JANUS
THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

October 2025

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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 October edition of Janus. The year is now 75% gone, the nights are getting longer and – potentially – we have more time for viewing. All we need is for the weather to cooperate!

But, before anything else, some exciting (and most welcome) news….. We have just heard that Epsom and Ewell Council have **APPROVED OUR PLANNING APPLICATION** for the siting of an observatory adjacent to the pavilion on Sutton Grammar School's playing fields in Northey Avenue. This marks the successful culmination of a fairly lengthy, at times tedious, process for which thanks are largely due to the tireless efforts of Ron Johnson. Whilst there is still work to be done to finalise costings and timescales, we have now cleared the first essential hurdle. Ron will probably have more to say at our next meeting which is on Friday 10 October when Astha from the University of Surrey will talk on a topic yet to be advised.

Elsewhere in this edition of Janus, Martin Howe and Casper Dyne report equally good progress on the Society's other "project" – the Solar System Walk in Nonsuch Park. This one is further advanced, to the point that there will be an inauguration at 10:30am on Saturday 25th October, attended by a number of committee members, local dignitaries and, hopefully, our president Professor Andrew Coates. Other society members are, of course, also most welcome to attend, along with any family and friends they care to bring with them – the more, the merrier!

Those members who are part of the society's WhatApp group may have seen a post from Matt Graydon suggesting, contrary to theories at the turn of the 21st century, the Sun's activity actually reversed course around 2008. This means that, for the next few decades, solar storms will likely be a more common occurrence. Full story at *https://www.popularmechanics.com/space/solar-system/a66434683/su-activity-increasing/*. What a good job NASA and NOAA have recently launched 3 new sun-studying missions (see item on page 6) !!

John

In this edition:

The Solar System October

MERCURY: begins the month having recently passed behind the Sun at superior solar conjunction. It will be very difficult to observe as it will reach its highest point in the sky during daytime and be 1° below the horizon at dusk. Visibility does not improve and by the end of the month, emerging into the evening sky as it approaches greatest elongation east, it remains difficult to observe, reaching its highest point in the sky during daytime and being on the horizon at dusk.

VENUS: begins the month just about visible as a morning object, now well past greatest elongation W and returning closer to the Sun. Visible in the dawn sky, rising at 04:38 BST – 2 hours and 20 minutes before the Sun – it will reach an altitude of 17° above the E horizon before fading from view as dawn breaks at around 06:38. By the end of the month, it will soon pass behind the Sun. Visible in the dawn sky, rising at 05:11 (BST) – 1 hour and 38 minutes before the Sun – it will reach an altitude of 10° above the SE horizon before fading from view as dawn breaks at around 06:27.

MARS: will soon pass behind the Sun at solar conjunction. Throughout the month, it will not be observable – it will reach its highest point in the sky during daytime and be below the horizon at dusk.

JUPITER: is currently emerging from behind the Sun. It begins the month visible in the dawn sky, rising at 23:51 BST and reaching an altitude of 56° above the SE horizon before fading from view as dawn breaks at around 06:38. By the end of the month, still visible in the morning sky, it becomes accessible around 22:10, when it reaches an altitude of 7° above the NE horizon. Reaching its highest point in the sky at 05:07, 59° above the S horizon, it will be lost to dawn twilight around 06:27, 56° above the SW horizon.

SATURN: recently passed opposition, and begins the month accessible at around 19:46 BST, when it rises to an altitude of 11° above the E horizon. Reaching its highest point in the sky at 00:15, 35° above the S horizon. It will become inaccessible at around 04:44 when it sinks below 11° above the W horizon. By the end of the month, now an early evening object, it becomes accessible around 17:20 BST, 16° above the SE horizon, as dusk fades to darkness. It will then reach its highest point in the sky at 21:06, 34° above the S horizon, and will continue to be observable until around 01:30, when it sinks below 11° above the W horizon.

URANUS: begins the month visible as a morning object. Becoming accessible around 22:52 BST, when it reaches an altitude of 21° above the E horizon, it will reach its highest point in the sky at 04:15, 58° above the S horizon before being lost to dawn twilight around 05:40, 54° above the SW horizon. By the end of the month, approaching opposition, it is visible as a morning object, becoming accessible around 19:51, when it reaches an altitude of 21° above the E horizon. Reaching its highest point in the sky at 01:13, 58° above the S horizon, it will be lost to dawn twilight around 05:28, 31° above the W horizon.

NEPTUNE: recently passed opposition. It begins the month visible from around 20:58 BST, when it rises to an altitude of 21° above the SE horizon. Reaching its highest point in the sky at 00:23, 37° above the S horizon, it will become inaccessible at around 03:48 when it sinks below 21° above the SW horizon. By the end of the month, it will become accessible at around 17:56, when it rises to an altitude of 21° above the SE horizon. Reaching its highest point in the sky at 21:19, 37° above the S horizon, it will become inaccessible at around 00:42 when it sinks below 21° above the SW horizon.

