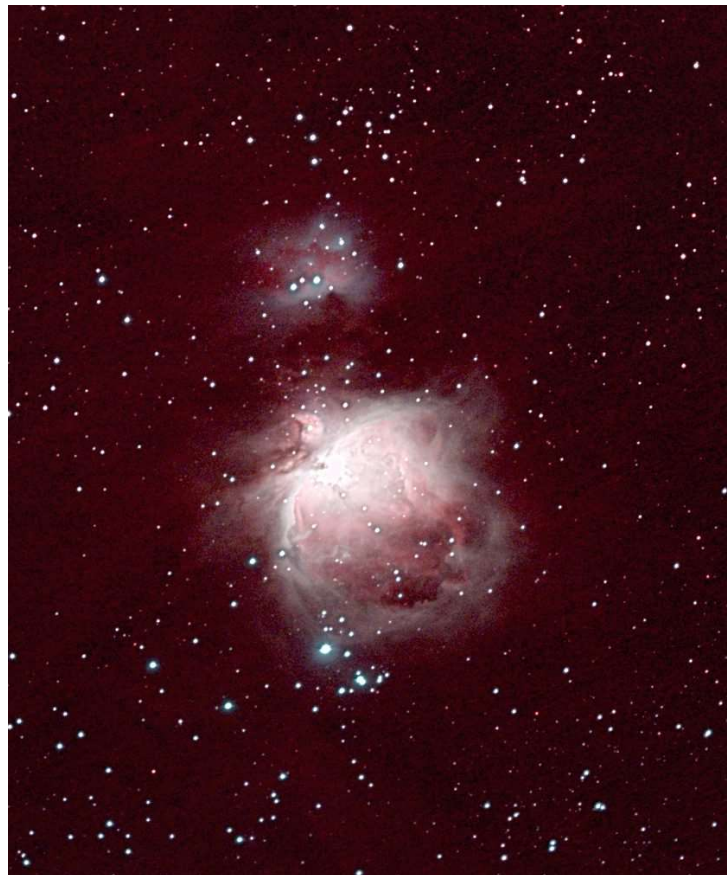
<https://www.gresham.ac.uk/>

Members Astro-photographs.

Dan Self



M44 area in Cancer 26X30sec



Canon 135mm F2 Lens, LEnhance filter M42 68X30Sec



Comet E3ztf 35X30sec



Roseta Nebula 47X30sec 135mm F2 lens LEnhance filter



IC423 Ghost nebula near Orion's belt 20" observatory telescope



IC424 near Orion's belt



NGC1999 Keyhole nebula Orion 9X30sec.

Malcolm James Dent



SHO process of IC410. 9 hours on target has given me some good quality data to bring out those little tadpoles.



The Running Man Nebula - NGC 1977 or Sh2-279



The Horsehead Nebula in HaGB



M63 or The Sunflower 3 hours of data in using RGB filters.

Roger Hyman



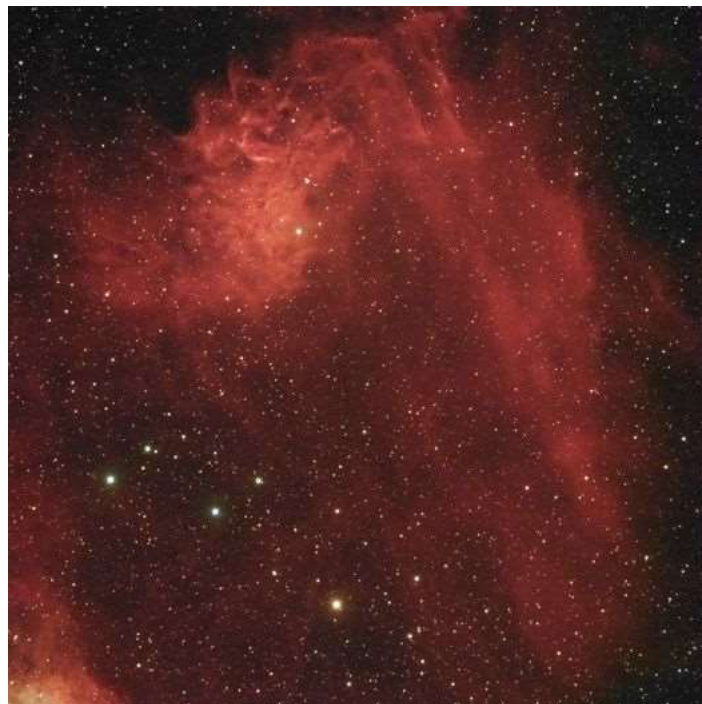
1st January 2023 at 23:30 UT. William Optics ZenithStar 126 with Saturn-C SQR camera on Skywatcher AZ-EQ6 Pro. Best 35% from 380 frames in ASI3, Registax 6 and adjusted to taste in Photoshop.



