JANUS
THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

April 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 April edition of Janus. This month's meeting on Friday 10 April features a talk by Peter Goodhew FRAS about Deep Sky Imaging.

Last month's talk by Astha Chaturvedi looked at the possible use of coatings on satellites to reduce their optical signature to a sufficiently low level that they no longer interfere with astronomical activity. The results look promising, but they only address one of the issues astronomers face from the ever-increasing satellite population. Radio astronomers will still have to deal with RF interference due to Unintentional Electromagnetic Radiation (UEMR) from satellite downlinks and payloads. According to a presentation I heard last week, with at least 100,000 satellites deployed by 2030, Low frequency radio-telescopes such as LOFAR and SKA-Low will always have a satellite within the main beam and several in sidelobes, all of which have the potential to adversely affect results from these, and other, expensive, multi-national facilities. The article on page 6 of this month's edition raises some other issues.

In this edition:

Now for two March highlights……First, close to home and dear to member's hearts, Saturday 28 March saw the long-awaited start of work on constructing the Society's observatory. Removal of soil and digging out the deep hole for the pier were completed ready for making up formwork, concreting of the telescope pier and, if the weather stays fine, concreting of the observatory base, the following week. Some pictures showing members hard at work appear on page 14.

Second – further from home, but hugely significant, the countdown for NASA's Artemis II test flight is finally underway at the Kennedy Space Centre in Florida. The onsite countdown clock started ticking down at 4:44 pm EDT (9:44 pm BST) on 30 March, targeting a launch time of 6:24 pm (11:24 pm BST) on 1 April. Artemis II is the first crewed launch of NASA's SLS (Space Launch System) rocket and Orion spacecraft and marks the next step on the path to a planned landing of astronauts on the Moon in 2028. Artemis II will send NASA astronauts Reid Wiseman, Victor Glover, Christina Koch, and CSA (Canadian Space Agency) astronaut Jeremy Hansen on an approximately 10-day journey around the Moon taking them further from earth than any humans before them. I'm sure we all wish them well.

John

skyUpdate
What's up this month?

The Solar System April

Only Venus and Jupiter are easy targets throughout this month. The remaining planets are either intermittently visible, or not visible at all

MERCURY: begins the month emerging into the morning sky as it approaches greatest elongation W. It is not observable, reaching its highest point in the sky during daytime and being on the horizon at dawn. By the end of the month, soon passing behind the Sun, it remains unobservable as it will reach its highest point in the sky during daytime and being 2° below the horizon at dawn.

VENUS: will soon pass behind the Sun. It begins the month visible from around 19:53, 12° above the W horizon, as dusk fades to darkness. It will then sink towards the horizon, setting 1 hour and 48 minutes after the Sun at 21:20. By the end of the month, it will become visible at around 20:43, 17° above the W horizon, before sinking towards the horizon and setting 2 hours and 33 minutes after the Sun at 22:53.

MARS: recently passed behind the Sun at solar conjunction. Throughout the month, it is not observable. It will reach its highest point in the sky during daytime and be 3° or 4° below the horizon at dawn..

JUPITER: recently passed behind the Sun at solar conjunction. It begins the month visible from around 19:53, 61° above the S horizon, as dusk fades to horizon, setting at 03:39. By the end of the month it will become visible at around 20:43, 45° above the SW horizon, and will then sink towards the horizon, setting at 01:56.

SATURN: recently passed 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 6° from it. Visibility improves slightly as the month progresses but remains challenging. By the end of the month, reaching its highest point in the sky during daytime it will still be 2° below the horizon at dawn.

URANUS: recently passed behind the Sun at solar conjunction. It begins the month visible from around 20:54, 26° above the W horizon, as dusk fades to darkness. It will then sink towards the horizon, setting at 23:55. By the end of the month, it is extremely difficult to see since it is very close to the Sun, at a separation of only 20° from it.

NEPTUNE: recently passed behind the Sun at solar conjunction. At the beginning of the month, it is not readily observable since it is very close to the Sun, at a separation of only 9° from it. It remains a difficult target throughout the month and, by the end of the month, it is not observable, reaching its highest point in the sky during daytime and being 6° below the horizon at dawn.

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*

April

1	136472 Makemake at opposition
2	The Sombrero Galaxy is well placed Full Moon
3	Mercury at greatest elongation west Mercury at dichotomy
4	Mercury at aphelion Comet C/2026 A1 (MAPS) passes perihelion
5	Messier 94 is well placed The Moon at aphelion
6	The Jewel Box cluster is well placed Comet C/2026 A1 (MAPS) passes perigee Lunar occultation of Antares
7	The Moon at apogee
8	Conjunction of Venus and Ceres
9	Lunar occultation of Sigma Sagittarii
10	Moon at Last Quarter
13	Conjunction of Mars and Neptune
14	Centaurus A is well placed Omega Centauri is well placed The Moon at perihelion
15	The Whirlpool Galaxy is well placed 136199 Eris at solar conjunction Conjunction of the Moon and Mercury
16	Conjunction of the Moon and Mars Conjunction of the Moon and Saturn Conjunction of Mercury and Neptune
17	Messier 83 is well placed New Moon
18	Messier 3 is well placed
19	The Moon at perigee Conjunction of the Moon and Venus Comet C/2025 R3 (PANSTARRS) passes perihelion Close approach of the Moon and M45
20	Conjunction of Mercury and Mars Conjunction of Mercury and Saturn Close approach of Mercury and Saturn Conjunction of Saturn and Mars
21	Lunar occultation of Beta Tauri
22	Lyrid meteor shower 2026 Conjunction of the Moon and Jupiter
23	Close approach of the Moon and Jupiter 136108 Haumea at opposition Comet 141P/Machholz passes perihelion
24	Messier 101 is well placed π-Puppid meteor shower 2026 Moon at First Quarter Conjunction of Venus and Uranus Close approach of the Moon and M44
26	Lunar occultation of Regulus Comet C/2025 R3 (PANSTARRS) passes perigee

