The Jeety Starn

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Welcome to Issue 7 of *The Jeety Starn*, the quarterly newsletter of the Stirling Astronomical Society. Among the articles in this issue are items on the Astrolabe and early Dutch astronomers, an update on the Blue Ghost and iSpace Resilience missions, and our regular ration of literary morsels. We start with an article on the unusual Kapteyn's Star.

Kapteyn's Star – a Galactic Interloper

By Alan Cayless FRAS

From one year to the next, the stars rise in their familiar constellations. Within a normal human lifetime these patterns appear unchanging, and indeed the stars of the constellations are often referred to as the *fixed stars* to distinguish them from the wandering planets. However, the fixed stars are not truly fixed: all stars move through space. Most stars move collectively with the rotation of the galaxy, and superimposed on this mass motion, individual stars move relative to one another. As seen from Earth this relative motion is almost imperceptible, but can be detected if measured carefully over a long enough period of time, especially for the nearer stars.

A star's motion relative to the Sun can be divided into two components – a radial component directly towards or away from the Sun, and a tangential component across the line of sight. The tangential component produces a gradual change in position which can be detected as a change in angular separation from other stars. This is known as a star's *proper motion* and can be measured by comparing a star's position against much more distant background stars. While the radial component does not cause any change in apparent position it can be detected and measured spectroscopically, through the Doppler effect.

The proper motions of most stars are very small – only fractions of a second of arc per year – meaning that their positions do not change appreciably over many hundreds or even thousands of years. Modern satellites such as Hipparcos can measure positions with extreme accuracy and hence identify proper motions as small as a few thousandths of an arcsecond per year, but historically only those nearby stars with larger transverse velocities had proper motions large enough to be detected through observations built up over many years.

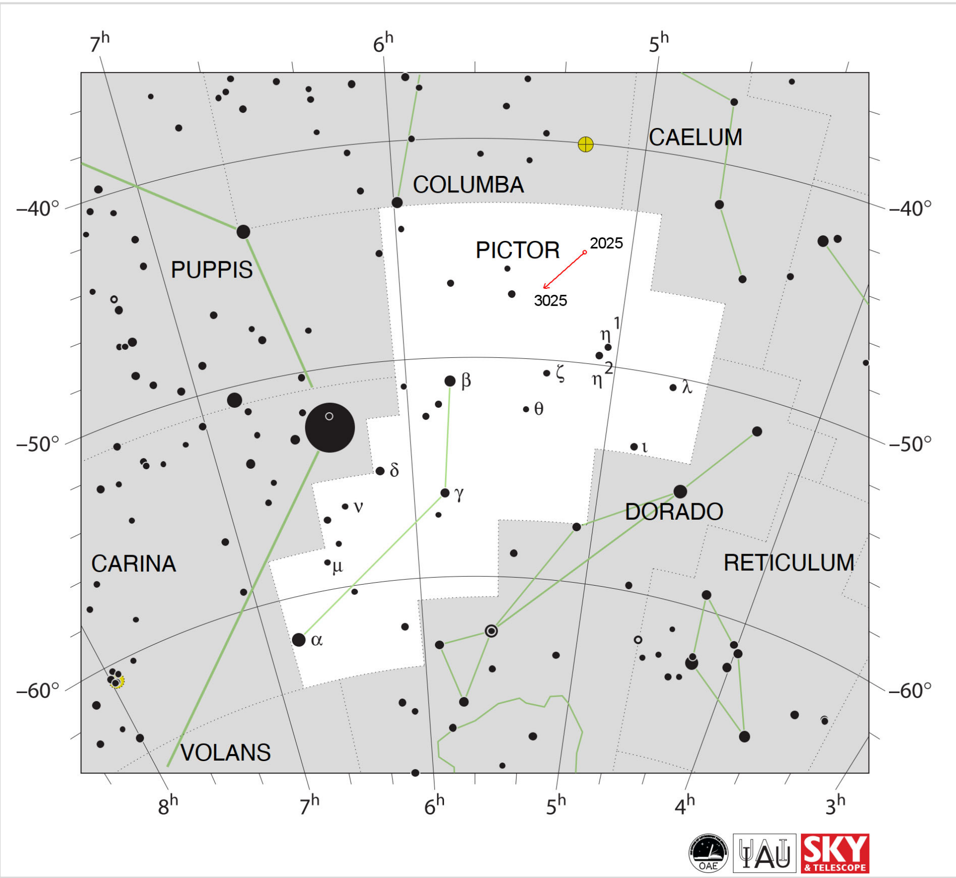
In the late 19th century, Dutch astronomer Jacobus Kapteyn (1851 – 1922) embarked on a systematic survey of the motions of stars in the southern sky, based on a series of photographic plates captured by Sir David Gill (1843 – 1914) at the Cape of Good Hope Observatory.

Dutch astronomer Jacobus Cornelius Kapteyn, (1851–1922). Painting by Jan Veth.

Over a number of years, Kapteyn took painstaking measurements of the parallax and proper motions of stars on hundreds of these plates, with the aim of understanding the overall structure and movement of the Galaxy. By combining these measurements with radial velocities determined from Doppler shifts, Kapteyn was able to calculate the true motions through space of many thousands of stars. From a statistical analysis of these results, Kapteyn identified two streams of stars moving in opposite directions (Kapteyn 1922). These were later interpreted as evidence of the overall rotation of the galaxy, with stars on one side of the Sun moving more slowly, and stars on the other side more rapidly.

Early on in this epic endeavour, Kapteyn noticed a strange anomaly on one of the plates. In 1897, while making measurements on a plate covering part of the constellation Pictor, Kapteyn noticed that a star that had previously been catalogued in 1873 was not in the expected position. Apparently missing from its original position, an identical star was found a little distance away by Scottish astronomer Robert Innes. It quickly became apparent that this was the same star, and that it had moved significantly since it was originally catalogued.

Also designated VZ Pictoris, the star has become better known as *Kapteyn's Star*. Moving at over 8.5 arcseconds per year, Kapteyn's Star had the highest proper motion of any known star until the discovery of Barnard's Star in 1916, and is still second on Hipparcos' list of 150 stars ordered by their proper motions (Hipparcos 1997).



Kapteyn's Star in the constellation Pictor. The red circle indicates the current position of Kapteyn's Star, and the red arrow shows its motion over the next thousand years. Based on a diagram originally produced by IAU / Sky & Telescope (CC BY 4.0).

While perhaps overshadowed by its more famous rival, Kapteyn's Star is only second in the proper motion stakes because of its greater distance of 12.8 light years. With a total velocity of 288 metres per second, Kapteyn's Star is actually moving through space more than twice as fast as Barnard's Star. Even more interestingly, this rapid motion is in the opposite direction to the stars around it – against the general flow of the galactic rotation (Kotoneva *et al.* 2005). Spectroscopically, Kapteyn's Star is a Class M red subdwarf: an ancient type of star more commonly found in globular clusters. Unlike the stars around it, Kapteyn's Star belongs to the halo of the Galaxy, and is currently passing through the disk on its own eccentric orbit. A true galactic interloper!

