JANUS
THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

February 2026

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Important Reminder:

To allow sufficient time to compile Janus and place it on the EAS Website by the 1st of the month any submissions for publication are required at least 3 days before the end of the month. Any items received after this date will be held over until the following month.

Editorial

Welcome to the February edition of Janus. This month's meeting will be on Friday 13 February. It features a talk by the Society's Secretary, Peter Scott, which departs from the usual "Astronomy" theme. Entitled "A Journey to Orbit", it will describe first-hand the "journey" from launching a spacecraft, through its deployment, commissioning and operation.

As reported elsewhere, January's meeting included Ron Johnson's annual review of observing conditions for the previous year. The conclusion – 2025 was the best year in terms of clear nights since 2003 – some 22 years ago! The best month was April, with almost double the number of clear nights (15) of any other month. In stark contrast, December had only 2 clear nights and the dubious distinction of the longest interval between clear nights (26). For the benefit of those who missed the meeting, I have included a summary of his presentation in this issue. At the moment, it's anyone's guess how 2026 will turn out, but it hasn't started very well.

It's not just astronomy that is affected by poor weather. Readers can't have failed to notice how wet and windy it has recently been over parts of the UK…. But it's not just the UK that's suffering from adverse weather. Arctic conditions on the Eastern seaboard of the US have affected plans for the launch of NASA's Artemis II rocket carrying the Orion spacecraft and its 4-person crew around the Moon and back to earth. The mission, the first manned, non-ISS related flight since the Apollo era, will now not launch before 8 February, but will take humans deeper into space than ever before. The following Artemis III mission is scheduled for launch no earlier than mid-2027. It will, if all goes according to plan, land astronauts on the Moon within 2 years from now.

In this edition:

John

skyUpdate
What's up this month?

The Solar System February

MERCURY: recently passed behind the Sun at superior solar conjunction. It begins the month not readily observable since it is very close to the Sun, at a separation of only 7° from it. It remains difficult to see until, by the end of the month, soon passing in front of the Sun at inferior solar conjunction, it is still not readily observable since it is very close to the Sun, at a separation of only 13° from it.

VENUS: recently passed behind the Sun at superior solar conjunction. It begins the month not readily observable since it is very close to the Sun, at a separation of only 6° from it. By the end of the month, it remains difficult to see, reaching its highest point in the sky during daytime and being no higher than 5° above the horizon at dusk.

MARS: will soon pass behind the Sun at solar conjunction. It begins the month not readily observable since it is very close to the Sun, at a separation of only 5° from it. By the end it is still not readily observable, remaining very close to the Sun, at a separation of only11° from it.

JUPITER: recently passed opposition. It begins the month visible in the evening sky, becoming accessible around 17:11, 24° above the E horizon, as dusk fades to darkness. Reaching its highest point in the sky at 22:26, 61° above the S horizon, it will continue to be observable until around 05:31, when it sinks below 7° above the NW horizon. By the end of the month, still visible in the evening sky, it becomes accessible around 17:58, 49° above the SE horizon, as dusk fades to darkness.

It will then reach its highest point in the sky at 20:31, 61° above the S horizon, and will continue to be observable until around 03:37, when it sinks below 7° above the NW horizon.

SATURN: will soon pass behind the Sun at solar conjunction. It begins the month visible from around 17:38, 27° above the SW horizon, as dusk fades to darkness. It will then sink towards the horizon, before setting at 21:00. Visibility decreases as the month progresses and, by the end of the month, it is difficult to see, reaching its highest point in the sky during daytime and being no higher than 9° above the horizon at dusk.

URANUS: is currently an early evening object, now receding into evening twilight. It begins the month visible in the evening sky, becoming accessible around 18:12, 57° above the S horizon, as dusk fades to darkness. Reaching its highest point in the sky at 18:52, 57° above the S horizon, it will continue to be observable until around 00:10, when it sinks below 21° above the W horizon. By the end of the month, it will become visible at around 18:56, 51° above the SW horizon, as dusk fades to darkness. It will then sink towards the horizon, setting at 00:55.

NEPTUNE: will soon pass behind the Sun at solar conjunction. At the beginning of the month, it will be difficult to see, but will become visible at around 18:12, 25° above the SW horizon, as dusk fades to darkness. It will then sink towards the horizon, before setting at 21:11. By the end of the month, it will be extremely difficult to see since it will be very close to the Sun, at a separation of only 21° from it.