Orion Nebula (M42). Image is made up of 60 x 30 seconds at 300 gain with William Optics Z126, Saturn-C camera with Optolong Ultimate filter on Skywatcher AZ-EQ6 Pro mount. Processed in APP and Photoshop.



M1 - The Crab Nebula 90 x 60 seconds at 300 gain with a William Optics Z126, Player One Saturn-C camera on a Skywatcher AZ-EQ6 Pro mount. Captured with SharpCap Pro 4 and processed in APP and Photoshop 2023.



The Flaming Star Nebula' in Auriga. Optolong Ultimate filter. William Optics GT71

William Optics 68III A x0.8 reducer/flattener Baader UV/IR cut filter Player One Saturn-C camera

Skywatcher AZ-EQ 6Pro mount. 420 x 60 second @ 300 gain. Captured with SharpCap Pro 4 and processed in APP and Photoshop 2023.



Comet 2022 E3 ZTF approaching Aldebaran in Taurus. 200 x 1 minute at 200 gain GT71 with 68III A 0.8 reducer/flattener and Saturn-C camera, Skywatcher AZ-EQ6 R Pro mount. Captured in SharpCap and processed in APP and Photoshop.



Orion and 'Running Man' Nebula. . GT71 with 68III A reducer/flattener, Baader IR/UV cut filter, Saturn-C camera Skywatcher AZ-EQ6 Pro. Captured in SharpCap and processed with APP and Photoshop.