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PICTOR

Pictor is a Southern Hemisphere constellation, between the Large Magellanic Cloud and the star Canopus. The name means *painter* and the constellation was originally named Equuleus Pictoris (painter's easel) by the French astronomer, Abbé Nicolas-Louis de Lacaille, in 1756. Six stars in Pictor are now known to have exoplanets. Kapteyn's Star is the nearest star in Pictor to Earth at 12.76 light-years distant.

Dutch Astronomers 1

By Sandi Cayless

The science of astronomy must be counted as one of, if not the, oldest in the world, being inextricably linked with agriculture from the dawn of that early discipline. There are of course numerous justly-renowned historic figures that feature in the science, but for such a small country which has (currently) a population over 18 million people that live within a land area of 41,850 km² (16,160 mi²), 26% of which is below sea level, the Netherlands has produced a remarkable number of brilliant astronomers that have made their marks on the science.

This is part one of a series that deals with some of them and their outstanding achievements. Here we look at two of the earliest, Willebrord Snel van Royen, and Christiaan Huygens.

Willebrord Snel van Royen (1580-1626)

Willebrord Snel van Royen, known as Willebrordus Snellius or Snell, was a 17th century Dutch astronomer and mathematician (1580-1626) born in Leiden. His father Rudolph was a mathematics professor at the University of Leiden and Willebrord, who studied law but had an interest in mathematics, began to teach mathematics at the University in 1600 (van Berkel *et al*. 1999a). He soon left to travel, associating with many illustrious scholars. In Würsburg he met Adriaan van Roomen (a mathematician, the professor of medicine at the University of Würzburg, and famous for, *inter alia*, solving the Problem of Apollonius and calculating π (pi) to sixteen decimals); in Prague, Snel carried out observations with Tycho Brahe and Johannes Kepler. He then went to Altdorf and Tübingen, where he met Michael Maestlin, the German astronomer and mathematician who was the teacher and mentor of Johannes Kepler, and recognised for calculating the first known decimal approximation of the (inverse) golden ratio (O'Connor & Robertson 2001). Snel was in Paris in 1602 to study law, and from there he went to Switzerland, and back to Leiden in 1604.

In Leiden, Snel spent his time studying mathematics, publishing translations of well-known mathematical treatises and restoring the books of Apollonius on plane loci (van Berkel *et al*. 1999a). In 1608 he received his MA and married, and after his father's death (1613), he officially succeeded him in 1615 as professor of mathematics at the University of Leiden. Snel's main interest was geodesy and he gave himself the task of working out the length of the Earth's meridian using the triangulation method suggested by Gemma Frisius (Haasbroek 1968), describing his methods in his work *The terrae Ambitus vera quantitate*, or *Eratosthenes batavus* (1617), under the pseudonym "The Dutch Eratosthenes" (Snel was probably the first after Eratosthenes (3rd century BCA) to use such triangulation for this purpose). Snel's estimate of 28,500 Rhineland rods equates to 107.37 km for one degree of latitude, giving the circumference of the Earth as 38,653 km, the actual being 40,075 km, an underestimation of 3.5%.

Astronomy was also an abiding interest, and in 1618 Snel published some observations of Jost Bürgi (a scientific instrument maker and key in creating the first astronomical charts) and Tycho Brahe. In November of that year he made observations of the Great Comet of 1618 (C/1618 W1), publishing a tract on it in 1619, showing that the comet was beyond the moon (van Berkel *et al*. 1999a). He also worked on determining π, and helped by van Ceulen's method (basically that of Archimedes), he calculated it to thirty four decimals. Snel also taught navigation and in about 1625, he concentrated his studies on plane and spherical trigonometry.

Snel died in 1626 at 46 years of age, and it was after his death that it was discovered that he had formulated the law of refraction of light rays (Snell's Law) as early as 1621. However, it is now known that Snell rediscovered the law – it was known to Ibn Sahl, a Persian mathematician and physicist, in 984 (Rashed, 1990).

The lunar crater Snellius is named for Snel, as is the Snellius Glacier in Antarctica; and the Royal Netherlands Navy has named three survey ships after him, including a currently-serving vessel (HNLMS Snellius (A802), a hydrographic survey vessel).

Christiaan Huygens (1629-1695)

Christiaan Huygens, a Dutch physicist, mathematician, astronomer and inventor, was born on 14 April 1629 into a wealthy and cultured family. He was educated at home by his father and private tutors until 1645, when he went to study law and mathematics at Leiden, transferring two years later to the Illustrious School at Breda (van Berkel *et al*. 1999b). He gained a degree from the University of Angers in 1655.

At home Huygens socialised with the likes of René Descartes and Marin Mersenne, and being wealthy, could pursue his own interests. From the late 1640s and into the 1650s he worked on hydrostatics, mathematics and geometrical optics, but astronomy was a lifelong interest. He and his brother Constantijn began making lenses and telescopes in 1654, and using one of the first of their creations, Huygens discovered Saturn's largest moon (later called Titan) in 1655. He and Constantijn ground their telescope lenses themselves, Christiaan devising a new and better way of grinding and polishing the lenses (O'Connor & Robertson 1997): many examples held in the Rijksmuseum Boerhaave in Leiden are signed with the brothers' names (Anon 2025a). In 1655 he visited Paris for the first time to discuss his discovery of Titan with French mathematicians and learnt of the work ongoing on probability in correspondence between Pascal and Fermat. Back in Holland, Huygens wrote *De Ratiociniis in Ludo Aleae*, on the calculus of probabilities: this was the first printed work on the subject (O'Connor & Robertson 1997). In 1656 he solved Saturn's odd appearance by correctly inferring that the planet had a ring, and in his *Systema Saturnium* (1659), Huygens explained the phases and changes in the shape of the ring. In 1656 he had patented the first pendulum clock and in 1657 he published his *Horologium*, detailing the same. He built various pendulum clocks to ascertain longitude at sea, which underwent sea trials in 1662 and later in 1686. By the time he was 30 years old he was already established as a leading European scientist (van Berkel *et al*. 1999b), travelling, and corresponding with many of the leading minds of the time. He became a member of the Royal Society of London and of the Académie Royale des Sciences.

Huygens lived in Paris between 1666 and 1681 (with gaps in 1670-71 and 1675-6 due to illness), returning to Den Haag (The Hague) permanently in 1681 due to religious unrest in France. There he divided his time between the family city home and the country house in Voorburg. In his mathematical work on the pendulum, he worked out how to make the mechanism isochronous, building a complete mathematical physics of the subject. Published as *Horologium Oscillatorium* in 1673, in it he gave the formula for acceleration in a circle, necessary for combining celestial and terrestrial physics (van Berkel *et al*. 1999b). As a result of his derivation of the law of centrifugal force for uniform circular motion, Huygens, along with Hooke, Halley and Wren, formulated the inverse-square law of gravitational attraction (O'Connor & Robertson 1997). The Huygens brothers made a large number of lenses over the years, and in the 1660s, Christiaan had discovered a field lens and ocular combination that gave a compound eyepiece that partly counteracted optical defects – the *Huygens Eyepiece* (van Berkel *et al*. 1999b). He did not grind lenses while in Paris but back in Den Haag from 1681 onwards, he and Constantijn ground a lot of long-focus lenses, many of which survive, and he worked on lens and lens-system geometry, although his work in this field was published posthumously.