Notable Events:

Some observations will require a telescope, whilst others will be visible with the naked eye.
More information at: *https://in-the-sky.org*

February	
1	Close approach of the Moon and M44 Full Moon
3	Lunar occultation of Regulus The Moon at aphelion
4	Uranus ends retrograde motion
8	α-Centaurid meteor shower 2026 NGC 2808 is well placed
9	Moon at Last Quarter
10	The Moon at apogee
11	Lunar occultation of Antares
13	Lunar occultation of Sigma Sagittarii
15	The Moon at perihelion
16	Conjunction of Saturn and Neptune
17	Comet C/2024 E1 (Wierzchos) passes perigee New Moon Annular solar eclipse
18	Conjunction of the Moon and Mercury Close approach of the Moon and Mercury Lunar occultation of Mercury
19	Mercury at perihelion Mercury at greatest elongation east Mercury at dichotomy Messier 81 is well placed
20	Mercury at highest altitude in evening sky Conjunction of the Moon and Saturn
21	The cluster NGC 3114 is well placed
24	Close approach of the Moon and M45 Moon at First Quarter The Moon at perigee
25	Lunar occultation of Beta Tauri
26	Conjunction of Venus and Mercury
27	Conjunction of the Moon and Jupiter Close approach of the Moon and Jupiter Asteroid 7 Iris at opposition The cluster IC 2581 is well placed
28	Close approach of the Moon and M44

March	
2	Lunar occultation of Regulus
3	Total lunar eclipse Full Moon The Theta Carinae cluster is well placed
6	The Moon at aphelion Conjunction of Ceres and Eris
7	Mercury at inferior solar conjunction Conjunction of Venus and Neptune
8	Conjunction of Venus and Saturn
9	The Wishing Well cluster is well placed
10	Lunar occultation of Antares The Moon at apogee
11	Jupiter ends retrograde motion Moon at Last Quarter
13	Lunar occultation of Sigma Sagittarii
14	Conjunction of Mars and Mercury γ-Normid meteor shower 2026
16	The Moon at perihelion
17	Conjunction of the Moon and Mercury Conjunction of the Moon and Mars
18	Comet 88P/Howell passes perihelion
19	New Moon
20	Conjunction of the Moon and Venus March equinox
21	Asteroid 20 Massalia at opposition
22	Neptune at solar conjunction The Moon at perigee Mercury at highest altitude in morning sky
23	Close approach of the Moon and M45
24	Lunar occultation of Beta Tauri
25	Saturn at solar conjunction Moon at First Quarter
26	Mars at perihelion Conjunction of the Moon and Jupiter Close approach of the Moon and Jupiter
28	Close approach of the Moon and M44
29	Lunar occultation of Regulus

Collected Observations (and thoughts) – Gary Walker

Double Shadow Transit on Jupiter – Posted 31 December

Yesterday evening, there was a double Shadow Transit of Jupiter's Moons. From about 10.25pm until about 12.36am this morning, I was observing the shadow of Ganymede crossing Jupiter, just below the Southern Equatorial Belt, and just at the top of a thin, narrow, dark belt to the South of them.

As it is the largest of Jupiter's moons, it means that, of all of Jupiter's moons shadow transits, its shadow is the largest and easiest to see.

It was best seen at 222X and 300X magnifications, but it was also easily seen at 100X, and possibly (with difficulty) with the 62X eyepiece!

At about 10.25pm, Ganymede itself was approaching the limb of Jupiter, following its shadow, which was already well upon the disk. An hour later, the shadow was roughly half-way across Jupiter and, by about 12.30am, it was two thirds of the way across. By then, another, smaller black shadow spot was following this shadow, with another moon now approaching the limb of Jupiter.

Thus, this was now a double Shadow Transit, with two shadows crossing the disk of Jupiter at the same time!

Shadow transits are always far more obvious than the moons, themselves, when crossing Jupiter! They appear almost 3 dimensional, as the black spots appear to be above Jupiter, (as indeed they are).

Apart from the two Equatorial Belts, I could also see a thin, dark belt to the South of these.

I must add that the second shadow transit was following exactly the same path that the shadow of Ganymede took!

The Return of the King – Posted 31 December

It is obvious that Jupiter is now back in the evening sky. Even better, at its culmination, it's now almost overhead!

It is still forming a sort of line with Pollux and Castor, both still very close by, but the line is now more of a "dog leg".

Saturn – Posted 31 December

Saturn is still in the evening sky but won't be for too much longer. I observed it again early this morning, and could see that the rings now appear brighter than they were in the period of November and early December, when the rings were at their closest to being edge on.

Like before, the Western ring seemed to partially break up into "droplets", which may indicate fainter moons in the ring plane, or atmospheric distortions, or it could even just an optical illusion!

The part of the rings that pass in front of Saturn now seem to be easier to see than before, obviously joining up with the rings, on either side of the planet.

Comet 31/ATLAS – Posted 31 December

I attempted to observe Comet 31/ATLAS on 19 December, and I thought that I could see a very large, diffuse, very faint fuzzy ball. However, I wasn't entirely sure!

I have since tried to repeat the observation but, as you will know, the December weather has been its usual appalling self, either being overcast repeatedly, or else on the rare occasions that it has cleared, there have still been annoying cirrus or cumulus cloud patches. ANY cloud, no matter how thin it was, would make it impossible to see such a faint object!

The comet was, in any case, only about magnitude 11, so not particularly bright and, of course, any extended fuzzy object such as this, or indeed, deep sky objects like galaxies, and nebulae, are always much harder to see than stars of the same magnitude!

I also tried for Comet C/2025 ATLAS but failed to find that!

One will notice a depressing familiarity, with yet MORE ATLAS Comets being found. This is because, nowadays, robotic telescope systems such as ATLAS and PANSTARRS find so many of these comets! This can make it really confusing for the amateur Astronomer to recognise WHICH comet is which!