Trevor Mayes



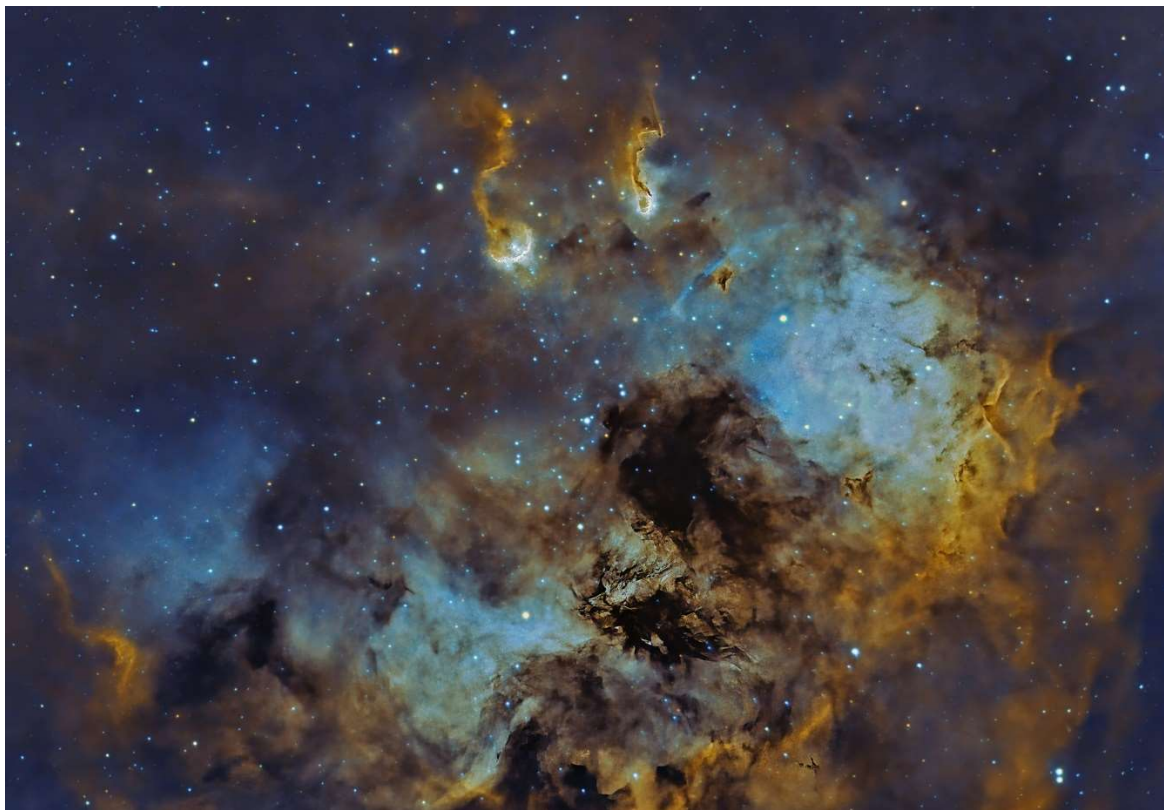
Canon 80D

EQ5 mount

Skywatcher 150pds

Single frame

Andy Weller



Neil Wilson



Celestron 9.25" EdgeHD + Hyperstar V4 Altair 26C Protec camera @ -10C
60mm guide scope + ZWO ASI120MC Skywatcher AZ-EQ6 mount
Captured with N.I.N.A. Stacked with Deep Sky Stacker
Processed with Photoshop and Starnet ++ 50 x 20 second light frames 10 x flat frames



C-2022 E3 (ZTF) 21st Jan Same equipment as above.



The Iris Nebula NGC 7023 © Neil Wilson 2023

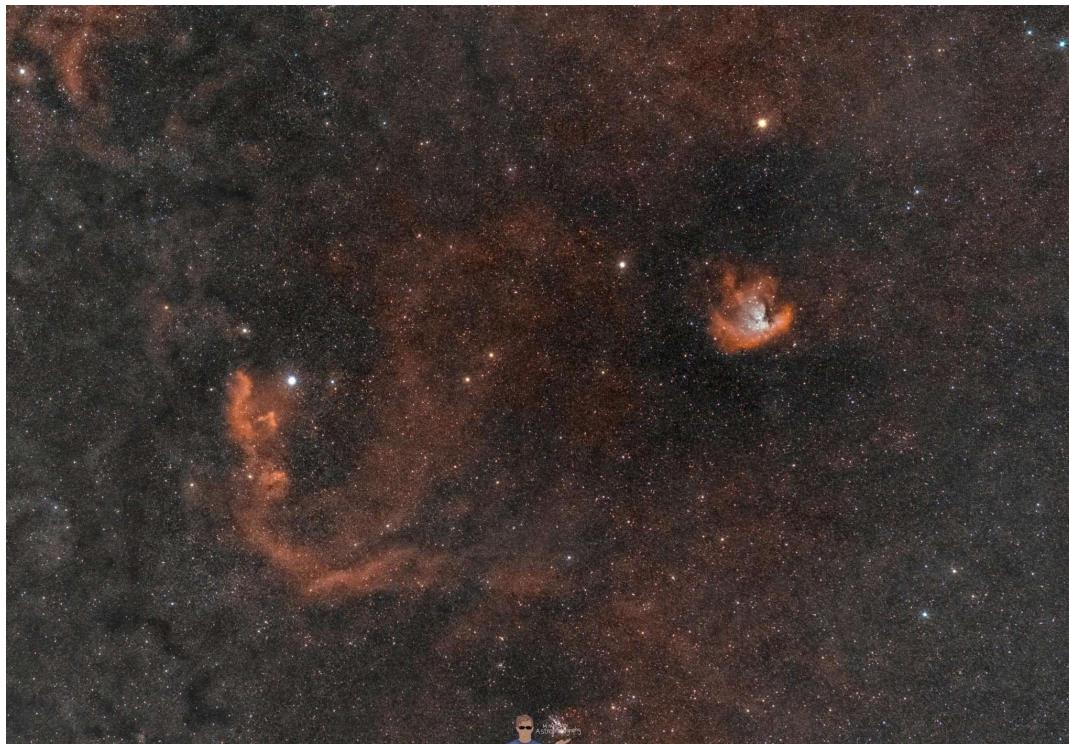
The Iris nebula, a bright reflection nebula in the constellation of Cepheus.
Celestron 9.25" EdgeHD + Hyperstar V4 Altair 26C Protec camera at -10C
Skywatcher AZ-EQ6 mount. 60 x 60 second light frames + flats + bias frames.