Huygens was an accomplished Cartesian and mathematical physicist, and had in his early work on the collision of elastic bodies corrected Descartes' faulty laws of impact (O'Connor & Robertson 1997; van Berkel *et al*. 1999b), although in 1672, having heard of Newton's work on the telescope, wrongly criticised *his* theory of light, particularly his theory of colour. Years later (1690) Huygens published *Traité de la Lumiére* in reply to Newton's *Principia*. Although an admirer of Newton, he did not believe the theory of universal gravitation, which he said appeared to him absurd. In his own work Huygens gave a wave construction that clarified the rectilinear propagation of light (i.e. the wave theory of light, later adapted by Fresnel, and still influential in optics – the Huygens-Fresnel principle) and the double refraction of Iceland spar, and, in a section on the cause of weight, he explained gravity by using Cartesian vortex mechanics. His approach was regarded as the best of the Cartesian theories of terrestrial gravity, though it did not account for universal gravitation or the inverse square law (Ferlin & Chabot 2020).

Huygens also described, in about 1691 in his *Lettre touchant le cycle harmonique*, a means of producing the 31-tone equal temperament (aka the tricesimoprimal, the tempered scale derived by dividing the octave into 31 equally-proportioned steps instead of the usual 12). This invention gave rise to what would become the Fokker organ, and indirectly lead to a tradition of 31-tone music in the Netherlands (Anon 2025b; O'Connor & Robertson 1997). Towards the end of his life Huygens wrote the popular *Kosmotheros*, describing the new discoveries of the seventeenth century, the latest proportions of the solar system, and including one of the earliest discussions of extraterrestrial life (it was published in 1698). Huygens died on 8 July 1695.

A number of monuments to Huygens exist in various Dutch cities including Rotterdam, Delft, and Leiden. Also named in honour of the great scientist, the ESA's Huygens probe was carried aboard the Cassini orbiter spacecraft as it travelled to Saturn. Launched on 15 Oct 1997, it was designed to study the smog-like atmosphere of Saturn's largest moon as it parachuted to the surface; it also carried cameras to photograph Titan's surface. Huygens landed on Titan on 14 Jan 2005, the first landing by a spacecraft in the outer solar system, and the most distant landing from Earth (Siddiqi 2018; NASA 2024). The genius of Christiaan Huygens has also been recognised elsewhere; some of these credits are listed in the table on the right.

Christiaan Huygens: Recognitions
Asteroid 2801 Huygens: Main belt asteroid of perihelion 2.32 AU and a period of 4.69 years (MPC 2025)
Huygens impact crater, Mars: Largest such with a near intact rim; ~ 467.25 km diameter and located in the Iapygia quadrangle at 304.42°W 13.88°S (ESA 2004)
Mons Huygens: The highest mountain in the Moon's Montes Apenninus range
Huygens Gap: A dark region discovered in 1981 in Voyager 2 images; located at the inner edge of the Cassini Division (NASA 2006) containing the dense, eccentric *Huygens Ringlet* in the centre
Huygens Ringlet: A narrow eccentric ringlet ~ 250 km exterior to the outer edge of Saturn's B ring (Spitale & Hahn 2016)
Horologium constellation: Created and named for Huygens by French astronomer Nicolas Louis de Lacaille; in the southern sky, it has no bright stars, but has three stars with known exoplanets and the Horologium Supercluster (Constellation Guide 2025)
Huygens-Fokker Foundation: Centre for microtonal music from 1960, it sits in Amsterdam's Muziekgebouw aan 't IJ; named for Huygens and Adriaan Fokker, creator of the Fokker organ (Stichting Huygens-Fokker 2025)
Le prix Descartes-Huygens: An annual scientific prize inaugurated in 1995 by the French and Dutch governments to finance one or more research visits in the Netherlands or in France (Institut Français-NL 2025)
MS Christiaan Huygens: A Dutch ocean liner built in 1927, requisitioned as a troopship at the start of WW II and used in the Mediterranean Sea and Indian Ocean. She struck a mine in the Scheldt on 26 August 1945, was beached, and later broke in two (Stichting Maritiem-Historische Databank 2025).

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Christaan Huygens (1629-95) Christiaan Huygens, the astronomer, by Caspar Netscher (1671); Rijksmuseum Boerhaave, Leiden, public domain.

A Quote or Two...

Einstein, Albert (1879-1955)
Only two things are infinite, the universe and human stupidity, and I'm not sure about the former.

The difference between stupidity and genius is that genius has its limits.

Ellison, Harlan (1934-2018)
The two most abundant things in the universe are hydrogen and stupidity.

Eliot, T. S. (1888-1965)
We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time.

Ennius, Quintus (239-169 BCE)
No one regards what is before his feet; we all gaze at the stars.

Euler, Leonhard (1707-1783)
For since the fabric of the universe is most perfect and the work of a most wise Creator, nothing at all takes place in the universe in which some rule of maximum or minimum does not appear.

Faraday, Michael (1791-1867)
Nothing is too wonderful to be true.

Fermi, Enrico (1901-1954)
If I could remember the names of all these particles, I'd be a botanist.

Feynman, Richard (1918-1988)
I believe that a scientist looking at non-scientific problems is just as dumb as the next guy.

You can know the name of a bird in all the languages of the world, but when you're finished, you'll know absolutely nothing whatever about the bird... So let's look at the bird and see what it's doing -- that's what counts. I learned very early the difference between knowing the name of something and knowing something.

Poets say science takes away from the beauty of the stars – mere globs of gas atoms. I, too, can see the stars on a desert night, and feel them. But do I see less or more?

Fulghum, Robert (1937-)
Sirius, the brightest star in the heavens.... My grandfather would say we're part of something incredibly wonderful – more marvellous than we imagine. My grandfather would say we ought to go out and look at it once in a while so we don't lose our place in it.

G'Kar of Narn, Babylon 5
The universe is run by the complex interweaving of three elements: energy, matter, and enlightened self-interest.

Gagarin, Yuri (1934-1968)
I see Earth! It is so beautiful!

Jodrell Bank Observatory

By Graem Farland

The Jodrell Bank Observatory is a world-leading deep-space radio observatory that is near the town of Macclesfield in England. It is a UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Site and has won many visitor awards.