Mira – Posted 4 January

The variable star Mira has been brightening from late last year.

On 17 November, it was only slightly brighter than a non-variable magnitude star of magnitude 9, immediately to the East of it - but by 19 December, it was significantly brighter than the star.

I always use this handy "companion" star as a useful guide to judge the magnitude of Mira!

Today, it was much brighter than this non-variable "companion" star. Mira was also easily visible in the 8X50 finderscope, but it wasn't showing any orange colour in that, yet.

According to the Night Sky website, Mira is presently at magnitude 3.4, so is now visible with the naked eye. It is expected to reach its maximum in March, but will be poorly placed by then, in the twilight sky! Over the last few years, Mira has only reached maximum when it has been near Solar Conjunction, so has been unobservable!

Mira has a cycle of 332 days, when it brightens from magnitude 9 to about 2.

Aurora Again – Posted 20 January

On the BBC News this evening, it was stated that the Northern Lights were seen across the UK last night. One photo showed them from Surbiton, as a bit of colour showing through the cloud cover! Unfortunately, it was generally overcast locally, and the Aurora didn't last very long.

The news about the Aurora appeared in the Weather forecast part of the News, which is appropriate, being as Aurora are classified as "Space Weather"!

The Aurora are, of course, a result of the Sun being very active recently and, on the few days that I have been able to actually SEE the Sun, there have been several Sunspot groups, some with large Spots, and accompanied by a swarm of small spots.

January Meeting – Posted 20 January

We had the first meeting of this year on 9 January. The talk, given by Phil Halper from the Royal Astronomical Society, was about the Battle of the Big Bang. He had a copy of his book on this same subject, and Casper got him to sign his copy of his own book, which he had brought along, and had a photo taken of them together!

This talk was well attended, with at least 40 people attending (about 30 physically attending, plus 10 more on Zoom). That was an unusually high amount on Zoom. This high attendance was particularly surprising, as I counted at least 5 of the regulars were absent!

Later, Ron Johnson gave his usual annual summary of the last year's weather. Unusually enough, last year proved to be a much better year for clear nights, with 63 clear nights, and a further 77 clear/cloudy nights. This meant that we had a total of 140 usable nights!
Ron said that last year was the best since 2003….. but! there were still 255 cloudy nights!

Jupiter – Posted 27 January

Over the past two months, I have been watching Jupiter slowly changing its position, relative to the stars, Pollux and Castor, but always within a few degrees of both! Jupiter now virtually forms a Right Angle with Castor and Pollux, being parallel with Pollux!

Proposed new mission will create artificial solar eclipses in space

Acknowledgement: This article was written by Nicola Baresi, Lecturer in Orbital Mechanics, Surrey Space Centre, University of Surrey, Huw Morgan, Reader in Physical Sciences, Aberystwyth University and Lucie Green, Professor of Physics, UCL. First published in THE CONVERSATION on 23 January 2026., it is republished in full under a Creative Commons Licence. The original article, with additional links and images can be found here: *https://theconversation.com/proposed-new-mission-will-create-artificial-solar-eclipses-in-space-272092*

When a solar storm strikes Earth, it can disrupt technology that's vital for our daily lives. Solar storms occur when magnetic fields and electrically charged particles collide with the Earth's magnetic field. This type of event falls into the category known as "space weather".

The Earth is currently experiencing one of the most intense solar storms of the past two decades, reminding us of the need for ways to understand these events.

An international team of researchers (including us) is working on a spacecraft mission that would enable researchers to study the conditions that create solar storms, leading to improved forecasts of space weather.

The proposed mission, known as Mesom (Moon-enabled Sun Occultation Mission), aims to create total solar eclipses in space. This would allow researchers to view the Sun's atmosphere in more detail than ever before.

The need for a better understanding of solar storms is evident from looking at past disruptions. In 1989, for example, the Canadian province of Quebec was forced into a nine-hour electricity blackout by a coronal mass ejection (CME) – a huge burst of hot plasma and magnetic field thrown off from the Sun's atmosphere towards space.

The event, which affected both Canada and the US, is estimated to have cost tens of millions of US and Canadian dollars – both in lost business productivity and the need to replace damaged power equipment.

In May 2024, a succession of similar solar eruptions caused thousands of satellites in low-Earth orbit to abruptly drop in altitude. GPS outages cost US farmers alone an estimated US$500 million (£370 million).

But these storms were significantly weaker than one in 1859, also the result of a CME, which is known as the Carrington Event. Electrical currents flowing through telegraph wires caused a range of effects in telegraph offices across North America and Europe. Operators received electric shocks – with one in Washington DC receiving a serious injury – and sparks triggered small fires in some telegraph offices.

Today, a Carrington-like event would have far more dramatic consequences on our technology-dependent world, as has been recognised by different UK governments since 2012.

Yet, our view of the Sun's outer atmosphere, the solar corona – from which CMEs and other adverse space weather events originate – remains dazzled by the bright light emanated from the Sun itself. A new UK-led spacecraft mission aims to change that by recreating total solar eclipse conditions in space.