May

1	Full Moon
2	Conjunction of Mercury and Eris
4	Lunar occultation of Antares The Moon at aphelion The Moon at apogee
6	η-Aquariid meteor shower 2026 Lunar occultation of Sigma Sagittarii
9	η-Lyrid meteor shower 2026 Moon at Last Quarter
13	Messier 5 is well placed Close approach of the Moon and Saturn Conjunction of the Moon and Saturn
14	Mercury at superior solar conjunction
15	Conjunction of the Moon and Mars The Moon at perihelion 1 Ceres at solar conjunction Venus at perihelion
16	New Moon
17	The Moon at perigee
18	Mercury at perihelion Lunar occultation of Beta Tauri
19	Conjunction of the Moon and Venus Close approach of the Moon and Venus
20	Conjunction of the Moon and Jupiter Close approach of the Moon and Jupiter
21	Close approach of the Moon and M44
22	Uranus at solar conjunction Venus at highest altitude in evening sky
23	Lunar occultation of Regulus Moon at First Quarter
29	Messier 4 is well placed Asteroid 29 Amphitrite at opposition
31	Blue Moon Lunar occultation of Antares

Collected Observations (and thoughts) – Gary Walker

The Sun is back in Business! – Posted 28 February

After a few spotless days, there are now some large spots again on the Sun. One of them is particularly large.

It is undeniable that the weather in February has been terrible! I only managed to observe the Sun on 13 days - i.e. just under half the month!

Of course, it was technically visible on some of the other days, but it was either too weak, shining via thick cloud, or else it only appeared as "flashes" of Sun, giving insufficient time to observe it. On some days, there was actually NO SUN at all!

The Planetary Parade – Posted 28 February

Once again, the Media are promoting today's "Planetary Parade".

It is stated that a total of 6 planets will be visible in the evening sky. Sadly, however, this could result in would be viewers being disappointed as some, like Mercury, Venus, and Saturn, are very low down in the sunset sky, whilst Uranus and Neptune are only visible with a telescope. Only Jupiter is at present well placed and easily visible.

On some sites, I have seen totally unrealistic views of the Planets, often wildly exaggerated in size]. If newcomers to Astronomy see these, they will be disappointed by what is actually visible!

The media seems to be increasingly keen on promoting these "events" every time that they come around; they seem to be the media's new "SuperMoon".

Some members of the Society joined an observation visit to Tattenham Corner, in order to try for the 6 planets, as the sky had finally cleared!

30 years since Comet Hyakute – Posted 2 March

March 2026 marks the 30th anniversary of the Great Comet, Hyakutake, which suddenly appeared in our skies in March 1996. This was exciting for me, as it was the first really bright comet that I had seen (the first two I saw, Comet IRAS - Araki-Alcock. and Halley's Comet, were underwhelming). The previous bright comet was Comet West in February 1976, which I never saw as it was not well publicised, coming after the disaster of Comet Kohoutek in 1973-1974.

Comet Hyakute was the first comet of those that I have seen, that actually looked like the old paintings of Great Comets with long tails.

Inevitably, in the UK, we had persistent cloud cover, but in late March, I finally got to see it.

As it was a bright comet, I had the luxury of just looking at the sky in the right direction, in order to see it! For once, I didn't have to check star charts, or use binoculars, even to find it in the first place!

The comet appeared as a fuzzy ball, with the Coma about half a degree in size, similar to a Full Moon. Even with the naked eye, and in 10X 50 binoculars, it appeared with a bright, intense point of light at the centre of the Coma. This "False Nucleus" appeared off-White, or Yellowish, in colour. That showed that it was bright enough to activate the human eye's colour sensors!

I obtained the best view of it on 26-27 March when I clearly saw the tail, extending for several degrees, even with the naked eye. I estimated that the tail extended at least 15 degrees, in all. It was absolutely spectacular!

However, I found the best views with my 10 X 50 binoculars. This is always the

best for really bright comets, or the naked eye

Happily, the comet was close to the Pole Star, so it was visible all night, as it was circumpolar. This meant that it did not move out of my telescope's field of view.

I saw this comet well into April 1996 . By this time, we knew of Comet Hale - Bopp, which would be in the sky from the Summer of the same year and, especially, as a Great Comet, in 1997.

It was typical, after a long “comet drought”, to get 2 brilliant comets in 2 consecutive years!