Notable Events:

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

October

2	Venus at perihelion 1 Ceres at opposition Andromeda Galaxy is well placed
3	NGC 253 is well placed
4	136472 Makemake at solar conjunction The Moon at aphelion Small Magellanic Cloud is well placed
5	October Camelopardalid meteor shower 2025 NGC 300 is well placed
6	Close approach of the Moon and Saturn Conjunction of the Moon and Saturn
7	Full Moon NGC 362 is well placed
8	The Moon at perigee Draconid meteor shower 2025
10	Close approach of the Moon and M45 Southern Taurid meteor shower 2025 Mercury at aphelion
11	δ-Aurigid meteor shower 2025 Lunar occultation of Beta Tauri
13	Moon at Last Quarter Conjunction of the Moon and Jupiter
14	Close approach of Moon and Jupiter
15	The Triangulum Galaxy is well placed
18	136199 Eris at opposition ε-Geminid meteor shower 2025
19	Conjunction of the Moon and Venus
21	Conjunction of Mercury and Mars Orionid meteor shower 2025 New Moon
23	Conjunction of the Moon and Mars Conjunction of Moon and Mercury
24	The Moon at apogee The Moon at perihelion Leonis Minorid meteor shower 2025
25	Lunar occultation of Antares 136108 Haumea at solar conjunction
26	The Perseus Double Cluster is well placed
29	Comet 3I/ATLAS passes perihelion Moon at First Quarter
	Mercury at greatest elongation east

November

2	Mercury at highest altitude in evening sky Close approach of the Moon and Saturn Conjunction of the Moon and Saturn
3	The Moon at aphelion
4	Mercury at dichotomy
5	Full Moon The Moon at perigee
6	Close approach of the Moon and M45
8	Lunar occultation of Beta Tauri
10	Close approach of the Moon and Jupiter Conjunction of the Moon and Jupiter
11	Jupiter enters retrograde motion Asteroid 471 Papagena at opposition
12	Moon at Last Quarter Northern Taurid meteor shower 2025 Conjunction of Mercury and Mars
13	Lunar occultation of Regulus
17	Leonid meteor shower 2025 The Pleiades cluster is well placed
20	The Moon at apogee New Moon Mercury at inferior solar conjunction
21	Uranus at opposition Conjunction of the Moon and Mars α-Monocerotid meteor shower 2025
22	The Moon at perihelion Comet 210P/Christensen passes perihelion
23	Mercury at perihelion
24	Lunar occultation of Sigma Sagittarii
27	The Hyades cluster is well placed
28	Saturn ends retrograde motion Moon at First Quarter November Orionid meteor shower 2025
29	Close approach of the Moon and Saturn Conjunction of the Moon and Saturn
30	Mars at apogee

Collected Observations (and thoughts) – Gary Walker

Saturn – Posted 2 September

On observing Saturn over the last few weeks, I have seen that the Western site of the ring system appears to break off, just before it reaches the limb of Saturn. I was puzzled by this, but on seeing images of Saturn taken recently, I saw that it was the usual phenomenon of the planet casting its shadow upon the rings, thus hiding them from sight as they reach the globe of Saturn. When the rings are wide open, this effect is easy to see, but now, as they are edge on, the reason for these rings appearing to fade away, is difficult to discern!

Aurora alert and the coming Lunar Eclipse – Posted 2 September

Yesterday and today, there was an Aurora alert, again. I looked out yesterday, but could not see anything, not even by using my camera for long exposures! However, the Aurora were seen as far South as Norfolk!

The coming Lunar Eclipse on 7 September was mentioned in the Weather part of the 6pm BBC News today, saying that we might possibly get a glimpse of it through the clouds!

Lunar Eclipse today – Posted 7 September

After a lot of wondering if I would see ANY of this eclipse, I finally managed to see it!

The Moon officially rose at about 7.24pm but, by then, the eclipse had already been going on for some hours, and Totality was coming to an end
.
The full cycle of times of the Eclipse were as follows:

- 4.28pm - Beginning of Penumbral Phase.
- 5.27pm - Beginning of Umbral Phase.
- 6.31pm - 7.53pm Totality
- 7.12pm - Maximum Eclipse.
- 8.57pm - End of Umbral Phase.
- 9.55pm - End of Penumbral Phase.

Due to these timings, it was clear that from the UK, even in the best conditions, only the end of Totality could be seen, and it was only the Post Totality Umbral Phases that would actually be visible. This eclipse was a reverse of the March eclipse, what with these eclipses occurring near Moonset and Moonrise and, again, only parts of the eclipse could be seen. Unfortunately, the Total Phase could not be seen in either of these eclipses.

Inevitably, the Weather forecast had been poor, with a low-pressure area rolling in. In the event, the weather was not bad during the day, with varying amounts and types of clouds.

By the mid evening, I saw that the cloud cover was moving away from the SW to the NE which, of course, would be where the Moon would be! Inevitably, the cloud cover was moving VERY SLOWLY and, of course, the Moon was in the furthest part of the sky (similar to during the Venus - Jupiter Conjunction last month)!

I thought I saw the Moon earlier, but it appeared very dim and fuzzy, and then I realised that it was just a bright cloud! When I did finally sight the Moon, it appeared fuzzily through the cloud and, just when it finally cleared this cloud, a cloud “street" started moving across the Moon. Fortunately, the cloud and Moon soon parted company, and I could see the rest of the eclipse properly!

I only finally saw the Moon (and the Eclipse) at about 8.28pm. By then, the Moon was already about two thirds of the way out of the eclipse. Although the Moon had risen an hour earlier, due to the stubborn cloud, it took ages for it to become visible.

The Umbra was, of course, steadily retreating, and there was no reddish colour, because the uneclipsed part of the

Moon was too bright. Nonetheless, the limb of the Moon was dimly visible through the Umbra. In the last few minutes of the eclipse, the Umbra seemed to shrink more rapidly and soon disappeared (similar to the end of the Solar Eclipse of 29 March). By about 8.56pm, the Umbra had essentially cleared the Moon, altogether.