Better forecasting

During total solar eclipses, the incredibly high-intensity radiation emanating from the visible surface of the Sun is occulted (covered) by the Moon, leaving behind a faint glow of light that comes directly from the outer layers of the Sun's atmosphere, the corona.

Observing the physical processes in the corona at different timescales and wavelengths is key to enabling better forecasting of space weather – a crucial part of protecting Earth against Carrington-like events – as well as solving longstanding mysteries of our star. These include how the hot plasma of its volatile atmosphere is confined and released by the evolving magnetic fields that thread through it.

Unfortunately, total solar eclipses are predictable yet rare events that only last for a few minutes. All total eclipses predicted in the 21st century will last less than seven minutes each, and will occur only once every 18 months, on average.

Total solar eclipse measurements from the ground are also subject to weather conditions and suffer from distortions and loss of detail, caused by the interaction of the faint coronal light with the Earth's atmosphere.

For decades, scientists and engineers have observed the corona by artificially covering the Sun using clever optics and instrument design inspired by the pioneering work of Bernard Lyot, a French astronomer who first come up with the idea of a "coronagraph".

Coronagraphs are telescopes equipped with an occulting disk to block out the overwhelming radiation emanated from the visible surface of the Sun, along with optical stops and filters that are positioned to suppress the light diffracted (scattered) by the disk itself.

In a coronagraph, the faint coronal light can finally reach the instrument's focal plane, where it is converted into digital signals using photoelectric sensors. This is the working principle of the Large Angle and Spectrometric Coronagraph (Lasco 3) onboard the Solar and Heliospheric Observatory (Soho 4) spacecraft, which has returned stunning images of the Sun's corona since its launch in 1995.

However, even ground-based and space-based coronagraphs cannot capture images of the deepest layers of the Sun's atmosphere, due to artifacts – artificial effects such as streaks of light that appear in images – and instrument limitations that significantly degrade the quality of the measurements closer to the Sun's surface.

Neither is the recently launched Proba-3 able to image the solar atmosphere's deepest layers. Proba-3 is a European Space Agency-led technology demonstration mission that

relies on a pair of satellites flying in a close formation (up to 150m apart during observations) to recreate total solar eclipse conditions in space.

Celestial neighbour

An alternative approach, first proposed by UK Airbus engineers Steve Eckersley and Stephen Kemble, advocates the use of celestial bodies as natural occulters (covers).

The idea is to fly a spacecraft mission in the shadow cast by a celestial object to enable prolonged and high-quality measurements of the corona down to the Sun's chromosphere – the layer of the Sun's atmosphere located just below the corona. This would effectively recreate the same total solar eclipse conditions we experience occasionally on Earth, but without the degradations caused by the atmosphere of our planet.

Our celestial neighbour, the Moon, is a more perfect sphere (its polar radius is only 2km shorter than the equatorial one) and does not have a thick atmosphere, which makes it among the best natural occulting disks found in the solar system.

A pool of engineers at the Surrey Space Centre has investigated the possibility of using the Moon as a natural occulting disk for studying the solar corona, and came up with the Mesom concept.

Mesom is a mini-satellite mission that capitalises on the chaotic dynamics of the Sun-Earth-Moon system to collect high-quality measurements of the inner Sun corona once a month, for observation windows as long as 48 minutes – much longer than the sporadic total solar eclipse on Earth.

Funded by the UK Space Agency, the feasibility study of Mesom has grown into a wider international consortium led by UCL's Mullard Space Science Laboratoryand including the Universities of Surrey and Aberystwyth, plus partners from Spain, the US and Australia.

The project has recently been submitted to the European Space Agency for consideration as a future mission. The current mission design proposes a launch in the 2030s, returning at least 400 minutes of high-resolution, low-altitude coronal observations during its two-year nominal science operations.

To collect the same amount of data on Earth, eclipse hunters would have to wait for more than 80 years. This makes Mesom a once-in-a-lifetime opportunity to unravel some of the secrets of the Sun's atmosphere.

For a YouTube video explanation of Coronal Mass Ejections see: *https://youtu.be/sg3NAdOYp8Q?si=vYAnQqFmTAF2pw2q*

Night Sky Conditions 2025 – Ewell, Surrey - Ron Johnson

The following is a summary of the night sky conditions during 2025 in Ewell, Surrey

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Clear	4	2	8	15	7	6	5	5	4	2	3	2
Cle/Clo	4	8	5	1	4	7	5	10	11	7	8	4
Cloudy	23	18	18	14	20	17	21	16	15	22	19	25