The radio observatory was set up in 1945 by Bernard Lovell, who was a radio astronomer at the University of Manchester. In the beginning, Jodrell Bank did research on cosmic rays; these were detected by radar echoes. Advances moved the science of radio astronomy forward into the 1960s and led to major changes in our understanding of the universe. The observatory carries out very significant work. It has several radio telescopes and outbuildings as well as the Control Building. Jodrell Bank has done (and is still doing) a lot of important scientific work including studies of the moon, meteors, quasars, quantum optics (how photons interact with atoms and molecules), pulsars, masers and gravitational lensing, and its instruments are used to track space probes and spacecraft.

Inside the large First Light Pavilion building of Jodrell Bank there is a new exhibition describing the ground-breaking work done by the scientists and engineers over the years. It has interactive displays, projections and historical objects and the presentations lead from the early days to the Space Race, the Cold War and up to the present day. It teaches visitors all about radio astronomy, and they can listen to the sounds of a black hole and see the live signals that the gigantic Lovell Telescope receives. There is also a planetarium show that takes a trip round the night sky.

Outside, visitors can be involved with the whispering dishes. These are two steel dishes parabolic in shape that are 40 metres apart; they let people hear each other whispering, and are designed to show how successful a paraboloid reflector is in magnifying weak radio signals (this is how the Lovell Radio Telescope works). There are also a playground and arboretum on the site, as well as picnic areas, cafes and a gift shop.

The Jodrell Bank Observatory is part of the University of Manchester's Jodrell Bank Centre for Astrophysics. The main telescope on the site is the Lovell Telescope; this is the third largest steerable radio telescope in the world (70 m diameter). Three other operating telescopes are also there. The Mark II (finished in 1964) is 38.1 m diameter; in addition there are 7 m and 13 m diameter radio telescopes in use.

Sir Bernard Lovell; photo credit: Jodrell Bank, University of Manchester

The Observatory is also the base of the Multi-Element Radio Linked Interferometer Network (MERLIN), which is an interferometer* array of radio telescopes that are spread across England and use the Jodrell Bank, Cambridge, Knockin, Defford, Darnhall and Pickmere telescopes to produce high-resolution images. The project is run by the University of Manchester (the Mark II telescope is part of this, as it can be used as an interferometer alongside the Lovell Telescope). MERLIN has been used for astrometry and to make radio maps to study radio-loud galaxies, quasars and spectral lines in interstellar gas clouds.

* Interferometers are instruments that merge sources of light to create an interference pattern that can be measured and analysed; the generated patterns contain data about the object or event being observed and are used to make tiny measurements that cannot be made in other ways. These include analysing the structure of the massive areas of gas and dust that exist in the far parts of the Universe, and sensing the almost undetectable movements of gravitational waves.

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High School Telescope mirror gets a new coating

By Alan Cayless FRAS

Mirror prior to recoating. Image credit: Alan Cayless

This summer, the mirror from the Society's historical telescope in the Highland Hotel in Spittal Street, Stirling, is going on its travels.

The mirror was removed from its housing on the 6th of May and has been taken to Orion Optics in Staffordshire for refurbishment.

The old reflective coating will be removed and a new coating applied. The mirror was last recoated in 2004. It will be reinstalled in the telescope over the summer, in time for the autumn observing season.

The copper-covered dome of the observatory at the top of the Stirling Highland Hotel (formerly the original High School of Stirling). It houses the Society's Victorian telescope, which was designed, constructed and installed in 1889 by William Peck, then the City Astronomer of Edinburgh.
Image credit: Sandi Cayless

Lunar Mission Updates – Blue Ghost and iSpace Resilience

By Alan Cayless FRAS

After more than six weeks in space, the Firefly Blue Ghost spacecraft reached the Moon in early March. Named after the Blue Ghost Firefly *Phausis reticulata*, the spacecraft, equipped with a package of scientific instruments, spent a little over three weeks in Earth orbit before making a four-day transition from Earth to Moon, carrying out scientific measurements and payload checks along the way. After spending more time in lunar orbit, Blue Ghost made the descent to the lunar surface, landing near the feature Mons Latreille in Mare Crisium on the 2nd of March (Banks 2025).

Mare Crisium is one of the first prominent features to appear on the young crescent Moon. A large, dark, circular feature, Mare Crisium is located near the Moon's eastern limb, slightly north of the lunar equator. It remains visible until a few days after Full Moon. By landing two days after New Moon, Blue Ghost was on the surface shortly after lunar sunrise and guaranteed fourteen days of daylight.

While still in transit from Earth to Moon, Blue Ghost's cameras were already in action, capturing a nostalgic view back to Earth showing our blue and white planet suspended against the blackness of space. After entering lunar orbit, Blue Ghost sent back spectacular close-up images of the lunar surface shortly before landing.

Lunar surface imaged shortly before landing [Image credit: Firefly Aerospace]

Scientific measurements made while in transit from Earth to Moon included magnetometry and radiation measurements as the spacecraft passed through the Earth's van Allen belts. Once on the lunar surface the main scientific instrument package went to work. This includes the LISTER probe, which drilled 2 to 3 metres below the Moon's surface to monitor heat flows, and the Lunar Magnetotelluric Sounder (LMS), which uses electrodes and magnetometers to probe the Moon's internal structure and composition. Instruments to test navigation systems were also deployed, along with a next generation Lunar Retroreflector (LLR). These will enable extremely precise measurements of the Earth–Moon distance and provide valuable data to assist in planning future missions (Freeman 2025).

Perhaps the most spectacular image relayed back from Blue Ghost's time on the surface came towards the end of its mission, when the lander witnessed the lunar eclipse on the 14th March. Lunar eclipses occur when the Moon passes into the Earth's shadow, darkening to a deep red as usually seen from the Earth. Seen from the Moon, the Earth covers the face of the Sun, becoming encircled in a ring of fire as the last rays of sunlight pass through the Earth's atmosphere. Blue Ghost became the first commercial lander to film this event live, capturing the diamond ring effect as the Sun began to re-emerge towards the end of the eclipse.

Two views of Earth: the Earth as seen from space during transit to the Moon, and the Earth covering the Sun during the eclipse of 14 March 2025, imaged from the lunar surface. [Image credit: Firefly Aerospace]

Having spent 14 days on the surface of the Moon, Blue Ghost passed into twilight as lunar night fell. With all of its scientific objectives successfully carried out, Blue Ghost's mission is now complete (Firefly Aerospace 2025). Meanwhile, the iSpace Resilience mission has left Earth orbit and continues on its slightly longer route to the Moon (iSpace 2025). A landing date has now been confirmed.

Resilience and the Tenacity rover are now scheduled to touch down in Mare Frigoris on the 6th of June.

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Poetic Licence

Blackmore, Sir Richard: The Creation: a Philosophical Poem in Seven Books (1712)

Yet is this mighty system, which contains
So many worlds, such vast ethereal plains,
But one of thousands, which compose the whole,
Perhaps as glorious, and of worlds as full.

All these illustrious worlds, and many more,
Which by the tube astronomers explore:
And millions which the glass can ne'er descry,
Lost in the wilds of vast immensity;
Are suns, are centres, whose superior sway
Planets of various magnitudes obey....