In all, I managed to see this eclipse from 8.29pm to about 8.58pm, i.e. only about half an hour, in total.

The temperature was very warm, despite a breeze, and it was very pleasant to be out in it.

I feel that I have scored a "hat trick", this year, as I have seen the Lunar Eclipse of 14 March, the Solar Eclipse of 29 March, and now this one, too!

Evidence of Life found on Mars (again)! – Posted 11 September

Mars has always been thought to be the most Earth-like planet, even to the point of hosting intelligent Martians, creating a system of canals, across their world! Later, this theory was discounted, and the first Mariner probe showed a boring and barren world, not much different from the Moon! Later probes, however, showed evidence of past water flows, deltas, and lakes, on Mars, which was why the Perseverance probe landed in this area.

Other hints of life processes included the Meteorite from Mars, which showed tiny wormlike features, but these are not now thought to be associated with life. This story appeared in all the national newspapers in 1996!

Even the Viking probes of 1976 had on board laboratories, which tested samples which seemed to give signs of life, but were ultimately, inconclusive.

Also, emissions of Methane gas have been detected on Mars, repeatedly, which could either be down to life processes, or volcanic ones.

On 10 September, It was announced that the Perseverance probe had found some rocks with "leopard spots" in them. These COULD have been caused by microbes creating chemical reactions in these 3.5-billion-year-old mudstones!

Unfortunately, probes are limited in what they can do to detect life signs, and the only way of being certain is to either send astronauts to Mars for the "Ground Truth", or by sending a sample return mission to bring it back to Earth!

Also, on Venus, the detection of Phosphine in the clouds has not yet been conclusively proved, one way or the other.

Meteorite in Scotland! – Posted 13 September

As Dr Steven Banham stated in last night's lecture, astronomers are normally looking up at the sky, but being as he is a Geologist, studying the Martian surface, he then has to look down at the ground!

Coincidentally, today on BBC News, there was a report on the hunt for meteorite fragments that probably fell from a meteorite seen flying over Scotland on 5 July.

These days, it is not uncommon for fireballs to show up on security cameras and, even, Ring doorbells, too!

The fragments have fallen in difficult walking country, and they were asking hill walkers to look out for them. They are thought to have fallen in the Dalwhinnie area, in NW Scotland, on the Stob Coire, Easain, Chno Dearg, and Ben Alder munros.

There is a race against time to find them before bad weather causes the fragments to disintegrate, altogether. Although the fragments should stand out from the regular geology of the area, unfortunately, they may be anywhere within a 12-mile range!

The last British meteorite fall was the Winchcombe one in 2021.

Like Dr Banham, the meteorite hunters, instead of looking up at the sky, will be looking down at the ground!

Ironically, the speaker originally scheduled for tonight's lecture was the one who found or was studying the "leopard skin" spots, found by the Perseverance probe! Obviously, he couldn't come, as he is now heavily caught up with all the scientific and media mayhem. It is, however, also ironic that he and tonight's speaker are both involved in the latest Martian Missions!

Occultation of Venus by the Moon – Posted 19 September

Amazingly enough, today was one of the few clear days in the recent past, so it was possible to observe the occultation of Venus by the Moon.

As it was in the daytime, I could only do a crude GOTO, to reach even the approximate position of Venus in my telescope. Ironically, I first came across the very dim and thin waning crescent Moon, which was only 5% illuminated. Venus was still out of my telescope's field of view, even at 62X, at about 11.33am. However, by about 12.14pm, the two objects were visible in this same field of view.

Venus was now nearly at its smallest in angular size, at only about 11.7' arcseconds, and nearly full, at 87%, so it was at gibbous phase. It appeared rather small, even at 222X, but the phase was still clear at all magnifications.

During the next half hour, or so, Venus crept slowly closer and closer to the bright limb of the Moon, (which was still very dim, under the conditions, previously stated).

As usual, even when it seemed to be reaching the Moons limb, it was still not quite close enough to be occulated. It always takes longer than you think!

Eventually, however, I saw Venus become occulted by the Moon about 12.57pm. Unlike a star which, as a point source, vanishes instantly, Venus, like any planet, took about 17 seconds to completely disappear!

I first saw Venus shrinking, and flattening down to a "spark", which subsequently quickly faded. Then, there were only a few faint "sparks" of light, which also vanished from view

I was unable to see the reappearance of Venus at around 2.07pm, partly because my telescope kept on drifting, and losing the Moon - despite being on GOTO - but also down to a patch of cirrus cloud. Obviously, the Moon was very difficult to see on its own, and I didn't manage to find Venus or the Moon in binoculars, either! I only saw Venus again, about 2.17pm.

Notwithstanding the difficulties, however, I deem this observation a success, as at least I saw the occultation and, for once, the weather was good! I last saw an occultation of Venus on 9 November 2023, just under 2 years ago. I have now seen 3 occultations of Venus, 1 of Mars, 1 of Jupiter, and for some reason, 5 of Saturn!

SpaceX launches NASA & NOAA missions exploring the impacts of the Sun – John Davey

On the morning of 24 September, a Space X Falcon 9 was launched from NASA's Kennedy Space Centre carrying a trio of Sun-studying payloads for NASA and NOAA. All three payloads are flying to the L1 Lagrange point.

Leading the rideshare mission is NASA's Interstellar Mapping and Acceleration Probe (IMAP) alongside the agency's Carruthers Geocorona Observatory and NOAA's Space Weather Follow-On Lagrange 1 (SWFO-L1). Each of the three missions focuses on a different aspect of the Sun.