Totals: Clear 63 Clear/Cloudy 74 Cloudy 228

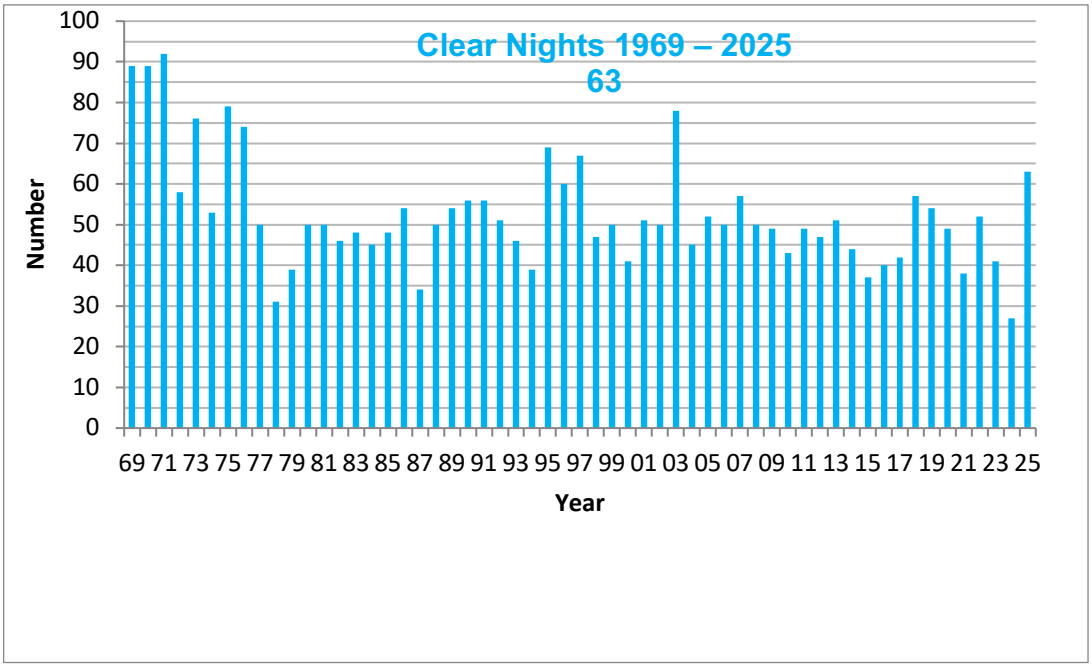
Longest run of consecutive clear nights: 8 nights 4 - 11 April

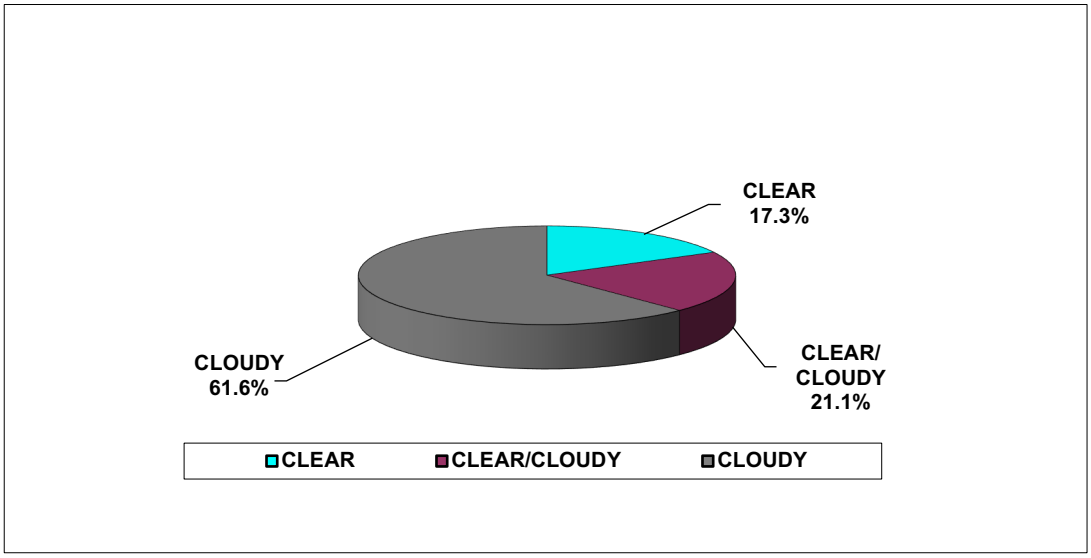
Longest period between clear nights: 26 nights 5 - 29 December

Longest run of consecutive cloudy nights: 16 nights 17 July – 1 August

Best Month: April (15 + 1) Worst Month: December (2 + 4)

The tenth best year for clear nights since records began in 1969





Calling occupants of interplanetary craft? – John Pillar

3I/Atlas …. the headline grabbing intergalactic alien visitor of 2025. The internet and popular press lit up when this object was reported – 'could this be evidence of intelligent beings from another planet?' asked Harvard astrophysicist Abi Loeb. NASA were unusually silent, speculation was rife, the SETI institute telescopes were activated, listening for radio transmissions.

But, after many observations, studies, analyses, data-releases and press reports, the debate has finally concluded with absolute certainty that 3I/Atlas is just a lump of space rock – sure – it is 'different', but that's what makes it interesting.

So – what is known about 3I/Atlas, and 'what about the previous two interstellar visitors?' that were detected in 2017 and 2019.
Three objects originating from outside the Solar System have been detected. These are:

- 1I/'Oumuamua (2017)
- 2I/Borisov (2019)
- 3I/Atlas (2025)

Each was unique and provided an insight into planetary systems of stars far away across our galaxy, possibly billions of years ago.

