New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 29 Issue 2 — March 2021 *When Printed, this Newsletter costs VAS at least £1*

Society News

Unfortunately, the Observatory and Pavilion remain Closed

Online Virtual Meetings

The recent February Virtual Monthly Meeting was very successful but we would like to see even more members joining us. Details of how to join the meetings is included on The Back Page of this edition so please give it a try. We now have meetings arranged for the next 4 months. These cover a wide range of subjects and should be of interest to many.

Connect Students to #CountdownToMars

Perseverance, NASA's most advanced Mars rover to date, is continuing NASA's investigation of the Red Planet. Only the fifth NASA rover destined for Mars, Perseverance is designed to build on the work and scientific discoveries of its predecessors. Bring the exciting engineering and science of this mission to students in the classroom and at home with STEM lessons and do-it-yourself projects covering topics such as biology, geology, physics, mathematics, engineering, coding and language arts.

This mission is a fantastic opportunity to engage students in real-world problem solving across the STEM fields. Learn about the mission including the rover, Perseverance, and the helicopter, Ingenuity.

Much More at: https://www.nasa.gov/

Brian Curd

VAS Website: wightastronomy.org

Submissions or letters to New Zenith are always welcome and should be sent to:

The Editor, New Zenith

Address will be changing in the next couple of weeks so please use email or the mobile number for all contact with the Editior

Tel: 07594 339950 or email: **editor@wightastronomy.org**

Material for the next issue by the 6th of the month please.

Observatory Diary

The diary is currently empty!

VAS Website: wightastronomy.org

Contents this Month

2021 Monthly Meetings

Check *http://www.wightastronomy.org/meetings/* for the latest information

Date	Subject	Speaker
26 Mar	Space Traffic Control	Dr Stuart Eves
23 Apr	The HOYS Citizen Science Project	Dirk Froebrich
28 May	Can we live on Mars?	Greg Smye-Rumsby
25 Jun	The Astronomy of Robert Hooke in Context	Paul Bingham

All Monthly Meetings are ONLINE ONLY
Members will receive sign in details by email

Please DO NOT attend the Observatory or Pavilion ONLINE ONLY

Sorry but we are still unable to hold face-to-face meetings during the Covid-19 virus pandemic.

Details of how to join the Online meetings will be emailed to members.