Chudleigh, Lady Mary: The Song of the Three Children Paraphras'd (1703)

Ye glittering Stars, who float in liquid Air,
Both ye that round the Sun in different Circles move,
And ye that shine like Suns above;
Whose Light and Heat attending Planets share:
In your high Stations your Creator praise,
While we admire both him and you…

More, Henry: Democritus Platonissans, or an Essay Upon the Infinity of Worlds (1647)

And as the Planets in our world (of which
The sun's the heart and kernal) do receive
Their nightly light from suns that do enrich
Their sable mantle with bright gemmes, and give
A goodly splendour, and sad men relieve
With their fair twinkling rayes, so our world's sunne
Becomes a starre elsewhere, and doth derive
Joynt light with others, cheareth all that won
In those dim duskish Orbs round other suns that run.

These with their suns I severall worlds do call…
Whereof the number I deem infinite:
Else infinite darkness were in this great Hall
Of th'endlesse Universe; for nothing finite
Could put that immense shadow into flight.
But if that infinite Suns we shall admit,
Then infinite worlds follow in reason right,
For every Sun with Planets must be fit,
And have some mark for his farre-shining shafts to hit.

Milton, John (1608–1674): Paradise Lost (1: 283–291)

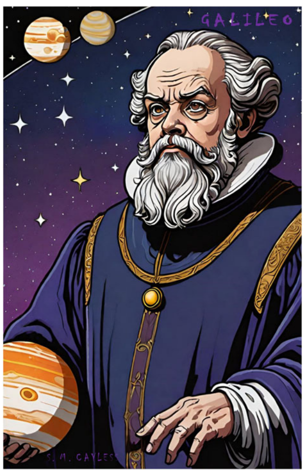
He scarce had ceased when the superior fiend
Was moving toward the shore; his ponderous shield
Ethereal temper, massy, large, and round,
Behind him cast; the broad circumference
Hung on his shoulders like the moon, whose orb
Through optic glass* the Tuscan artist views
At evening from the top of Fesole,
Or in Valdarno, to descry new lands,
Rivers or mountains in her spotty globe.

Milton, John: Paradise Lost (3: 588–590)

There lands the fiend, a spot like which perhaps
Astronomer in the sun's lucent orb
Through his glazed optic tube* yet never saw.

Milton, John: Paradise Lost (5: 257–265)

From hence, no cloud, or, to obstruct his sight,
Star interposed, however small he sees,
Not unconform to other shining globes,
Earth and the garden of God, with cedars crowned
Above all hills. As when by night the glass
Of Galileo*, less assured, observes
Imagined lands and regions in the moon:
Or pilot from amidst the Cyclades
Delos or Samos first appearing kens
A cloudy spot…



* Milton met Galileo in Italy in the late **1630s**: "There it was that I found and visited the famous Galileo grown old, a prisner [sic.] to the Inquisition, for thinking in Astronomy otherwise than the Franciscan and Dominican licensers thought." [Ref: Clemens, J (2012) Galileo's telescope in John Milton's Paradise Lost: the modern origin of the critique of science as instrumental rationality? Filozofski vestnik Vol. XXXIII, No. 2, 163–194.]

The Astrolabe: an Ancient Astronomical Instrument

By Sandi Cayless

An astrolabe is basically a two-dimensional version of an armillary sphere, which had already been invented in the Hellenistic period (323-30 BCE). The word derives from the Greek *astro* (star) and *labio* (taker, finder or their), thus it literally means *star finder* (Schreier 2014). The first basic astrolabes arose in Greece and their use spread rapidly from there westwards across the Mediterranean (Wymarc 2018). The instrument itself had its roots much earlier: the Greco-Egyptian mathematician Theon of Alexandria (c. 335–405) wrote a detailed treatise on the astrolabe but its use scientifically is believed to date back to Ptolemy (ca. 100 – 160s/170 ACE) or further (Neugebauer 1949). Wymarc (2018) quotes Morrison (2007) as saying: "The earliest surviving descriptions of actual instruments were written by John Philoponos of Alexandria (Johannes Grammaticus) in the sixth century (ca. 530)". (NB Philoponus' book *On the Astrolabe* is available as a modern reprint). The astrolabe spread to the Middle East in the mid-8th century. The first Muslim known to have made an astrolabe was Muḥammad ibn Ibrāhīm ibn Ḥabīb al-Fazārī, an early astronomer; he gives instructions in his Kitāb al-ʿAmal bi-ʾl-asṭurlāb al-musaṭṭaḥ, or Book on the Use of the Astrolabe (Plofker 2007). In the 10th century, Muslim astrolabe maker Al-ʻIjliyyah (aka Mariam Al-Astrolabiya) so advanced the design, and created new, that she was employed by the Emir of Aleppo to work at court (Khan 2025). Travelling Persian astronomer Jamal al-Din took the astrolabe to Kublai Khan (1215–94) in China, and the first Sanskrit treatise on the astrolabe was written in 1370 (Webster & Webster 1998, p3-4).

The much-improved version of the astrolabe was re-introduced into Europe during the crusades and through trade and was in use from at least the 13th century (Wymarc 2018). The astrolabe was seen as vital to understanding our place in the cosmos by the likes of Chaucer (ca. 1343-1400) in the late Middle Ages – he in fact wrote an essay on it, and as an astronomical tool the astrolabe was considered crucial in advancing the scientific understanding of the Earth and the universe. In the Middle Ages, an educated European child was expected to know how to build and use an astrolabe (Schreier 2014). Astrolabes were used by educated people, alchemists, astrologers and astronomers, and its use, according to Wymarc (2018), was taught in universities in the way slide rules once were. Astrolabes were made of paper, paper-wood laminate, wood or metal, and most surviving examples are of the latter. Although largely falling out of favour and use in the seventeenth century (Schreier 2014), it still retains a fascination, and the Astrolabe Project (www.astrolabeproject.com) is an ongoing work that includes instructions on how to produce an astrolabe, downloadable tools and a handout on the theory of the astrolabe and how to use it that contains extensive and clear diagrams (Wymarc 2018).

But what was an astrolabe for, and how did it work? An observing instrument to measure angles, a planispheric astrolabe was also a portable device to solve astronomical, astrological and geometric problems (Schechner 1998). It represented a model of the universe where the path of the sun was traced across the surface of a large celestial sphere centred on the earth. Made generally of brass, it is composed of various parts, detailed below.