1I/'Oumuamua (2017)

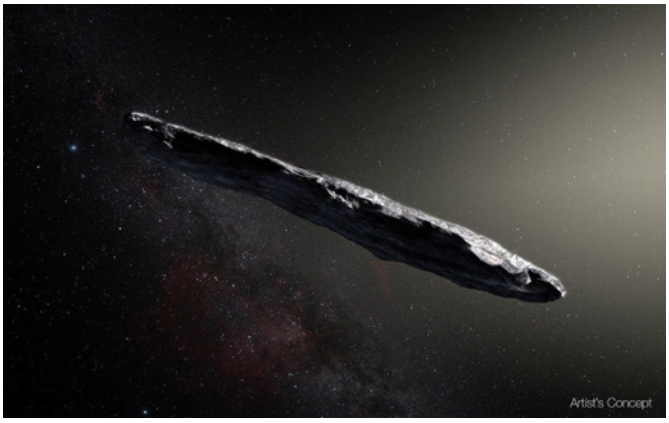


Figure 1: 'Oumuamua artists impression. From https://science.nasa.gov/solar-system/comets/oumuamua/

1I/'Oumuamua was first observed by a Canadian astronomer, Robert Weryk, using the Pan-STARRS observatory in Hawaii in October 2017. At the time of its discovery it had just past its closest approach to the sun and was heading away into deep space, moving at around 50 km/s. Observations over a few weeks determined that it was moving too fast to be 'trapped' by the sun's gravity, and it was verified as an object that had come from, and would escape into, interstellar space. Initially classified as a comet, it was reclassified as an asteroid because it didn't display a coma – the halo of dust and gas typically emitted by comets when then move near the sun.

'Oumuamua entered our Solar System from the direction of Vega in the constellation Lyra… however, this is close to the direction in which the sun is heading through the Milky Way and is therefore the most likely direction from which objects outside the Solar System will be appear to come (like a car running into flies when driving down the road). In fact, 'Oumuamua has a velocity very similar to the local Milky Way – it isn't moving with high, anomalous velocity, suggesting that 'Oumuamua is still moving with velocity of the local molecular cloud from which its parent star system formed.

A striking feature of ‘Oumuamua is its shape – analyses of its brightness variations suggest that it is small, maybe only a few 10’s of metres in length, is either oblong or pancake shape and that it is tumbling with a rotation period of around 8 hours.

Class D asteroids have a deep red colour, low reflectivity, and a surface rich in carbonaceous and organic compounds and water ice. They originate mainly in the Jupiter (Trojan) belt.

The composition of ‘Oumuamua is puzzling … theories range from metallic iron dominated through to ice fragments. It displays a reddish colour, and its reflectivity (albedo) is similar to that of Class D asteroids in our Solar System. Another key observation is that ‘Oumuamua increased in speed slightly as it moved away from the sun – as if some kind of ‘rocket engine’ was accelerating it forward. However, as mentioned above, ‘Oumuamua lacks a cometary halo… there is no detectable emission of CO, CO_2 or dust.

A leading, recent theory suggests ‘Oumuamua has a surface dominated by N_2 ice (Jackson and Desch, in JGR Planets, vol 126/5 May, 2021). These authors tested the effectiveness of a full suite of potential ‘rocket fuel’ gases known to be common in cometary bodies… H_2, Ne, CH_4, CO, N_2, NH3, O_2, CO_2 and H_2O. Of these, only CH_4, CO, and N_2 could provide a powerful enough ‘push’ to cause the observed acceleration of ‘Oumuamua as it travelled away from the sun… but CH_4 and CO can be ruled out by the lack of observable cometary halo – leaving N_2 sublimation as the most likely fuel for the cometary propulsion ‘engine’. Also, the colour and reflectivity of ‘Oumuamua are similar those of Pluto and Triton, bodies which have large amounts of N_2 on their surface, plus small amounts of CH_4 (that causes a red colouration).
It seems most likely therefore that ‘Oumuamua is an almost solid chunk of frozen N_2, similar to material found on the surfaces of Pluto and Triton, originating in the Keuper Belt of a solar system similar to ours.

‘Oumuamua is an uncommon, but not exotic, body, a fragment of a Pluto-like planet from another stellar system, that has travelled inter-stellar space since its formation in a molecular cloud in Lyra, near Vega, in the Perseus arm of our galaxy.

2I/Borisov

2I/Borisov was discovered in 2019 by a Gennadiy Borisov, an amateur Crimean astronomer and telescope maker (he has discovered 9 comets plus a number of asteroids using telescopes he built himself).
2I/Borisov was discovered as it approached the solar system, inbound, from the direction of Cassiopeia, in-line with the galactic plane, and is now heading out toward Telescopium, a southern constellation (below Sagittarius from our northern location). At first it was believed to be a normal, solar system comet, but as more data were collected on its trajectory and speed it was realised that it was moving in a high velocity hyperbolic path that would take it away from the sun.