IMAP features a suite of 10 science instruments and will study the edge of the heliosphere, creating a complete map of the boundary that protects our solar system from varying amounts of galactic radiation. Its overall objective is to document both short-term and long-term space weather as an aid to future space weather predictions.

Creating actionable space weather forecasts is the job of NOAA's SWFO-L1 spacecraft. It's designed to provide warning of a coronal mass ejection (CME) anywhere between 12 hours and a few days before it would reach the Earth. A CME reaches the spacecraft and it can tell its strength with greater specificity, it can translate that back to mission managers with between 15 and 45 minutes warning.

According to NOAA, the observatory will enable aging legacy satellites to be decommissioned without causing a coverage gap. Solar observatories that are well past their design life include:

- Solar and Heliospheric Observatory (SOHO), an ESA-NASA project launched in 1995
- Advanced Composition Explore (ACE), a NASA probe launched in 1997
- Deep Space Climate Observatory, a NOAA spacecraft launched in 2015.

Unlike its predecessors, the SWFO-L1 observatory will constantly stream data down to Earth without interruption and obstruction, offering improved performance over older instruments and faster delivery of observations.

While IMAP and SWFO-L1 are eyeing the Sun, NASA's Carruthers Geocorona Observatory will be aiming back at the Earth. It will be far enough away to capture a full picture of the outermost layer of Earth's atmosphere using a pair of imagers.

Taking continuous pictures of the full geocorona as it's impacted by solar wind and other space weather events will allow researchers to better understand how this piece of the atmosphere is or is not able to protect the Earth.

Information could be a fundamental part of the universe – and may explain dark energy and dark matter

Acknowledgement: This article was written by Florian Neukart, Assistant Professor of Physics, Leiden University, and was first published in THE CONVERSATION on 24 September 2025. 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/information-could-be-a-fundamental-part-of-the-universe-and-may-explain-dark-energy-and-dark-matter-265415*

For more than a century, physics has been built on two great theories. Einstein's general relativity explains gravity as the bending of space and time.

Quantum mechanics governs the world of particles and fields. Both work brilliantly in their own domains. But put them together and contradictions appear – especially when it comes to black holes, dark matter, dark energy and the origins of the cosmos.

My colleagues and I have been exploring a new way to bridge that divide. The idea is to treat information – not matter, not energy, not even spacetime itself – as the most fundamental ingredient of reality. We call this framework the quantum memory matrix (QMM).

At its core is a simple but powerful claim: spacetime is not smooth, but discrete – made of tiny “cells”, which is what quantum mechanics suggests. Each cell can store a quantum imprint of every interaction, like the passage of a particle or even the influence of a force such as electromagnetism or nuclear interactions, that passes through. Each event leaves behind a tiny change in the local quantum state of the spacetime cell.

In other words, the universe does not just evolve. It remembers.

The story begins with the black hole information paradox. According to relativity, anything that falls into a black hole is gone forever. According to quantum theory, that is impossible. Information cannot be ever destroyed.

QMM offers a way out. As matter falls in, the surrounding spacetime cells record its imprint. When the black hole eventually evaporates, the information is not lost. It has already been written into spacetime’s memory.

This mechanism is captured mathematically by what we call the imprint operator, a reversible rule that makes information conservation work out. At first, we applied this to gravity. But then we asked: what about the other forces of nature? It turns out they fit the same picture.

In our models assuming that spacetime cells exist, the strong and weak nuclear forces, which hold atomic nuclei together, also leave traces in spacetime. Later, we extended the framework to electromagnetism (although this paper is currently being peer reviewed). Even a simple electric field changes the memory state of spacetime cells.

Explaining dark matter and dark energy

That led us to a broader principle that we call the geometry-information duality. In this view, the shape of spacetime is influenced not just by mass and energy, as Einstein taught us, but also by how quantum information is distributed, especially through entanglement. Entanglement is a quantum feature in which two particles, for example, can be spookily connected, meaning that if you change the state of one, you automatically and immediately also change the other – even if it’s light years away.

This shift in perspective has dramatic consequences. In one study, currently under peer review, we found that clumps of imprints behave just like dark matter, an unknown substance that makes up most of the matter in the universe. They cluster under gravity and explain the motion of galaxies – which appear to orbit at unexpectedly high speeds – without needing any exotic new particles.

In another, we showed how dark energy might emerge too. When spacetime cells are saturated, they cannot record new, independent information. Instead, they contribute to a residual energy of spacetime. Interestingly, this leftover contribution has the same mathematical form as the “cosmological constant”, or dark energy, which is making the universe expand at an accelerated rate.

Its size matches the observed dark energy that drives cosmic acceleration. Together, these results suggest that dark matter and dark energy may be two sides of the same informational coin.

A cyclic universe?

But if spacetime has finite memory, what happens when it fills up? Our latest cosmological paper, accepted for publication in The Journal of Cosmology and Astroparticle Physics, points to a cyclic universe – being born and dying over and over. Each cycle of expansion and contraction deposits more entropy – a measure of disorder – into the ledger. When the bound is reached, the universe “bounces” into a new cycle.

Reaching the bound means spacetime’s information capacity (entropy) is maxed out. At that point, contraction cannot continue smoothly. The equations show that instead of collapsing to a singularity, the stored entropy drives a reversal, leading to a new phase of expansion. This is what we describe as a “bounce”.