Major Components of the Astrolabe

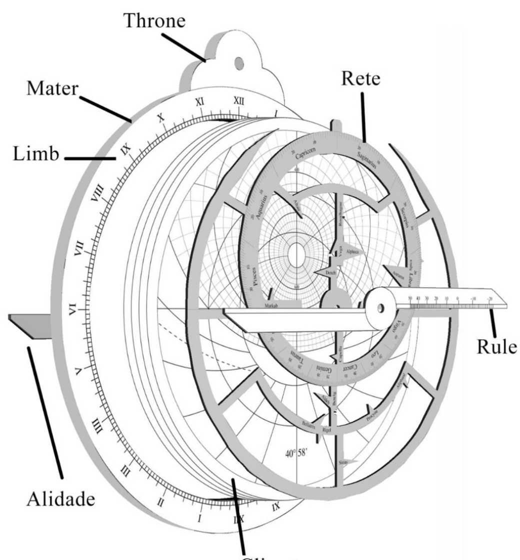


FIGURE CREDIT: WYMARC (2018)

On the front, the **rete** is an intricately cut and pierced plate that consists of a network of circles, arcs and line segments in the same plane. The circles and arcs represent the ecliptic, the celestial equator, and the tropics of Cancer and Capricorn. The tips of the pointers that branch off the arcs and lines represent the positions of bright stars. The rete is thus a two-dimensional map of the celestial sphere as it looks to an observer at the celestial south pole, seeing it as projected stereographically onto the plane of the celestial equator. The rete rotates freely about its centre: this point represents the celestial north pole and the earth's axis (Schechner 1998).

Behind the net-like rete, showing through it, are **tympans** (also known as **plates** or **climates**). These are specific to a given latitude (usually those of particular cities of importance, e.g. major centres such as Cairo, Mecca, Medina or Jerusalem). A tympan is a flat plate etched with a stereographic projection of the horizon, meridian, zenith, lines of azimuth and circles of altitude for a given latitude (and sometimes lines for astrological houses and unequal hours). The rete rotating on top of the tympan reproduces the apparent motions of the sun, stars and planets seen by an observer as they rise and set at his location. A rotating **rule** (single or double sided) on top of the rete helps line up markings and take readings. Most astrolabes had a number of tympans with their faces engraved for different latitudes (Wymarc 2018), to allow a traveller to swap one for another to get accurate readings. These spares were often housed in a built-in storage space called the womb, a cavity on the front side of the **mater** (Schechner 1998).

The mater is the thick piece of cast brass with a raised edge that makes the case and back of the astrolabe. The **limb** on the front of the mater is incised to mark equal hours; the limb on its back is divided into 360 degrees. Within this divided circle sit one circle divided into days of the civil calendar and another circle, eccentric to it, divided into degrees of the zodiac.

A rule with sighting vanes, known as the **alidade**, is secured with a bolt at the centre of the mater's back but like the rete and rule, it rotates – this bolt also goes through the tympans, rete, and rule. The alidade gives the angle of elevation of a celestial body above the horizon and its edges are used to correlate a specified date with the position of the sun in the zodiac. It is also used to measure angles between parts of terrestrial landmarks along with one or more shadow scales etched inside the lower quadrants of the mater's reverse. A shadow square design is a rectangle divided into two squares, the vertical and horizontal sides of each being divided into equal parts that use the point where the alidade crosses, thus measuring angles in terms of the fixed ratios of the sides of the triangle formed (tangents and cotangents). Eastern Islamic astrolabes could also have a mathematical device to solve trigonometric problems involving sines and cosines in their upper left quadrant, and in the upper right quadrant, a stereographic projection of the declination and zodiacal position of the midday sun, with arcs for unequal hours, times of prayer, and the azimuth of the qibla (the direction facing Mecca). In the upper left or right quadrants of the mater, Western Islamic and European astrolabes can have quadrants for equal/unequal hours.

A wedge-shaped pin called the horse (because it often looks like a resting horse) slides through a hole in the bolt connecting the alidade, tympans, rete, and rule to secure all parts of the device. The top part of the mater, the **throne**, projects above the outermost divided circles. A large ring could be attached to hang the instrument from a hook or a thumb.

Astrolabes were challenging to make, costly to buy and so mathematically complex that a good grounding in geometry was needed to learn their use; in other words they were intimidating scientific tools that could be seen as the forerunner of the modern computer (Schreier 2014). As such, astrolabes are one of the most important scientific instruments in the history of Astronomy.

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Interesting Asteroids: Bennu

By Sandi Cayless

As part of an occasional series on interesting asteroids, we look at Near-Earth Asteroid (NEO) 101955 Bennu (1999 RQ36). Bennu was discovered on 11 September 1999 during a near-Earth asteroid survey by the Lincoln Laboratory Near-Earth Asteroid Research (LINEAR) Team at Socorro (JPL 2024). It was named for an Egyptian mythological bird figure linked to Osiris, Atum and Ra, and its name was proposed by 9-year old student Michael Toler Puzio through a naming contest. We know rather a lot about Bennu, because a spacecraft has landed on it and brought back samples to Earth. It is one of 5 asteroids to date that have been visited. The others are: 433 Eros (1998); 25143 Itokawa (2005); 162173 Ryugu (2018); and, Dimorphos a.k.a. (65803) Didymos I (2022).

Bennu is carbonaceous and belongs to the Apollo group of near-Earth asteroids, which means that it is considered potentially hazardous and is listed on the Sentry Risk Table, the automated impact prediction system run by the Center for Near Earth Object Studies (CNEOS) at the Jet Propulsion Laboratory (NASA/JPL 2021). Risk calculations indicate that Bennu has a cumulative 1 in 1,750 chance of hitting the Earth between 2178 and 2290. Bennu has an axis of rotation tilted 178° to its orbit, it spins retrograde with respect to its orbit, and OSIRIS-REx data has shown that the surface is very rough, with over 200 surface boulders larger than 10 m, the largest being 58 m diameter (Lauretta *et al*. 2019a). Bennu is roughly spheroidal and looks like a spinning top. It has a distinct ridge along its equator, which suggests the accumulation of fine-grained regolith particles in the area, perhaps due to its low gravity and fast rotation of about once every 4.3 hours (Lauretta et al. 2015). Bennu is also rotating faster over time, a phenomenon known as the Yarkovsky-O'Keefe-Radzievskii-Paddack effect, due to the uneven emission of surface thermal radiation in sunlight as Bennu rotates (NASA 2019); this means that Bennu's rotation period decreases by around a second in every 100 years.

The asteroid is active, and emits particle plumes and rocks which are sometimes lost and sometimes return to surface (Connolly Jr *et al*. 2019; Lauretta *et al*. 2019b). Due to this activity and Bennu's small minimum orbit intersection distance from Earth, the asteroid may even be the parent body of a weak meteor shower. Ye (2019) suggests that particles from Bennu would radiate from the southern hemisphere constellation Sculptor around 25th September, but they would be close to the naked eye visibility limit, with a zenith hourly rate of fewer than 1.