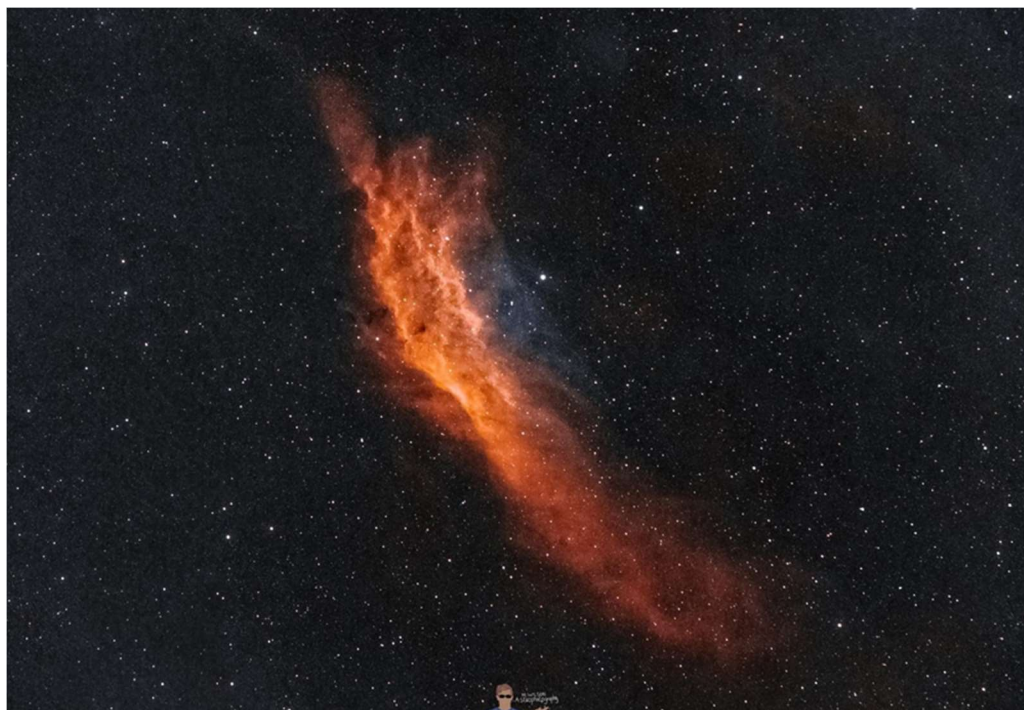
SH2-261 Lower's Nebula © Neil Wilson 2023

Celestron 9.25" EdgeHD + Hyperstar V4, Altair 26C Protec camera at -10C
Skywatcher AZ-EQ6 mount, 60mm guide scope + ZWO ASI120MC
40 x 60sec light frames, 20 x Flat frames, 20 x Bias frames
Captured with N.I.N.A. and PHD2
Processed with Astropixelprocessor, Photoshop and Starnet++