Venus Reappearing – Posted 14 March

On the way up to the Society meeting last night, I saw Venus clearly, in the Western sky. That was the first time that I have seen it, in the evening sky, (apart from when I saw it through my telescope, in the afternoon, reported in Janus, last month).

There have been a couple of unprecedented clear nights, this week, after yet another period of endless clouds. One was on the evening of this month's meeting (as is often the case!).

Latest Observations – Posted 22 March

After a seemingly endless period of overcast, wet, days and nights, we have recently seen an unprecedented number of clear nights! The evening of 21 March was particularly beautiful - absolutely clear and cloudless, with not even any pesky cirrus clouds.

There was a beautiful New Moon, with Earthshine clearly visible. Later, I got the telescope out, and observed some galaxies, such as M65, M66, M95, M96, M105, and NGC 3384. The galaxies of M105 and NGC 3384, form a close pair, easily visible in the same field of view.

I also revisited the planetary nebula of NGC 6543, in Draco, which is a bright one, with a "handy" star close by, which is useful for checking focus (planetary nebulae are, by definition, fuzzy!). NGC 6392, the Eskimo Nebula in Gemini, is similar in also having a star in a close pairing with it.

The planetary nebula of NGC 3242, the "Ghost of Jupiter", in Hydra, is a weird one, appearing very bright, for such an object in my telescope, as a fuzzy mass. It seemed to have a brighter "bar" within its shape, indeed, images show it as looking like the CBS eye!

The BBC News today announced that, on the night of 20 March, there was another display of the Aurora, extending as far South as Norfolk.

The Moon – Posted 25 March

Tonight, the Moon was at First Quarter, about the best time for observing it. I saw the "clair - obscur" effect of the "Lunar X" on the terminator. This is an effect created by the changing light and shadows on the Moon where, in this case, the sunlight shining on several crater rims creates the "Lunar X".

To me, it appears like a propeller aeroplane, with a "fuselage" and straight "wings" on either side of it. It could be easily seen, even at low magnifications.

There is also a "Lunar V" effect, but I didn't see that tonight. There are a number of other "clair-obscur" effects that can be seen on the Moon, on various nights, created by light and shadow, usually on or near the terminator, where the interplay of light and shadows are at their most pronounced.

The words, "Clair-obscur", come from the French for "light-dark".

A million new SpaceX satellites will destroy the night sky — for everyone on Earth

Acknowledgement: This article was written by Samantha Lawler Associate Professor, Astronomy, University of Regina, Aaron Boley Associate Professor, Physics and Astronomy, University of British Columbia and Hanno Rein Associate Professor, Physical and Environmental Sciences, University of Toronto. First published in THE CONVERSATION on 22 March 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/a-million-new-spacex-satellites-will-destroy-the-night-sky-for-everyone-on-earth-277938*

More than 10,000 Starlink satellites currently orbit the Earth. We see them crawling across dark skies, no matter how remote our location, and streaking through images from research telescopes.

SpaceX recently announced that it wants to launch one million more of these satellites as orbital data centres for AI computing power.

A few years ago, we wrote a paper predicting what the night sky would look like with 65,000 satellites from four planned megaconstellations: SpaceX's Starlink, Amazon's Kuiper (now Leo), the U.K.'s OneWeb and China's Guowang. We calibrated our models to observations of real Starlink satellites and came up with a startling prediction: One in 15 visible points in the night sky would be a satellite, not a star.

A million satellites would be so much worse.

The human eye can see fewer than 4,500 stars in an unpolluted night sky. If we permit SpaceX to launch these satellites, we will see more satellites than stars — for large portions of the night and the year, throughout the world. This will severely damage the night sky for everyone on Earth.

SpaceX's proposal also completely fails to account for atmospheric pollution, collision risk or how to develop the technology needed to disperse waste heat from orbital data centres.

Predicting the night sky

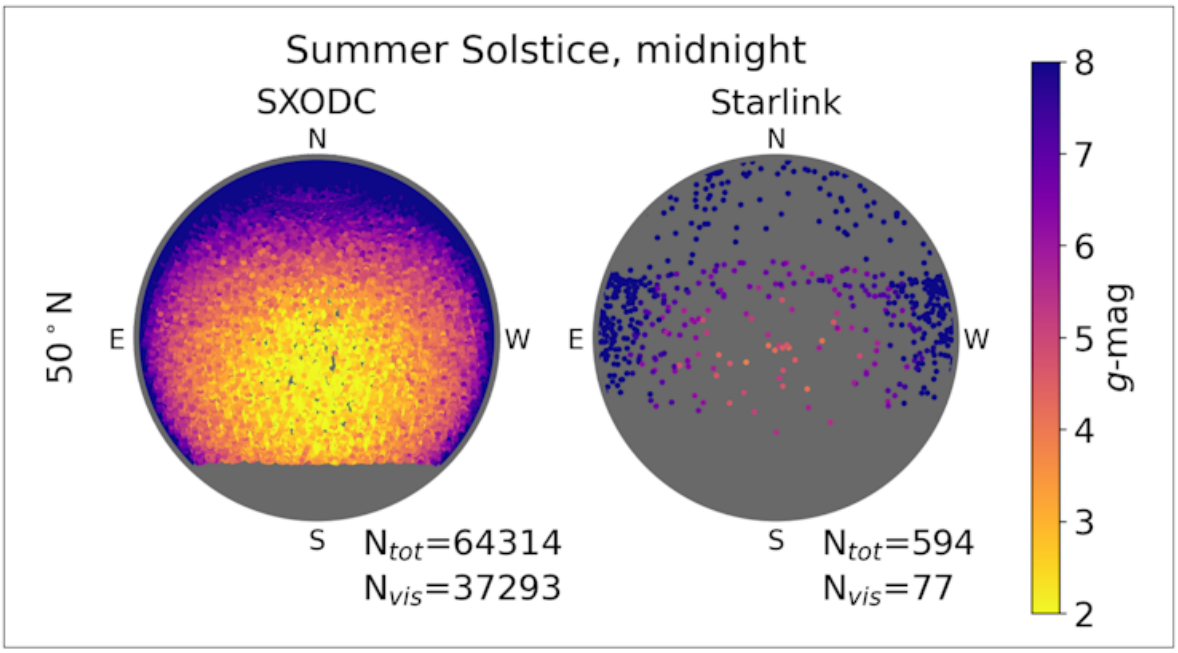
SpaceX has filed its million-satellite proposal to the United States Federal Communications Commission (FCC) and has only provided bare-bones information about these new satellites so far.