Bennu was the aim of NASA's OSIRIS-REx sample return mission (launched 8 Sept 2016) and the craft touched down on 22 October 2020, collecting about 60 g of surface material via its sample collector (the Touch-And-Go Sample Acquisition Mechanism, or TAGSAM), which was eventually stowed in the Sample Return Capsule (SRC) (NASA 2020). The capsule was returned safely to Earth, touching down on 24 September 2023 (NASA 2023). Remote sensing had shown that Bennu had hydrated phyllosilicates, magnetite, organic compounds, carbonates and scarce anhydrous silicates on its surface; this was confirmed by analysis of the returned sample (Lauretta *et al*. 2024), which also included sulphides, pre-solar grains and (unexpectedly) magnesium- and sodium-rich phosphates and other trace phases. These results indicate water alteration, and the researchers also found distinct hydrogen, nitrogen, and oxygen isotopic compositions (elements crucial to the emergence of life on Earth), with some of the analysed material augmented by fluid-mobile elements. The asteroid may thus have had a watery past, and was perhaps once part of a wetter world. Further analysis of the Bennu samples has shown that the asteroid is rich in carbon, nitrogen and ammonia and the researchers found amino acids (including 14 of the 20 found in Earth-based life), and other organic molecules that included all five nucleobases found in DNA and RNA (Glavin *et al*. 2025). They concluded that the samples were formed and altered by low-temperature reactions, perhaps in ammonia-rich fluids and that Bennu's parent body developed in or accreted ices from an outer Solar System reservoir where ammonia ice was stable.

Asteroid 101955 Bennu	
Argument of Perihelion (°)	66.39438
Ascending Node (°)	1.97241
Orbital Inclination (°)	6.03290
Orbital Eccentricity	0.2037311
Perihelion Distance (AU)	0.8965906
ΔV w.r.t. Earth (km/sec)	5.1
Semi-Major Axis (AU)	1.1259897
Mean Anomaly (°)	102.50404
Mean Daily Motion (°/day)	0.82490170
Aphelion Distance (AU)	1.355
Period (years)	1.355
Absolute Magnitude	20.7
Diameter (km)	0.48444
Geometric Albedo	0.044
Phase Slope	0.15
	Data: IAU/JPL

Bennu's surface features are named for bird or bird-like mythological creatures and places linked to them; this theme was approved by the International Astronomical Union's Working Group for Planetary System Nomenclature (WGPSN), alongside the OSIRIS-REx team, as the mission's naming theme was based on Egyptian mythology, being Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (Steigerwald 2019). The asteroid's terrain types include: regiones (broad geographic regions), craters, dorsa (ridges), fossae (grooves or trenches) and saxa (rocks and boulders). The first feature named (Benben Saxum) was a huge boulder so tall it was first seen from Earth. Named features include the following (Steigerwald 2020, USGS 2025):

Tlanuwa Regio (Cherokee), a boulder-covered area in the southern hemisphere: called after giant birds who scattered pieces of a serpent over the Earth that turned into standing pillars of rocks.
Benben Saxum (Ancient Egypt), named for the mound rising from the primordial dark waters Nu. In mythology, the god Atum settled on Benben to create the world after he had flown over Nu in the shape of the Bennu bird.
Roc Saxum (Arabian), after the Roc, the enormous mythological bird of prey; the largest boulder feature on Bennu.
Simurgh Saxum (Persian), the benevolent, mythological bird that was said to possess all knowledge. Simurgh Saxum specifies the asteroid's prime meridian and is the basis for Bennu's coordinate system.
Huginn Saxum and **Muninn Saxum** (Norse) are adjacent boulders named for the god Odin's attendant ravens, Huginn and Muninn.
Ocypete Saxum (Greek), named for one of the harpies (half-maiden, half-bird personifications of storm winds) that would snatch and carry things away from Earth. This boulder is close by the origin of Bennu's particle ejection event of 19 Jan 2019.
Strix Saxum (Roman), named for the bird of ill-omen, the Strix. It is a large boulder beside the OSIRIS-REx mission's backup sample collection site.
Amihan Saxum (Philippines), named for the mythological Tagalog, the first creature to inhabit the universe and depicted as a bird. It is a large, flat, apparently partly-buried boulder in Tlanuwa Regio.
Pouakai Saxum (Māori), called after the monstrous bird who kills and eat humans. This boulder is 10.6 m wide and sits slightly north of Benben Saxum in the southern hemisphere.
Aëtos Saxum (Greek), named for the Earthborn childhood playmate of the god Zeus. He was turned into an eagle by Hera and served as the god's messenger. Aëtos Saxum is a very flat boulder with a wing-like shape near Bennu's equator.
Gargoyle Saxum (French), after the fire-breathing, dragon-like monster with wings and a bird-like neck. It is a large prominent boulder near the OSIRIS-REx backup sample site and is one of the darkest objects on Bennu's surface.
Aellopus Saxum (Greek), another rock named for one of the harpies (Aello), the half-maiden, half-bird personifications of storm winds that would snatch and carry things away from Earth.
Alicanto Crater (Chilean), named for a mythological nocturnal bird whose wings shine at night with metallic colours so bright that they cast no shadow. It lives in small caves and eats metal ores, which makes it so heavy it cannot fly.
Boobrie Saxum (Scottish), called after the mythological shapeshifting entity dwelling in the lochs of the west coast of Scotland. It commonly appears as an enormous water bird.
Bralgah Crater (Aboriginal Australian people of the Murray River basin), a crane who tossed an egg from the nest of emu Dinewan into the sky, where it became the sun.
Camulatz Saxum (Mayan), one of four birds that destroyed the first race of people carved out of wood and would decapitate people who did not survive passage through the underworld.
Celaeno Saxum (Greek), another rock named for a harpy, a half-maiden, half-bird personification of

storm winds that snatch and carry things away from Earth.

Ciinkwia Saxum (Algonquian), named for the thunder-beings that live in the sky, cause thunder and lightning and look like giant eagles or birds with human heads.

Dinewan Crater (Aboriginal Australian people of the Murray River basin); Dinewan was the emu whose egg created the sun.

Dodo Saxum, named for the round and grey flightless bird, and the fictional character in *Alice's Adventure in Wonderland* (1865) by Lewis Carroll.

Gamayun Saxum (Slavic), a prophetic bird, symbol of wisdom and knowledge depicted as a large bird with a woman's head.

Gullinkambi Saxum (Norse), a gold-combed rooster who lives in Valhalla and wakes gods and heroes.

Hokioi Crater (Māori), the mythical bird with a huge long divided tail that lives in the heavens and never visits Earth.

Huhuk Crater (Pawnee), the Thunderbird, a huge long-necked bird with a forked, jagged tail, the beating of whose wings causes thunder.

Kongamato Saxum (Kaonde of NW Zambia & nearby areas in Zaire), a giant flying creature that looks like a bird or bat.

Lilitu Crater (Mesopotamian/Sumerian), a nocturnal wind demon depicted as woman with wings and birds' feet with talons.

Minokawa Crater (Lumad group, Mindanao, S. Philippines), a massive bird that has resided beyond the eastern horizon since before time began and causes lunar eclipses in the myths of the Bagobo.

Odette Saxum, named for the princess turned into the White Swan in the ballet Swan Lake (1877) by Tchaikovsky. This character's name, derived from French, is opposite to Odile, the Black Swan maiden.