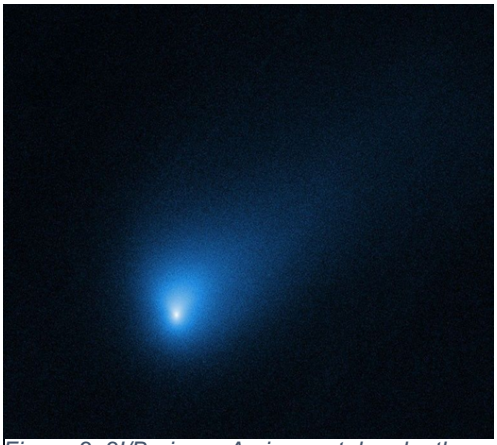


Figure 2: 2I/Borisov. An image taken by the Hubble telescope when the comet was 418million km from the sun. NASA, ESA and D. Jewitt (UCLA)

2I/Borisov has many characteristics of a normal, solar system comet, unlike ‘Oumuamua. It has a nucleus

estimated to be about 400m diameter with a 4-hour spin rate, surrounded by a coma, a cloud of dust and gas estimated to be as large as 14 times the diameter of the earth. Gas emissions changed systematically as the comet rounded the sun – at first it showed a strong H_2O plus CN (cyanide), CO (carbon monoxide) and unusually low C_2 and O proportion. As the nucleus heated and exsolved its outer layers (a 'skin' modified and weathered by exposure to interstellar cosmic radiation for maybe billions of years) the CO rate remained constant and H_20 decreased, revealing a CO rich interior.

2I/Borisov exhibits two major differences in chemistry relative to typical Solar System comets... higher CO and C, and less H_2O and O – these provide interesting insights into the host system from which it formed. The high CO/H_2O indicates that 2I/Borisov formed beyond the CO snowline in the outer reaches of a host system that was richer in carbon and CO than our own. Also, the outer reaches of the host system must have been a dynamically active zone (more so than our own), with common planetesimal collisions capable of ejecting an object like 2I/Borisov into interstellar space.

3I/Atlas

3I/Atlas is an interstellar comet, with similar characteristics to 2I/Borisov and many Solar System comets, consisting of a solid icy nucleus surrounded by a coma, a cloud of dust and gas 'boiled' off the nucleus by the sun's radiation. It was first observed by an ATLAS telescope in Chile (Asteroid Terrestrial-impact Last Alert System) in July 2025, moving at a speed of 61km/s near the constellation of Sagittarius – much faster than 1I/'Oumuamua and 2I/Borisov. There was concern that 3I/Atlas might impact earth, but further observations indicated that it posed no danger and was on a hyperbolic interstellar path. The trajectory of 3I/Atlas was very different to that of the previous 2 interstellar objects – its movement is 'retrograde'… moving in the opposite direction to the planets as it passed, and it moved upward through the galactic plane. Studies suggest that 3I/Atlas is on an inclined orbit around the Milky Way and originated in the thicker part of the disk, a region populated by old, generation II stars. 3I/Atlas may be between 7 and 11 billion years old, much older than our Solar System.

After discovery, astronomers are able to 'back track' a trajectory and check previously acquired images. 3I/Atlas was actually seen by the Vera-Rubin and NASA's TESS telescopes earlier in 2025

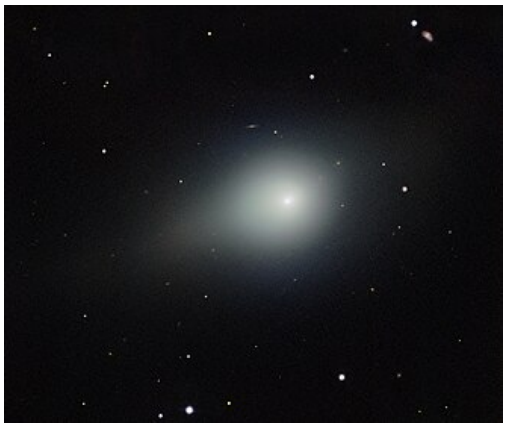


Figure 3: 3I/ATLAS photographed by the Gemini North telescope on 26 November 2025. The nucleus is likely less than 1km diameter, and is spinning with a 15-hour period.

The coma of 3I/Atlas became more prominent as it moved through perihelion (closest approach) to the sun – unsurprising after the nucleus endured temperatures of over 200°C.

Water, barely detectable pre-perihelion, became a significant component, CO increased, and hydrocarbons methane (CH_4), ethane (C_2H_6) plus CH_3OH and H_2CO increased significantly.

The hydrocarbons occur together dusty particles in an ‘anti-tail’… pointing toward the sun, whereas the water and other components occur in a concentric halo around the nucleus. The dust appears to comprise amorphous carbon and olivine ($MgSiO_4$), a common high-temperature mineral formed in the proto-planetary disk of a young star (and a significant component of inner, rocky, planets such as earth and the moon).