We do know that the proposed constellation will have satellites in much higher orbits, making them visible for longer periods of the night.

We decided to build an updated simulation, using the website of astrophysicist Jonathan McDowell. This includes a set of orbits consistent with the limited information in SpaceX's filing.

We used the observed brightness of Starlink satellites as a reference, scaling the brightness model by considering size jumps between Starlink V1, V2 and predictions for V3, and assuming even higher complexity and power requirements.

There are many factors we don't know anything about, so there is some uncertainty in the brightness we predict.



Predictions for satellite brightness and positions comparing SpaceX's proposed one-million-satellite AI data centres with a previously approved 42,000 satellite megaconstellation. (Lawler et al. 2022), CC BY-NC-ND

In the figure above, each grey circle shows a simulation of the full night sky, as seen from latitude 50 degrees north at midnight on the summer solstice.

The left circle shows the night sky with SpaceX's orbital data centres (SXODC), and the right shows the night sky with 42,000 Starlink satellites for comparison.

The coloured points show the positions and brightness of satellites in the sky, with blue the faintest and yellow the brightest. Below each all-sky simulation we list the number of sunlit satellites in the sky (Ntot) and the number of naked-eye visible satellites (Nvis), with tens of thousands predicted for SXODC.

Each of our simulations shows there will be more visible satellites than stars for large portions of the night and the year.

It is hard to overstate this: Should a million new satellites be launched, in the orbits and with the sizes proposed, the stars we are able to see at night would be completely overwhelmed by artificial satellites — throughout the world.

This does not even account for additional large satellite system proposals filed to the International Telecommunication Union (ITU) in recent years by numerous national governments.

A satellite crematorium

SpaceX's proposal is that these new satellites will operate as orbital data centres.

Data centres on the ground are drawing increasing criticism for the huge amounts of water and electricity they use. In an impressive feat of greenwashing, SpaceX suggests that launching data centres into orbit is better for the environment. This is only true if you ignore all the consequences of satellite launch, orbital operations and re-entry.

We can already measure atmospheric pollution from "re-entries", when satellites fall back to Earth. We know that multiple satellites are falling every day and that if they do not fully burn up on re-entry, debris falls on the ground with risk for injury and death.

Increasing densities of satellites also drive up collision risks in orbit. And using the atmosphere as a satellite crematorium is changing the atmosphere in ways we don't yet understand.

Practically, it is not at all clear whether the proposed orbital data centres are feasible any time soon. To operate data centres in orbit, they would need to disperse huge amounts of waste heat. Despite the greenwashing, this is actually very hard to do in space as they would have to manage the intense radiation from the sun, while cooling the satellite by radiation.

SpaceX should know this well: one of the first brightness mitigations they tested for Starlink was "darksat," a Starlink satellite they effectively just painted black. The satellite overheated and the electronics fried

A slap in the face for astronomers

SpaceX has done a lot of engineering work to make its Starlink satellites fainter. They are still too bright for research astronomy, but thanks to new coatings, their brightness has not increased dramatically even as SpaceX has launched larger and larger satellites.

SpaceX's proposal for one million AI data centre satellites with enormous power requirements does not include any discussion of the co-ordination agreement for dark and quiet skies required by the FCC.

It feels like a slap in the face after many astronomers have spent years working with SpaceX on ways to mitigate their Starlink megaconstellation and save the night sky.

Orbital space is a finite resource

The SpaceX filing does not include exact orbits, the size or shape of satellites or the casualty risk from de-orbiting (other than a vague promise that it won't exceed 0.01 per cent per satellite). It doesn't even include any information on how the company plans to develop the technology that does not currently exist but is needed to make this plan work.

Despite how shockingly little information SpaceX provided, the FCC accepted SpaceX's filing and opened the comment period within four days. Astronomers and dark sky advocates worldwide scrambled to write and submit comments in the short four weeks that the comment period was open.