Odile Saxum, named for the Black Swan maiden in the ballet Swan Lake (1877) by Tchaikovsky. This character's name derives from Old German (cf Odette, the White Swan Princess).

Ohnivak Crater (Czech/ Slovak), a glowing or burning bird (firebird) with colourful red, gold and orange feathers.

Pegasus Crater (Greek), the winged horse who let Bellerophon ride him so as to defeat the monster Chimera.

Sampati Crater (Hindu), a giant vulture whose wings had been burnt by the blaze of the Sun when he had flown too close to it in racing with his brother.

Thorondor Saxum, named for the King of the Eagles in Middle-earth, in the fiction of J.R.R. Tolkien; he is the greatest of all eagles, with a wingspan of 55 m (as is this boulder, approximately).

Wuchowsen Crater (Abenaki Algonquians), a giant bird, named Windblower, who sits upon a rock at the edge of the sky far in the north and produces winds by his wings.

Wututu Crater (Fon of Benin/Togo), a mythical bird that reconciled the two gods in their dispute and thus ended a great drought.

Asteroid 101955 Bennu is a fascinating object and will no doubt reveal more surprises in the future.

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The OSIRIS-REx Sample Return Capsule on its return to Earth, 24 Sept 2023. The capsule was released from the spacecraft and parachuted safely to land on the U.S. Department of Defense's Utah Test and Training Range, where it was retrieved by the OSIRIS-REx team. Photo credits: NASA

Happy Observing!

The first of June brings the 5 day old Moon and Mars close together, sharing the same right ascension. The Moon will pass 1°23’ to the north of Mars, a close approach called an appulse. From Stirling, the two will become visible at around 23:27 (BST), 18° above the western horizon, sinking to setting at 01:54. Both are in Leo, the Moon at mag -11.4, and Mars at mag 1.3. On 7 June the Moon is at apogee, and being close to full phase, this month’s full moon on 11 June (the Strawberry Moon – see *The Jeety Starn* issue 5 for more on the names of full moons) will be a little smaller and less bright than usual. The Daytime Arietid meteor shower (14 April - 24 June) is at its peak rate around 10 June. Seen from Stirling, the shower will not be visible until about 02:03 each night, when its radiant point (in Aries) rises in the east. It will remain active until dawn breaks around 03:25. The best displays are likely to be shortly before dawn, when the radiant point is highest.

June 21 marks the summer solstice for the northern hemisphere, and brings us the longest day. The solstice occurs at 03.42 am BST, i.e. the point at which the northern hemisphere is tilted farthest towards the Sun. From here on the days get progressively shorter until winter solstice on 21 December. For Stirling, sunrise is at 04:25, noon at 13:16 and sunset at 22:06. The conjunction of the Moon and Venus on 22 June will be difficult to see as the pair will only rise to 8° above the eastern horizon. They will be visible in the dawn sky, rising at 02:38 (BST) and fading as dawn breaks at around 03:48. Mercury will reach its highest point in the sky in its Jun–Jul 2025 evening show on 23 Jun (mag 0.4), but will be difficult to see, reaching a peak of 9° above the horizon at sunset.

The June Boötid meteor shower, active from 22 June to 2 July, is at its peak around 27 June. From Stirling the radiant point (in Boötes, the Herdsman) is circumpolar; that means it is always above the horizon and the shower will be active through the night. The best displays are likely soon after dusk, when the radiant point is still high. The shower will peak close to the new moon, and so moonlight will be minimal. The parent body responsible for creating the June Boötid shower is the comet 7P/Pons-Winnecke.

The Full Moon of the 10 July is often known as the Buck Moon, when new antlers grow on male deer, and over the next nights, the Moon will rise around an hour later. Just after mid-July the Perseid meteor shower begins. It lasts well into August (17 July – 24 August), but well before the peak, on 21 July, we will have a conjunction of the Moon and Venus in Taurus, when the 26 days old Moon will pass 7°07’ to the north of Venus. The sight will be visible in the dawn sky, rising at 02:05 (BST) to reach an altitude of 16° above the eastern horizon, fading with the dawn at 04:24.

The end of the month brings more meteors. The Piscis Austrinid shower (15 July – 10 August, parent body unknown) peaks about 28 July, with the best displays shortly before dawn, when its radiant point is highest. The Southern δ-Aquariids (12 July – 23 August, parent body comet P/2008 Y12 (SOHO)) peak around 30 July, and again the best viewing time will be just before dawn, on July 30. Also peaking on 30 July, the radiant point of the α-Capricornid meteor shower (3 July – 15 August, parent body comet 169P/NEAT) is above the horizon all night, and should thus be active throughout the hours of darkness, although the best show over Stirling will be about 01:00 BST. And as we are in a peak of solar activity, there could be many more aurora; the 2025 maximum is expected this month, with a peak of 115 sunspots.

The 1st of August sees Mercury at inferior solar conjunction and so close to the sun that it will be unobservable for several weeks. This point marks the transition of the planet from an evening to a morning sky object (NB *Never* directly view an object close to the Sun). The conjunction of Saturn and Neptune on 6th August in Pisces should be visible from Stirling in the dawn sky; the pair rise at 22:23 (BST) and reach 31° above the southern horizon, fading as dawn breaks around 03:16. The 9th August brings us the Sturgeon Moon, and on the 10th, Pallas (Asteroid 2) is at opposition and perigee, and is highest (48° above the southern horizon) around midnight, but at a peak magnitude of 9.4, it will need binoculars or a telescope to see. You may also be able to pick out Asteroid 89 Julia (mag 8.5), highest at 22° above the southern horizon at 01:20. On the 12th August Venus and Jupiter come close (within 51.6 arcminutes of each other) in Gemini. From Stirling, they rise at 02:11 (BST) and reach an altitude 21° above the eastern horizon. You may also see the Moon, Saturn and Neptune coming close in Pisces, reaching their highest point of 31° in the sky at 03:59.

Meteor showers continue to enliven the night sky. The Perseids (17 July – 24 August, parent body comet 109P/Swift-Tuttle) reach their peak rate on the 12th August and we may see up to 150 meteors per hour, or even a fireball, shortly before dawn. Alas, the maximum is three days after the Full Moon, limiting viewing, although the shower's long duration brings darker opportunities such as the new moon of 23 August. A meteor seen around 18 August may belong to the κ-Cygnid shower (3 – 25 August, radiant Draco, no known parent body); it reaches its peak rate above Stirling of about 2 meteors per hour and will be at its best around 22:00 BST. On August 19, the Moon and Jupiter make a close approach in Gemini, rising at 01:51 (BST). Venus is at its highest point in the morning sky then, and on the 20th, Venus and the Moon will come into conjunction. Happy observing!

Many thanks to all our contributors to this quarter's issue of *The Jeety Starn*. Members, please hand submissions to the editor, or send them via the Society's contact email address. Illustrations and snippets also welcome! S.C.

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