Interstellar cosmic ray radiation converts CO_2, CH_4, C_2H_6 into organic polymers, tholins, which may be the raw materials for prebiotic chemistry

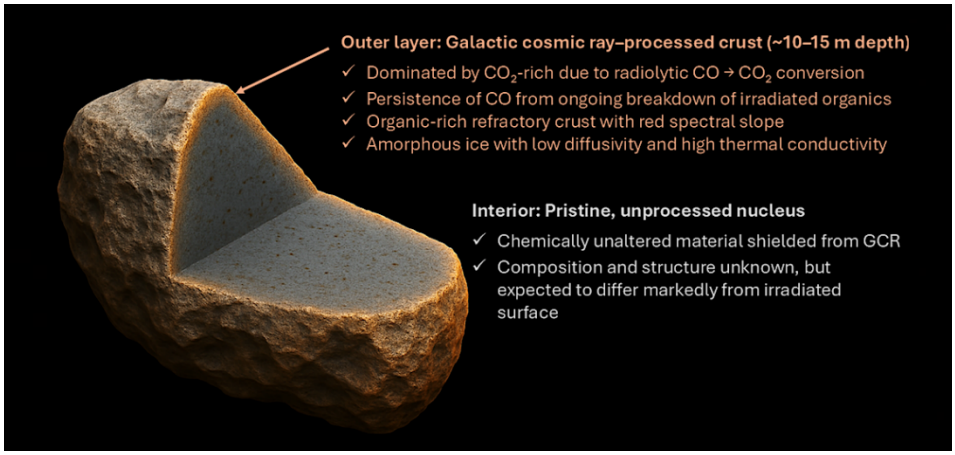


Figure 4: Schematic illustration of interstellar comet 3I/ATLAS, showing an outer skin enriched in CO_2 by galactic cosmic ray irradiation over several billion years, an organic-rich refractory mantle with a red spectral slope, and compact amorphous ice. Beneath this layer lies a pristine, unprocessed interior. From Magglio et. al, astro-ph.EP arXiv:2510.26308v1 30 Oct 2025

Jets of CO and CO_2 from the nucleus appear to have carried the dusty grains containing water ice into the coma of 3I/Atlas – dust is efficiently heated by the sun… as the dusty coma warmed the entrained water ice sublimated to water vapour. 3I/Atlas thus provides an interesting insight into how the coma may evolve under the influence of solar radiation … changes in cometary appearance are not just due to how the nucleus reacts to heating, but also to chemical and physical processes within the coma.

How common are inter-stellar objects?

Astronomers estimate that our galaxy hosts billions of interstellar objects, and that several thousand visit the solar-system each year. Most of these objects are believed to be ejected from the Oort clouds or Kuiper Belts of young stars - indeed, scientists estimate that only a small percentage of objects are actually retained in an Oort cloud… most are ejected by impacts and deflections into interstellar space.

The Oort cloud of our Solar System is made of billions of icy planetesimals orbiting well beyond the limits of Pluto and Neptune, concentrated in a disk that is aligned with the solar ecliptic and a ginormous spherical cloud extending out into interstellar space. The innermost portion of the Oort cloud is at least 1000 times further than the Kuiper Belt. The outer limit of the Oort cloud defines the boundary of the Solar System, at the limit of the suns’ gravitational influence.

Occasionally objects are disrupted from the Oort cloud and move inward as comets, and also, may be ejected into interstellar space to travel for billions of years, chemical time-capsules, 1I/'Oumuamua, 2I/Borisov and 3I/Atlas.

A Winter Stroll Along the Solar System – Casper Dyne

Approximately one month after our Christmas celebrations, despite the cold and particularly wet winter weather, we proceeded with a walk in Nonsuch Park.

On this occasion, I intended to take a leisurely stroll through some other park; however, my wife Katie suggested experiencing the Solar System Walk, which inspired our choice. The weather had improved significantly following prior storms and the rainfall the previous night.

Upon our arrival at the introductory board near the café, we found both the board and additional mounted posts to be in excellent condition, with leaflets well stocked. A few passers-by were engaged with the installations, reading and photographing QR codes, while children appeared interested and actively engaged with the educational materials.

I encountered a family during our visit, introduced myself as a member of the team, and they kindly agreed to have their photo taken as part of the experience. This interaction reinforced my sense of contributing to public interest in astronomy.

The route itself remained engaging throughout, featuring twelve posts that highlighted the natural environment. We observed magpies, wood pigeons, blue tits, robins, and acrobatic squirrels among English oaks.

Nonsuch Park is rich in arboreal diversity, including horse chestnuts, sycamores, ash, firs, pines, and other species.

Expansive meadows and snowdrops were emerging, and trails lined with trees of varying ages run parallel to the footpaths and the Solar System installations, making the park an ideal destination for both walkers and amateur astronomers.

It was a rewarding experience, and I am pleased with our successful completion of the Solar System walk through.

Up Next:

NEXT MEETING: 8pm Friday 13 February – Nonsuch High School

EAS Secretary Peter Scott will give a talk entitled "A Journey to Orbit."

The talk will describe the "journey" from launching a spacecraft, through its deployment, commissioning and operation.

As usual, there will also be a presentation on the sky at night for the coming month.

NEXT USER GROUP:

Suspended until further notice.

The next sessions, allowing for moon rise & set times and cloud conditions, should be sometime around the new moon which is on 17 February.

The precise date and timings of any session will be advised by email and WhatsApp a few days in advance but should be within the period 13 – 20 February.

AD HOC OBSERVING AT WARREN FARM:

These will be at short notice when the weather is favourable, and may replace, or be additional to, sessions at Denbies. Please watch our WhatsApp feed for alerts