Michael James Wilson

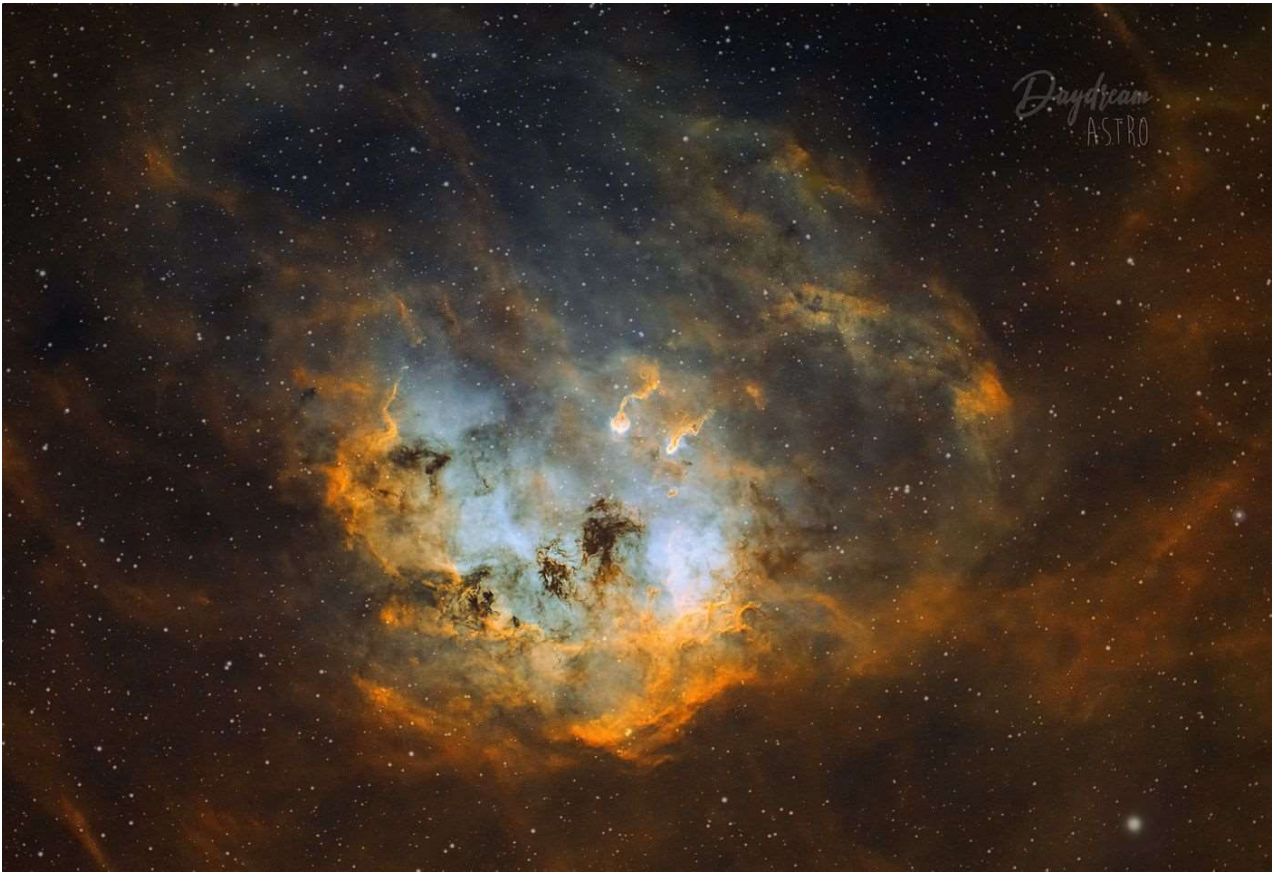


Canon 6D UV/IR cut filter mod, Samyang 135mm F/2.8
Astronomik 12nm Ha clip filter, Astronomik 12nm OIII clip filter
Sky Watcher Star Adventurer star tracker Manfrotto 055 tripod
Stacked in DSS. Edited in Starnet++V2, Photoshop and Lightroom