The scientific process is slow and careful, and it often takes months or years to publish a peer-reviewed result. Companies like SpaceX have stated repeatedly that their method is to "move fast and break things." They are now close to breaking the atmosphere, the night sky and anything on the ground or in space that their satellites and rockets fall on or crash into.

Earth's orbital space is a finite resource. There is an evolving set of international guidelines for operating in outer space, grounded in a set of high-level international rules. Yet, those rules and guidelines are inadequate.

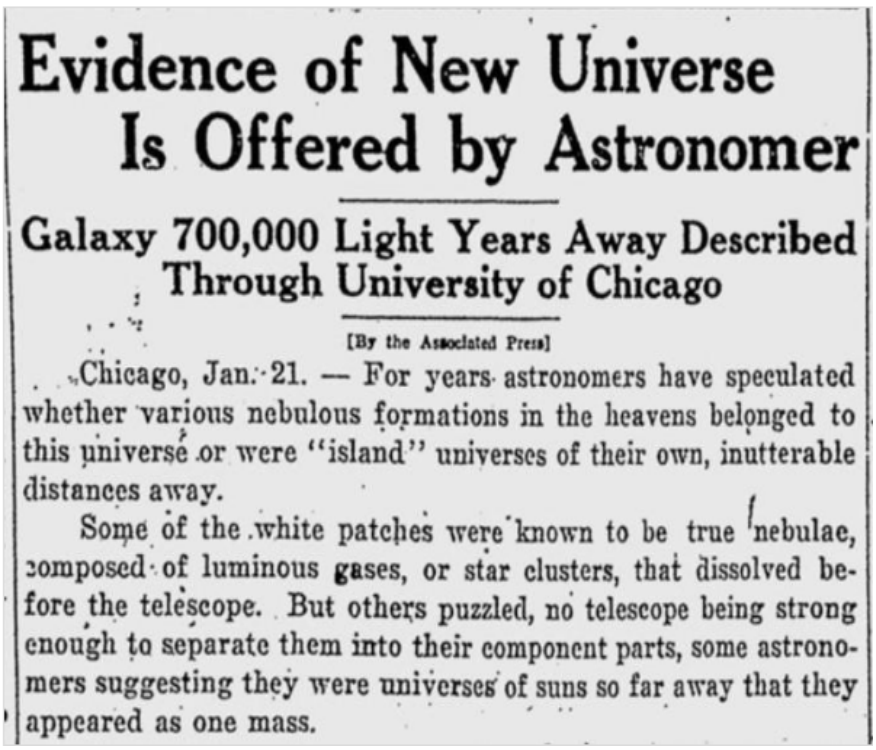
One corporation based in one country should not be allowed to ruin orbit, the night sky, and the atmosphere for everyone else in the world.

March 2026 Gresham Lecture – Suzanne Fox

This month I went to a Gresham lecture in Central London by Prof Chris Lintott titled - "*The Universe's 100th Birthday: Galactic Fireworks and Little Red Dots*". Chris Lintott is always an amazing speaker, and this talk was particularly enjoyable, not least because I bumped into Casper from the Society.

The synopsis of the talk was - 100 years ago this year, Edwin Hubble published the first conclusive evidence that there were galaxies beyond the Milky Way. This lecture, using new results from our latest space telescopes and ground-based instruments, surveys the diversity of systems that we've found since, from giant and beautiful spirals to mysterious Little Red Dots.

The older you get the shorter 100 years feels, and it's incredible to think that only 100 years ago the cosmological thinking was that the Milky way galaxy was pretty much The Known Universe surrounded by some random nebulae of gaseous patches. Then in 1924/25 Edwin Hubble determined that Cepheid variable stars in the Andromeda "nebula" were too distant to be part



Evidence of New Universe Is Offered by Astronomer

Galaxy 700,000 Light Years Away Described Through University of Chicago

[By the Associated Press]

Chicago, Jan. 21. — For years astronomers have speculated whether various nebulous formations in the heavens belonged to this universe or were "island" universes of their own, inutterable distances away.

Some of the white patches were known to be true nebulae, composed of luminous gases, or star clusters, that dissolved before the telescope. But others puzzled, no telescope being strong enough to separate them into their component parts, some astronomers suggesting they were universes of suns so far away that they appeared as one mass.

Source : Chicago Tribune, January 21, 1926

of the Milky Way, proving it was a separate galaxy, described in the 1926 publication of his results as a New Universe.
Hubble's discovery was made possible by the earlier work of Henrietta Swann-Leavitt published in 1912. She was working at Harvard Observatory on a project to determine absolute brightness from photographs of all stars measurable at that time. In the course of this work, she identified the precise relationship between variable period and absolute luminosity of pulsating stars (known today as Cepheid variables) which in turn allows us to infer the stars distance. By observing a Cepheid variable star in the Andromeda Galaxy Hubble was able to calculate its distance and prove that Andromeda was, in fact, a separate Galaxy. Prof Lintott noted how early estimates of the number of galaxies were extremely uncertain and vastly smaller than we now know, he mentioned estimates of a Universe with 400 galaxies.