By comparing the model to observational data, we estimate that the universe has already gone through three or four cycles of expansion and contraction, with fewer than ten remaining. After the remaining cycles are completed, the informational capacity of spacetime would be fully saturated. At that point, no further bounces occur. Instead, the universe would enter a final phase of slowing expansion.

That makes the true “informational age” of the cosmos about 62 billion years, not just the 13.8 billion years of our current expansion.

So far, this might sound purely theoretical. But we have already tested parts of QMM on today’s quantum computers. We treated qubits, the basic units of quantum computers, as tiny spacetime cells. Using imprint and retrieval protocols based on the QMM equations, we recovered the original quantum states with over 90% accuracy.
This showed us two things. First, that the imprint operator works on real quantum systems. Second, it has practical benefits. By combining imprinting with conventional error-correction codes, we significantly reduced logical errors. That means QMM might not only explain the cosmos, but also help us build better quantum computers.

QMM reframes the universe as both a cosmic memory bank and a quantum computer. Every event, every force, every particle leaves an imprint that shapes the evolution of the cosmos. It ties together some of the deepest puzzles in physics, from the information paradox to dark matter and dark energy, from cosmic cycles to the arrow of time.

And it does so in a way that can already be simulated and tested in the lab. Whether QMM proves to be the final word or a stepping stone, it opens a startling possibility: the universe

may not only be geometry and energy. It is also memory. And in that memory, every moment of cosmic history may still be written.

There goes a supernova …. John Pillar PhD, FGS

Yes – there is a supernova in the sky, in galaxy NGC7331, discovered in July 2025 by the GOTO array of telescopes. After a few days the supernova was shining at magnitude ~12. The images in Figure 1 were captured in September from my backyard.

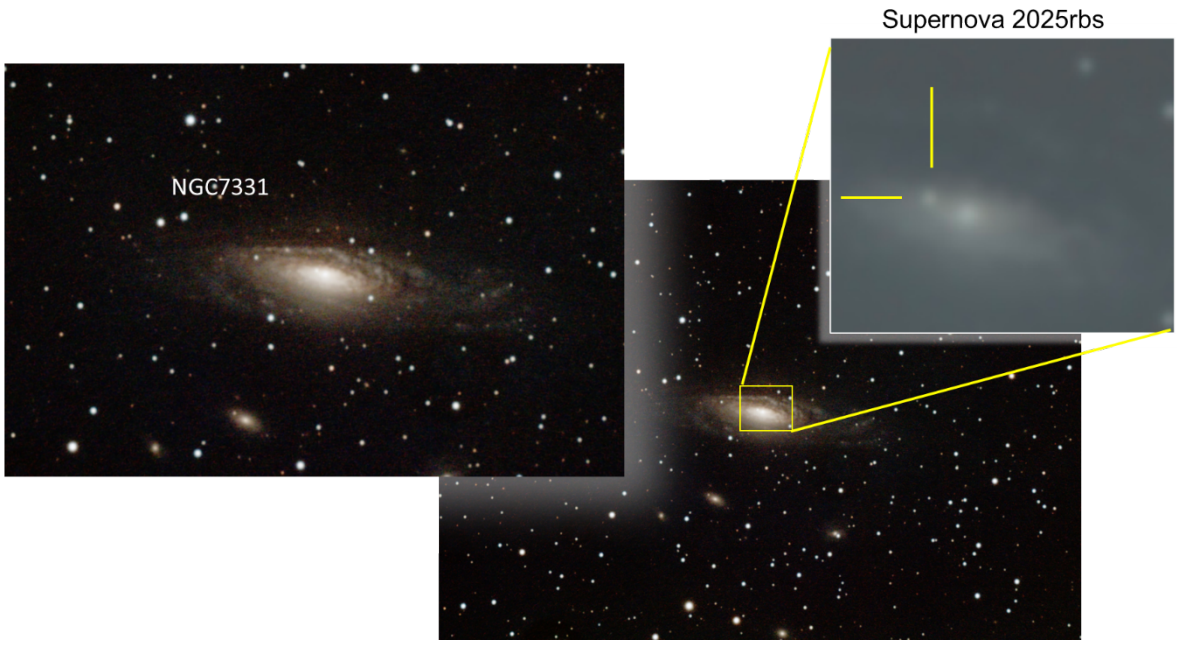


Figure 1: NGC7331 in Pegasus. The inset attempts to highlight the supernova in the core region of the galaxy (it's a bit dim, but is visible). Amazingly the supernova almost outshines the galactic core.

NGC7331, also known as Caldwell 30, is an unbarred spiral galaxy about 40 million light years away in the constellation of Pegasus, discovered by William Herschel in 1784. The galaxy is similar in size to the Milky Way, 146000 light years across, but interestingly its core, the galactic bulge rotates in the opposite direction to the disk in the outer portion of the galaxy.

GOTO stands for Gravitational-wave Optical Transient Observer… an array of robotic optical telescopes designed to image the counterparts of gravitational wave events that are detected by the LIGO system.

SN2025rbs is a **type 1a** supernova. Supernovae are officially classified according to characteristic features in their spectra, but what started out historically as a simple classification seems to have become more complex and convoluted.

Prior to the 1930's little was known about novae or supernovae, but through the late 1930's spectrograms of novae and supernovae became more commonplace and with the growing database came the realisation that there were two distinct families of supernovae – those without hydrogen Balmer lines in their spectra, and those with. A classification of Type I and Type II supernovae was introduced in 1941 by Minkowski (a German/American astronomer who worked at Palomar Observatory) …. Type I for events without hydrogen lines and Type II for events with hydrogen lines.