The California nebula in HOORGB Canon 6D UV/IR cut filter mod
Astronomik 12nm Ha clip filter. Astronomik 12nm OIII clip filter
Samyang 135mm F/2.8 Sky Watcher Star Adventurer star tracker Manfrotto 055 tripod
Stacked in DSS. Edited in Starnet++V2, Photoshop and Lightroom

Rachael Riot

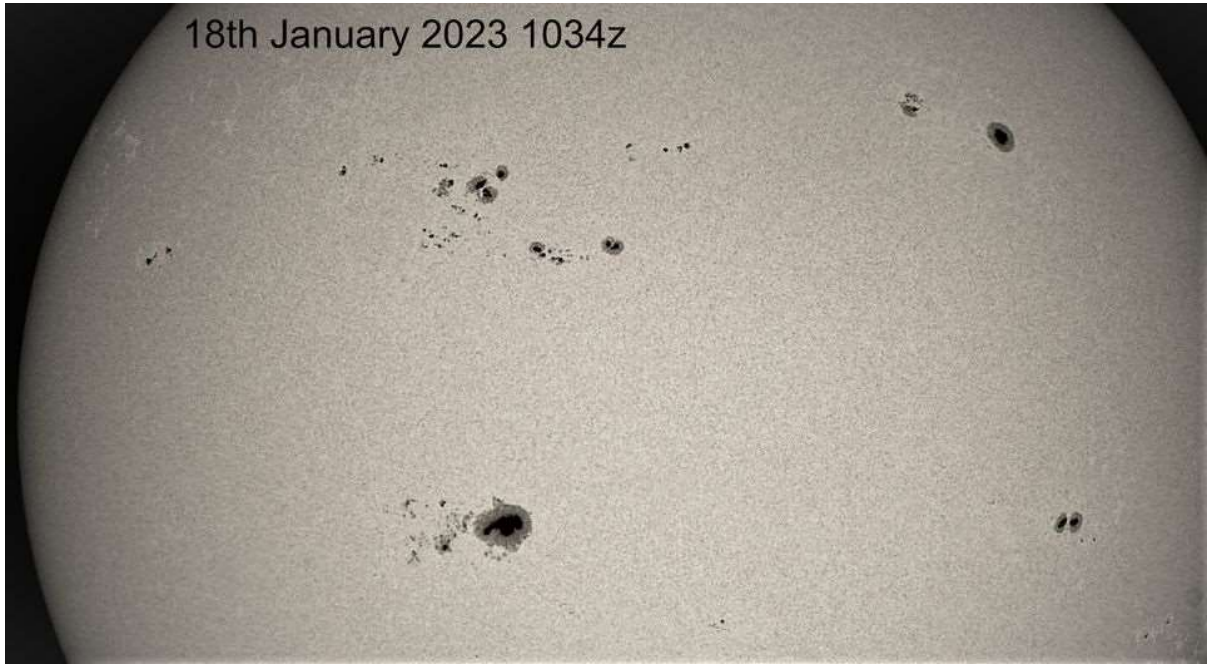


IC410 - Tadpole Nebula in Auriga, 12.5 hrs total integration, 3nm SHO Optolong filters

Georgina Isherwood



Chris Bailey





BRECKLAND ASTRONOMICAL SOCIETY

Charity No.1044478

www.brecklandastro.org.uk

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

Dr Dan Self, Chairman, 56 Lindley Street, Norwich, Norfolk, NR1 2HF.

07734 364667 chairman@brecklandastro.org.uk

OBSERVATORY RISK ASSESSMENT 2022

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

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

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

Section 2 - Risk Assessment

Hazards (<i>visit leaders must identify any additional hazards 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	Tolerable