Fast forward to today, and the amazing images available to us from telescopes like JWST and Vera C Rubin, and our knowledge that there are actually billions of Galaxies in the known Universe. We've gained so much knowledge over the last 100 years and also discovered new things we can't (yet) reliably explain, and this led to the second part of the talk - little red dots (LRDs) revealed in images from the JWST.

Astronomers agree they're highly redshifted and therefore distant systems likely from much, much earlier in the Universe's formation. They are compact but bright and don't fit any of our existing models of astronomical objects. Current theories are that they might be very early active galactic nuclei or compact star-forming systems. In February Chris Lintott wrote about the current research and theories on LRDs in the online Sky At Night magazine - *https://www.skyatnightmagazine.com/news/rxc-j2211-0350-little-red-dots*.

In particular, he mentions a paper published by observers at the Peking University studying images of an LRD object - RX1. Paraphrasing the article - Although the LRD is physically behind a galaxy cluster, the light is gravitationally lensed, magnifying the image, but also, because of the geometry light is split into separate images, and because the light travels slightly different distances to produce each image we're able to observe snapshots of the same dot taken at slightly different points, so we can observe changes over time, researchers estimate that one image is 130 years earlier than the other. I wonder how excited Hubble would be if he were still here to read that paper.

I left the talk thinking how far astronomy has come in 100 years and wondering where the next 100 years would take us. It was an evening of amazing technology - on the way to the venue I walked over Waterloo Bridge and saw a Waymo autonomous vehicle driving along complete with LIDAR sensor on the roof, it had a human controller in charge of it as they are not in actual operation yet but I'm guessing soon to be if they are training them in London. An incredible evening all around spent on the forefront of modern technology, up to the point of trying to get home from Waterloo where there were several cancelled trains - some things are not so cutting edge!

Carbonara – John Pillar

Correction: In my article on globular clusters last month, I mistakenly referred to Palomar-2 as Palomar-5 in the text and figures. Palomar-2 is located in the constellation of Auriga, and although of itself it is one of the brightest globular clusters, we see it as one of the faintest - reddened and dimmed by 3 orders of magnitude because it lies in the outer halo of the Milky Way, behind the Perseus Arm and the Norma Outer Arms.

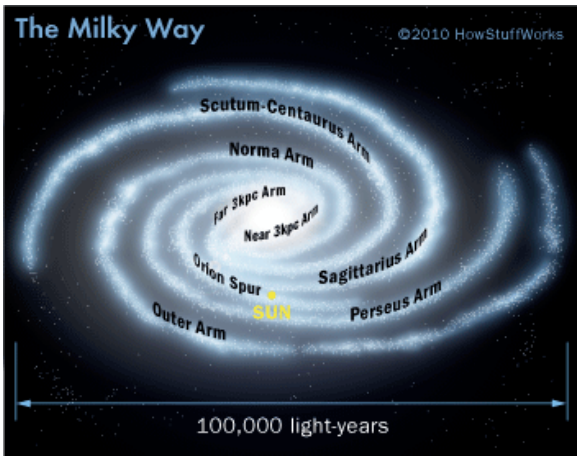


Figure 1: From HowStuffWorks article by Robert Lamb. https://science.howstuffworks.com/what-is-the-milky-way.htm

Carbonara?

Carbon is one of the most familiar elements in the periodic table – we're made of it, we talk of "CO_2" causing global warming, it comes out of chimneys and car exhaust pipes, it adds the fizz to our drinks, and it is essential to life on Planet Earth. Carbon is in fact the 4th most abundant element in the universe, after hydrogen, helium, and oxygen.

To see the colour of a carbon star accustom your eyes to the dark, and then look briefly, and directly, at the star. Averted vision doesn't work well because the rods in our eyes are colour-blind whereas the cones detect colour

Toward the end of its life an aging star may become shrouded in a self-made cloud of carbon 'soot' that glows with a beautiful ruby-red hue. These are known as "carbon stars"… observing carbon stars through binoculars or small telescope is a rewarding pursuit, offering unique colours that