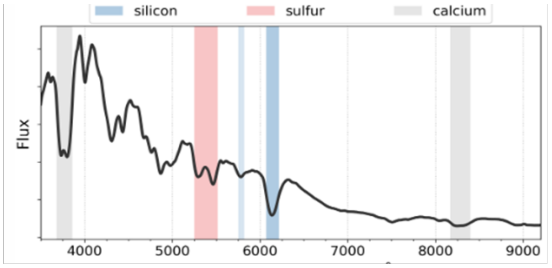
However, although the Type I and II classification seemed to work reasonably well, it was recognised that there were subtle differences and similarities within the broad Type I classification.

Through the 1960's the concept that supernovae were the result of rapid nuclear fusion after collapse of massive stars was developed by Fred Hoyle (Cambridge astronomer and author) and William Fowler (American nuclear physicist), but it wasn't until 1973 and a paper by Whelan and Ben that a successful theory invoking a binary-star mechanism for Type Ia supernovae was widely accepted (The Astrophysical Journal, 186: 1973, Binaries and Supernovae of Type I*).

Figure 2 attempts to illustrate the key discriminating features of the main types of supernovae spectra. Essentially, the spectra are the end-product of light emitted by the relict, hot core and radioactive decay of the progenitor star when it explodes, minus light (at particular wavelengths) absorbed by the ionised gas envelope ('shell') that may have been ejected from the star before it exploded. Supernovae type Ia are characterised by a strong silicon II absorption line, plus calcium, magnesium, sulphur and oxygen lines, indicating that the outer layers of the ejecta are mainly composed of these intermediate mass elements.

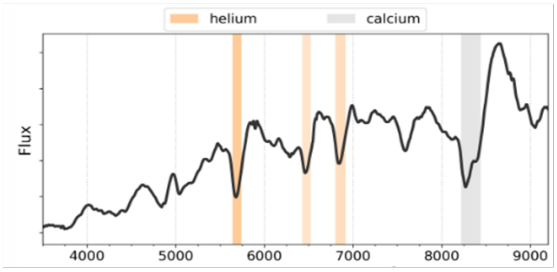
Type 1a: White dwarf binary system

- No hydrogen or helium absorption.
- Strong absorption from silicon and calcium.
- Sulphur and iron absorption can also sometimes be seen



Type 1b, 1c, 1d: Core collapse in stars that have no hydrogen

- These lack absorption from hydrogen.
- Some show absorption from helium (SNe Ib) while others lack absorption from both hydrogen and helium (SNe Ic)



Type II: Core collapse of massive stars that have hydrogen

- Show absorption from hydrogen because the hydrogen envelope around the star is still intact.
- The strength of the hydrogen absorption can vary

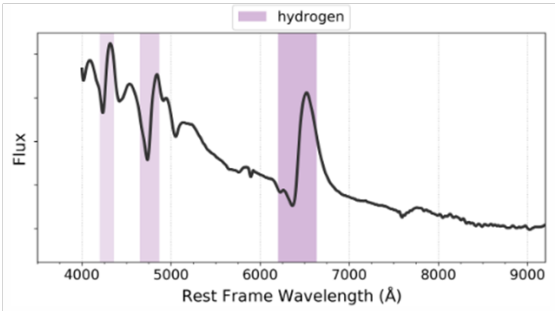


Figure 2: Example 'type' spectra of supernovae. From Zooniverse Chemical Factory https://www.zooniverse.org/projects/adamamiller/zwicky-chemical-factory/about/researchfrom

Type 1a supernovae

Type 1a supernova are unique – different from all the rest. They are caused by detonation of a white dwarf star. Of itself, however, a white dwarf star is stable … to become a supernova it needs to gain sufficient mass to kick-start a thermonuclear explosion in its core. Whelan and Ben's (1973) generally accepted model for supernovae Type I invokes a binary system comprising of a large 'primary' star (of about 3 $M_\odot$) and a secondary of about 0.8 $M_\odot$, illustrated in Figure 3. The primary, as a relatively large star, evolves on the main sequence quickly and during its unstable demise through red-giant stage it loses mass to a planetary nebula in the normal way, ultimately becoming a carbon-oxygen white dwarf of mass close to 1.4 $M_\odot$. The smaller secondary evolves more slowly, but eventually swells to the point that it comes within reach of the primary, and it starts to transfer material. The increasing mass of the primary causes it to exceed the critical mass required for thermonuclear explosion in its core (the Chandrashekhar mass, equal to approximately 1.4$M_\odot$). Within a few seconds of core collapse a substantial proportion of the star undergoes nuclear fusion, releasing enormous amounts of energy and forming a rapidly expanding shock wave.