	field. Responsibility with teachers/akelas.	
Pre-existing medical conditions	Visitors have been asked to bring with them anything they need with regard to medicine/ first aid training. DS is first aid trained as part of job.	Tolerable
In the Observatory: Moving the telescope dome - Mechanical hazard from cogs and metal clips on dome motors and sliding parts. Falling from dome.	Supervision is necessary to prevent visitors' fingers being caught in dangerous places before moving. Train supervisors. Gears are located in inaccessible places. Signs to keep head out of opening while moving it. Failure of clips holding very difficult due to strong fastening.	Tolerable Tolerable
Electrical hazards	All electrical circuits are protected by RCD trip switches, which have been checked. Equipment should only be used by trained demonstrators as PAT testing is not viable.	Tolerable
Light intensity from laser pointer, bright LEDs	A low power class 2 laser can be used to collimate scope, this should not be used during visits. An upper end- class 2 green laser is sometimes used for pointing out stars outside. This should NOT be pointed near people, or planes, only switched on briefly and used by supervisors/demonstrators only. Laser is currently broken.	Low
Skin contact with dangerous chemicals	Fly spray, propanol, and cleaning fluid kept in cupboard in small quantities. Keep cupboards shut when visitors are present and supervise.	Tolerable
Standing in dome - Falling (height is 7 feet)	Shutter opening is guarded by 2 bars at child / adult heights. Limit numbers in dome 7 + supervisors can easily fit.	Tolerable
Standing in dark places - Stumbling in low light	Use dim red lights on floor to preserve night vision. Dim lights gradually.	Low
Climbing ladder in dark - Falling while viewing through telescope.	Ladder must be shown to people first, but enough light is available. Check for mobility difficulties.	Tolerable
Ascending stairs - Falling or being hit with trap door	Be sure demonstrator to go up first and lock door open. A knocking procedure is known if the door is shut.	Tolerable
Fire risk	Large items are not flammable. Mainly metal fixtures and fittings. Sources of ignition (sparks) are contained in electrical equipment. Flammable gases are not kept in building. Radio linked smoke alarms installed. Fire extinguishers available and annually checked. Call 999 in emergency. Can exit via dome opening in emergency	Tolerable

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

Trustees as of 17/04/2022 are: Dr Dan Self ⁺(Chairman), Andy Jones⁺ (Treasurer), Richard Harmon. Committee members (acting trustees): Rebecca Greef^{*}, John Copsey. Trusted supervising members: Mick Ladner, John Gionis, Peter Farmer, Andrew Luck, Chris Bailey.

^{*}DBS checked for day job. ⁺Frist Aid trained for day job

Signed.....
Chairman, Breckland Astronomical Society, UKCC 1044478.

For Sale or Wanted

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

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

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

Beautiful Orion Optics UK VX12 1/10th Pwave Newtonian Reflector

in pristine condition that has a brand new Moonlite focuser and comes with the original ACU-2S Crayford Focuser, Hotech SCA-1.25C Crosshair Laser Collimator together with a special professionally hand made protective cover. Fantastic telescope, bargain at £1200.

Due to size and weight, collection only please. I would consider meeting within 50 miles of Lowestoft.





Contact Jim Slight - j.slight@btopenworld.com

Equipment available for loan to Members

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

Refractors:

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

SCT/Maks:

Celestron C925 Starbright F10 SCT FL D234.95mm F2350mm f/10 Refractor – preferably this should not be taken off the premises.

Celestron C8 SCT D203.2mm F2000mm f/10 Refractor (orange tube)

Meade LX200R SCT D203.2mm F2000mm f/10

Konus Motormax-90 Maksutov-Cassegrain 90mm F1200mm f/13 #1795

Meade ETX125 D127mm F1900mm f/15 Maksutov-Cassegrain Reflector

Mak-Newt:

Skywatcher 190MN DS Pro Maksutov-Newtonian Optical Tube Assembly D190mm F1000mm

Dobsonians:

Skywatcher Skyliner 200mm F1200mm Dobsonian Reflector

Helios D200mm F1000mm Dobsonian Reflector

8-inch Dobsonian (turquoise tube, hand-made)

Solarscope:

Coronado Solarmax 40

Meade 8x50mm Guide Scope

Binoculars:

Vanguard KR-7500 7X50mm Field 7 degrees Binoculars – a little out

Konus #2253 7x50 Field 6.8° 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 Teleneegative 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 1 1/4"+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)