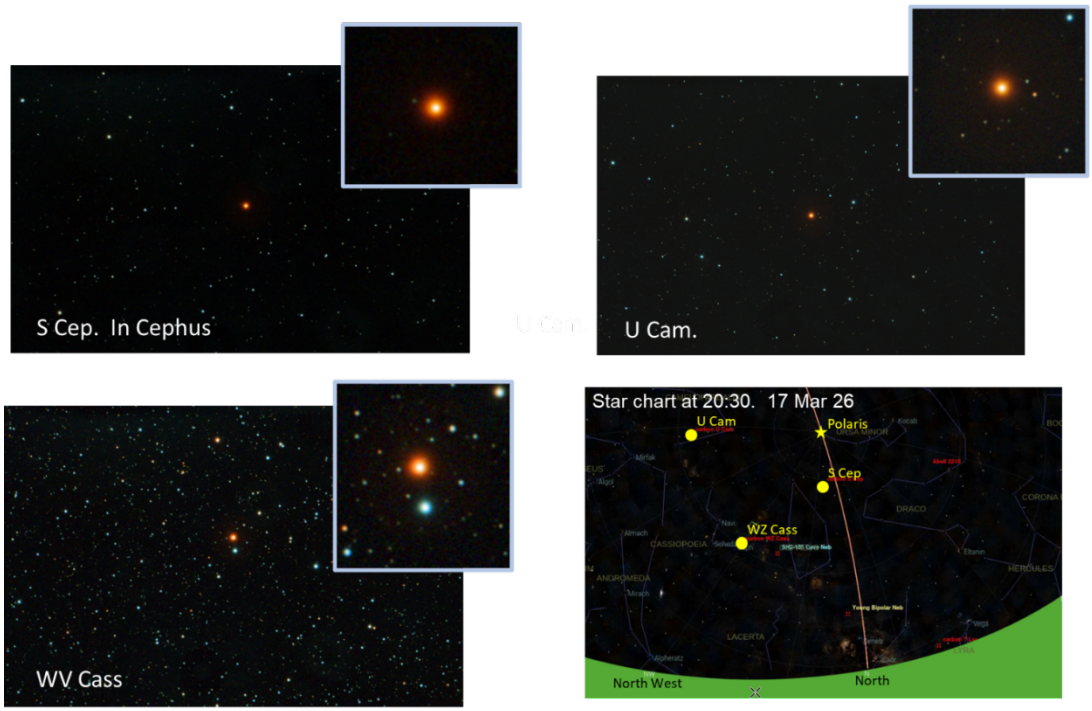


Figure 2: Example carbon stars, imaged from my back-yard. There are many more, and observing them can become a rewarding quest.

contrast with the normal background of stars. Here are images of 3 carbon stars I managed to catch recently from my backyard (Figure 2) – just 30 minutes exposure for each. These are high in the northern sky at the moment – maybe you could start your carbon collection with these 😊.

A star spends most of its life producing energy in its core by large-scale fusion of 4 hydrogen nuclei into a helium nucleus. Eventually, into the last 10% of the lifetime of the star, the supply of hydrogen in the core is depleted and the hydrogen to helium fusion process moves to a shell surrounding the core. At this time radiation pressure deep inside the star is no longer able to match gravitational weight of the star's outer layers, and the star shrinks – which in turn increases the temperature and pressure. The core may eventually reach temperatures of around 100 million degrees C and start to form carbon by the fusion of 3 helium-4 nuclei to form carbon-12, whereas the outer layers of the star expand and puff up as a red giant.

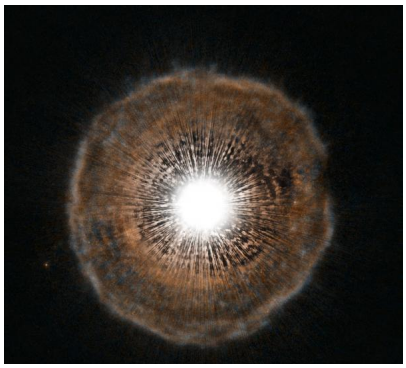


*Figure 4: Star U Cam (the top-right star of **Error! Reference source not found.**), taken by the Hubble Space telescope, showing the dusty, dim, carbon rich envelope.*

Lower mass stars, such as our sun (see Figure 3 and Figure 3), continue to produce carbon from helium in their core and become unstable, entering a cycle of expansion and collapse. During this phase, which may only last a few thousand years, convection processes bring the carbon to the dusty outer atmosphere, a process known as 'dredge-up'. The dusty envelope blocks light from the blue end of the spectrum, resulting in the characteristic red colour of a carbon-star. The outer atmosphere of a carbon star is rich in carbon monoxide (which has sucked up all the free oxygen), plus carbon compounds such as CH, CN (cyanogen) or SiC_2 (carborundum). Figure 4 shows the dusty envelope of star U Cam (shown in Figure 2) cast off by the star only 800 years ago.

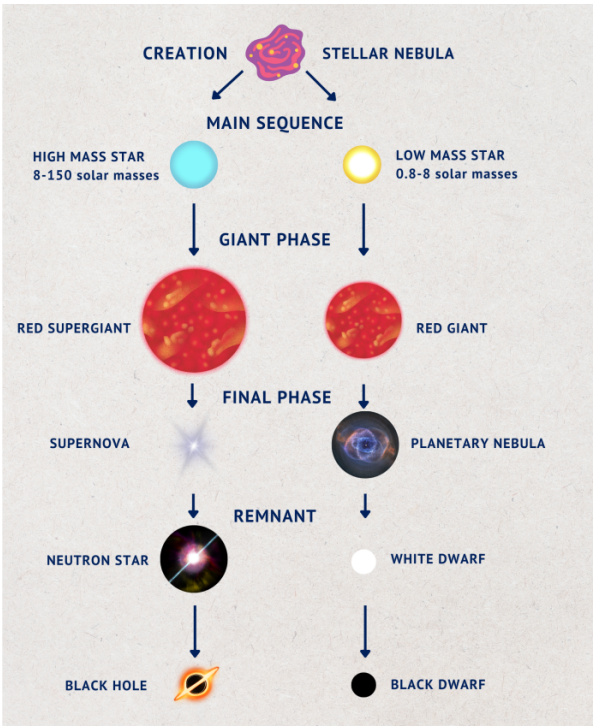


Figure 3: Life-cycle of a star. The carbon star phase is a short-lived precursor to the planetary nebula stage. From https://www.schoolsobservatory.org/learn/space/stars/evolution

Eventually the star sheds all its outer envelope and the hot core is exposed - UV-radiation from which ionises the dusty halo and causes it to glow as a planetary nebula.