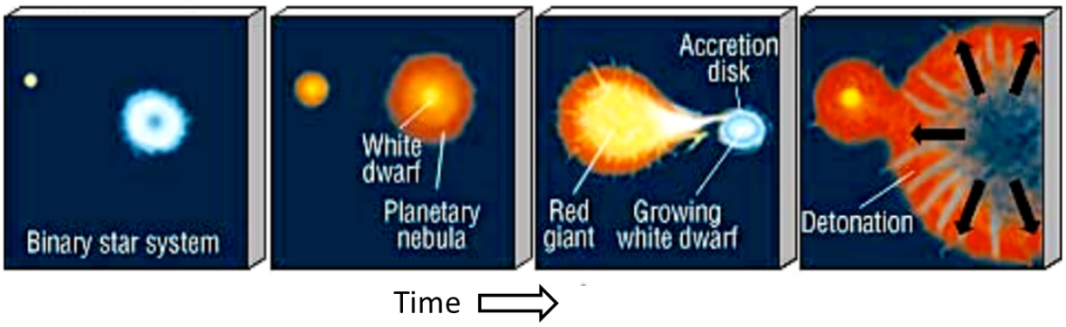


Figure 3: Evolution of a binary system to Supernova type 1a. Modified from https://sites.astro.caltech.edu/~george/ay20/Ay20-Lec12x.pdf

The brightness and spectral properties of Type 1a supernovae are very consistent and similar, of about magnitude -19.2, which is why these events are so useful as indicators of distance (their apparent brightness is related to their distance away, just like looking at a car headlamp from close by, or far away). Much of the light emitted by the supernova is not actually directly due to the explosion, but is emitted by the decay of an isotope of nickel and cobalt… ^{56}Ni, decays to ^{56}Cobalt, and then further to ^{56}Iron. The half-life decay times of these isotopes (6 days for ^{56}Ni, 77 days for ^{56}Co) drives a very characteristic light decay curve, (i.e. how quickly the brightness of the star dims in the time after the explosion) shown in Figure 4. Enormous amounts of nickel and cobalt (many thousand earth masses) can be produced by this process.

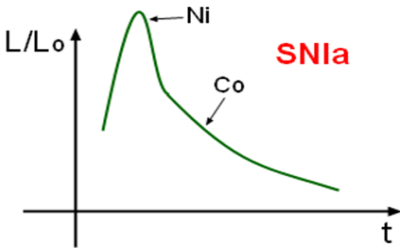


Figure 4: Typical SN Type 1a light decline curve, highlighting the early dominance of Ni half-life, and later Co. From Wikipedia and Mazzali et., al. (2001). The Astrophysical Journal 547:988-954

How far away is NGC 7331?

Supernovae type 1a are excellent 'standard candles', and using the published maximum brightness of SN2025rbs we can estimate how far away the galaxy NGC7331 is.

We do this using the distance modulus equation,

$$d=10^{(m-M+5)/5}$$

Where d is the distance in parsecs, m is the observed magnitude of the supernova, and M is its absolute magnitude (standard Type 1a magnitude is -19.12).
The published maximum brightness of SN2025rbs was between 11.5 and 12 (although I've seen values up to 14.4 online)… putting this value into the equation…

$$d=10^{(11.5-(-19.12)+5)/5}$$

yields a distance of 13.8 megaparsecs, equivalent to 44 million light years. The actual published distance to NGC7331 is 45million light years… pretty close 😊, but actually, given the range of values reported, the error range on this simple calculation is very large. More sophisticated equations attempt to account for loss of brightness due to dust in the parent galaxy and in the milky way, the decay of brightness as the supernova fades, and doppler shift of the light because the parent galaxy is usually receding.

What does SN2025rbs spectra show?

The Transient Name Server website *(https://www.wis-tns.org/)* posts details of observed

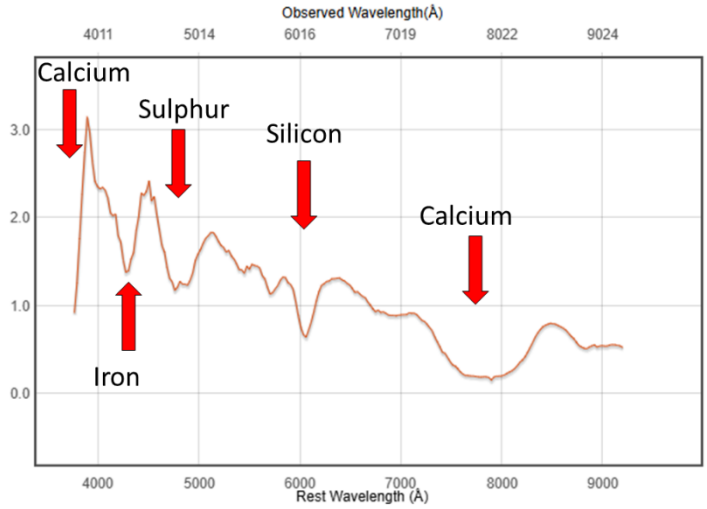
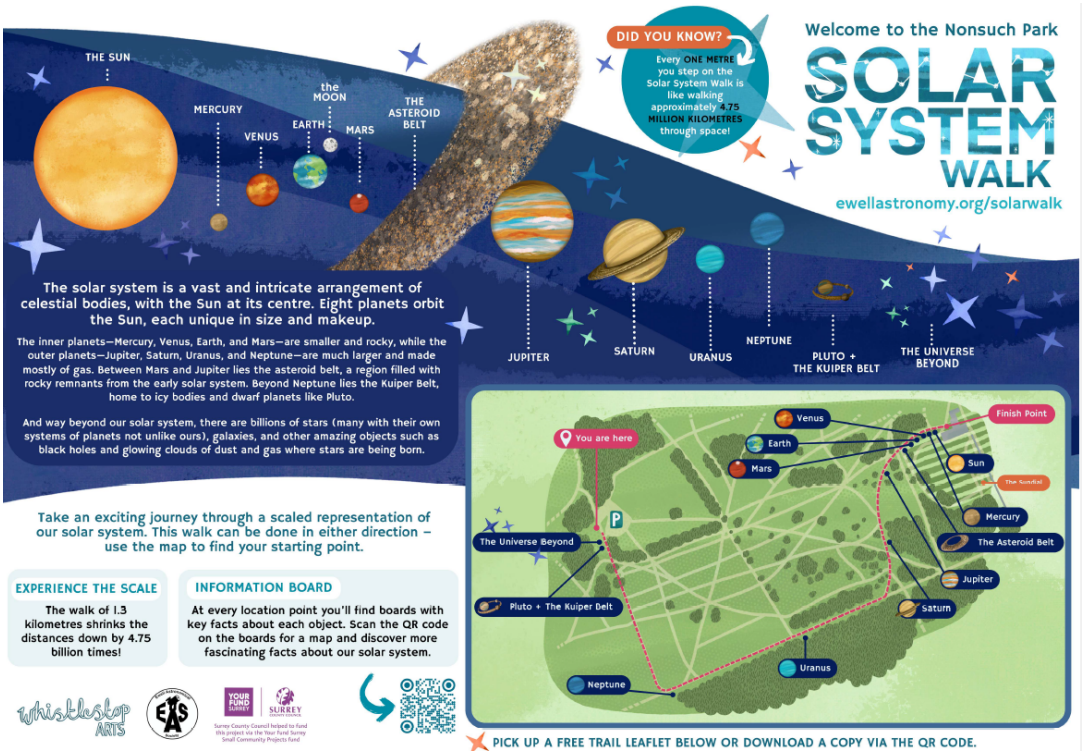


Figure 5: Spectra from SN2025rbs. I've highlighted the key absorption lines. The lack of hydrogen and the silicon Si II absorption line at around 6000 is characteristic of type Ia supernovae. From Caltech ZTF SEDM P60 robotic transient observer.

variable objects and has several versions of the SN2025rbs spectra …. example shown in Figure 5. The spectrum a very typical Type 1a example, displaying no hydrogen signal, and absorption lines of silicon, iron, calcium and sulphur – all elements produced in the thermonuclear explosion from the carbon+oxygen core of the white dwarf. Interestingly the silicon II line is significantly blue shifted (to shorter wavelengths) because the ionised Si envelope is moving toward us so fast.

The Nonsuch Park Solar System Walk - Martin Howe

I hope by now you are all aware of the soon-to-be launched solar system walking trail in Nonsuch Park. This will be a 1.3km trail, visiting the objects of the solar system, on a scale of 1:4.75 billion. The content is being developed by our society, and we have engaged a design company, Whistlestop Arts, to design the artwork for us. Below is an example one of the main A1-sized signs that will mark either end of the trail.



These will be located near the café in the mansion house, and the southern London Road carpark. The walk can be done in either direction, with the Sun at the mansion house end, and the wider universe at the carpark end.

Set out at intermediate points along the route, according to the scale, will be smaller A4-sized information boards, which will look a little like the representation here.

Each board will also have a QR code that can be scanned which will take users to webpages providing more information and activities, including a word search and quiz.

This walk has been developed by a small working group of volunteers from the society, including Pete Scott, Suzanne Fox, Shirish Phade, Srikala Iyengar and myself. We are very grateful to the Surrey Country Council, who have funded this project for us through their community fund.

We will be having a launch event at the mansion house end of the walk at 10:30am on Saturday 25th of October. Please come along with your family and friends!

The Monolith has landed: Realisation of the Solar System Walk - Casper Dyne

Finally, after a year-long process, with approval from Epsom and Ewell Council, work commenced to install the “monolith” style educational posts for the Solar System Walk.

The primary goal of this initiative is to promote public understanding of the position and scale of objects in the solar system. Whilst books and planetariums illustrate these concepts through images and videos, it is uncommon to encounter a physical representation such as this. The distances between the planets, as depicted by the posts, are calculated using reduced scales corresponding to the actual interplanetary distances. Determining an accurate scale that would fit within Nonsuch Park required careful planning and calculation.

Installation commenced under favourable weather conditions at 9:30am. With assistance from Nonsuch Park volunteers Jon and Peter, the necessary materials were transported, and all fifteen eight-foot composite posts were positioned along the pathway. The completed installation evoked comparisons to the iconic monolith scene from "2001: A Space Odyssey."

The installation was completed approximately three and a half hours ahead of schedule, entirely due to the dedicated support of John Pillar, Suzanne, Anita, Dennis, Martin, Jon, Peter, Alex (the Epsom and Ewell council worker responsible for detecting underground utilities), and myself. Special mention goes to Dennis for his considerable efforts in digging the holes for the posts!




Throughout the work, several park visitors expressed interest in the project and were given detailed explanations.

The next phase is to affix descriptive plates featuring details about each planet to each post, as well as the introductory boards illustrating the solar system at each end of the route.

To celebrate completion of this important first phase, the team enjoyed refreshments of Victoria sponge cake and coffee.

Up Next:

NEXT MEETING: 8pm Friday 10 October – Nonsuch High School

Astha from the University of Surrey will talk on a topic yet to be advised.

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

INAUGURATION OF EAS SOLAR WALK: 10:30am, Saturday 25 October - Nonsuch Park

NEXT USER GROUP:
Suspended until further notice.

NEXT DENBIES OBSERVING SESSION:

The next sessions, allowing for moon rise & set times and cloud conditions, should be sometime around the new moon which is on 21 October.

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 18 – 24 October.

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