It is generally believed that larger stars do not form carbon stars – possibly because they don't go through a phase where the dusty envelope is exposed to UV light from an exposed core. Large stars are capable of immediately fusing carbon into heavier elements such as magnesium, oxygen and neon, all the way up to iron. When the stage of iron formation is reached the star has essentially run out of fuel and rapidly collapses, causing a rebounding shock wave that triggers a violent explosion – a supernova. The core is reduced to a neutron star or black hole, whereas the outer shells of the former star are ejected far into interstellar space.

The James Webb telescope recently observed a supernova in galaxy NGC1637, and researchers were able to trawl back through previous James Webb and Hubble Space telescope images of the same galaxy to locate the progenitor star - a single red supergiant star (*https://esawebb.org/news/weic2604/*) shown in Figure 5.

Rather than being super bright and luminous as expected, the star was found to be surprisingly dim and red - an indication that it was surrounded by dust that blocked shorter, blue, wavelengths of light. Also, the team was surprised to find that the dust was very carbon-rich. It seems that the carbon dust must have been dredged up from the star's interior shortly before it exploded – a similar process to that which forms the carbon rich envelopes of standard carbon stars. In this case however, the dust formed an opaque cloak around the dying supergiant rather than being ionised by UV radiation and shining red as a familiar carbon star.

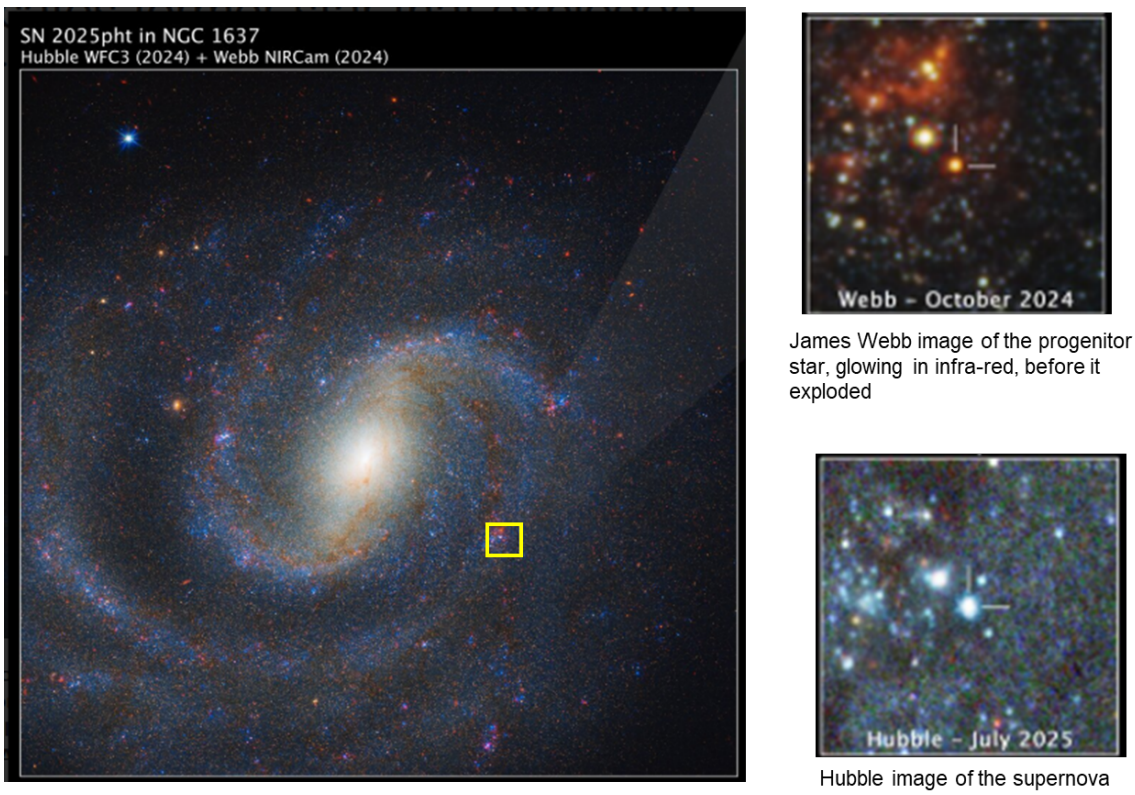


Figure 5: Hubble and James Webb images of a supernova and its progenitor star in galaxy NGC1637 . https://esawebb.org/news/weic2604/

Up Next:

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

Peter Goodhew will talk about Deep Sky Imaging. Peter is a Fellow of the Royal Astronomical Society, a Member of the British Astronomical Association and a Member of The Webb Deep-Sky Society. His personal website is – https://www.imagingdeepspace.com/

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

NEXT USER GROUP:

Suspended until further notice.

NEXT OBSERVING SESSIONS

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

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 – 21 April.

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 alert

Observatory Construction Begins


Trip
hazard
Keep out
Warning
Construction Site