Please see the Back Page

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Important

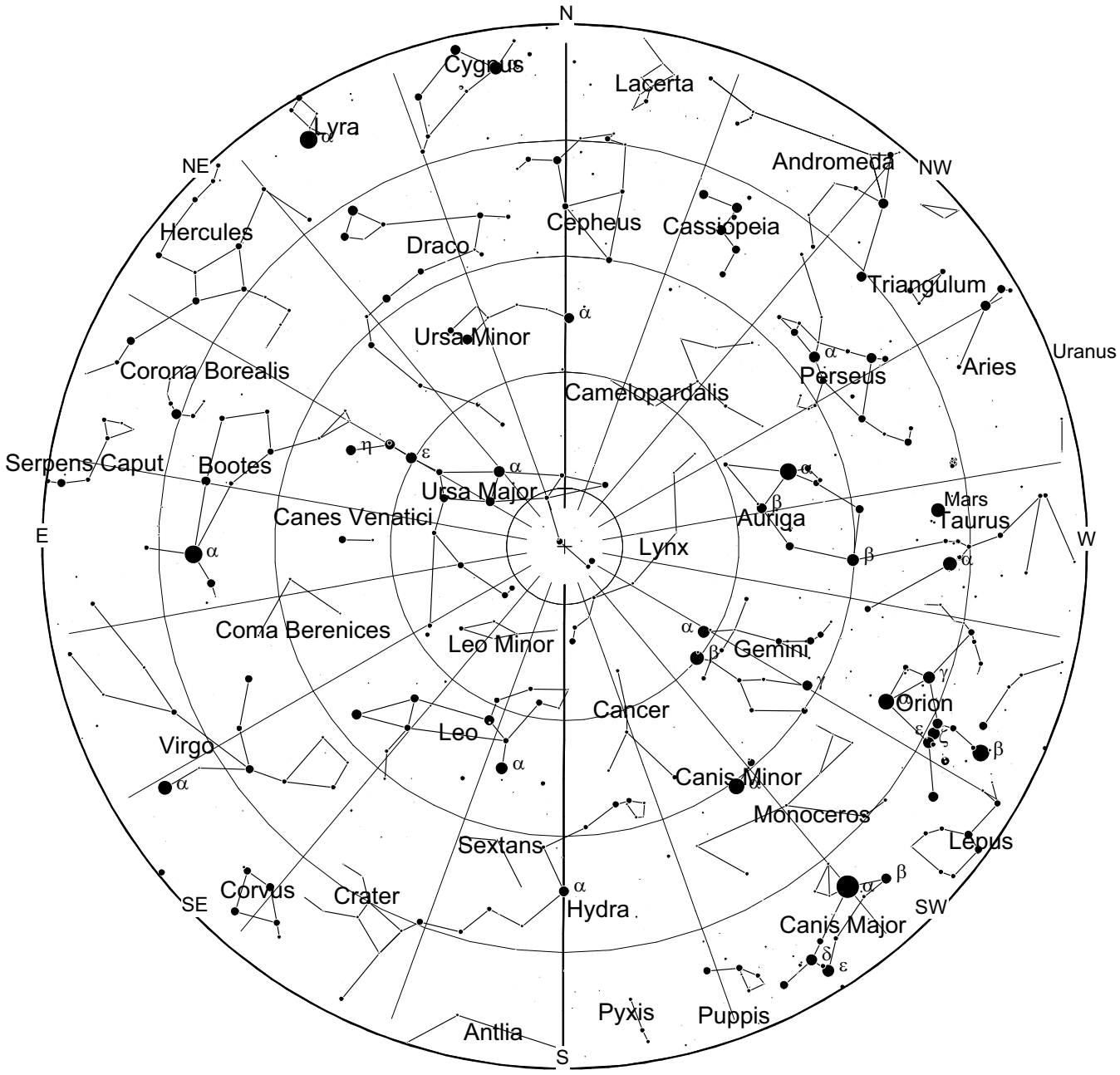
IMPORTANT

Could all VAS members please ensure they notify the Membership Secretary of any change of address.

To ensure our compliance with GDPR rules, we must maintain accurate membership records.

Sorry, but the Observatory is still closed to all members and visitors until further notice

March 2021 - Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 March 2021

The Owl Nebula (M97 or NGC 3587) is a starburst (**"**planetary**"**) nebula approximately 2,030 light years away in the northern constellation Ursa Major. Its light reaching our neighbourhood is about 8,000 years old. It is approximately circular in cross-section with faint internal structure. It was formed from the outflow of material from the stellar wind of the central star as it evolved along the asymptotic giant branch. The nebula is arranged in three concentric shells/envelopes, with the outermost shell being about 20–30% larger than the inner shell. A mildly owl-like appearance of the nebula is the result of an inner shell that is not circularly symmetric, but instead forms a barrel-like structure aligned at an angle of 45° to the line of sight.

Photo Credit: By Göran Nilsson; The Liverpool Telescope - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=63316538

March 2021- Night Sky

Moon Phases

New	First Qtr	Full	Last Qtr
13th	21st	28th	6th
			

Vernal Equinox

The vernal equinox, the time at which Sun crosses the equator on its way north, and day and night are of equal length occurs this year on March 20 at 09:37.

Planets

Mercury

Mercury makes a very poor appearance in the morning sky. On the 5th it is in close conjunction with Jupiter. They both rise about 45 minutes before the Sun, but from or latitude are still very close to the horizon at sunrise.

Venus

Venus is in conjunction with the Sun and will not be visible until next month

Mars

At mid evening at the start of the month Mars can be found well up in the western sky about 3 degrees to the left of the Pleiades star cluster. It is about the same brightness and colour as Aldebaran the red eye of Taurus the bull. If viewed at around the same time every night, as the month progresses, it does not change its height above the horizon very much. The star background will slide by quite noticeably finishing with Mars well above Aldebaran and the Hyades cluster.

Jupiter

Being a very bright planet, at the very end of the month, Jupiter may be glimpsed just before sunrise very low down in the east-southeast. This will be quite challenging; a clear sky and very good eastern horizon will be needed.

Saturn

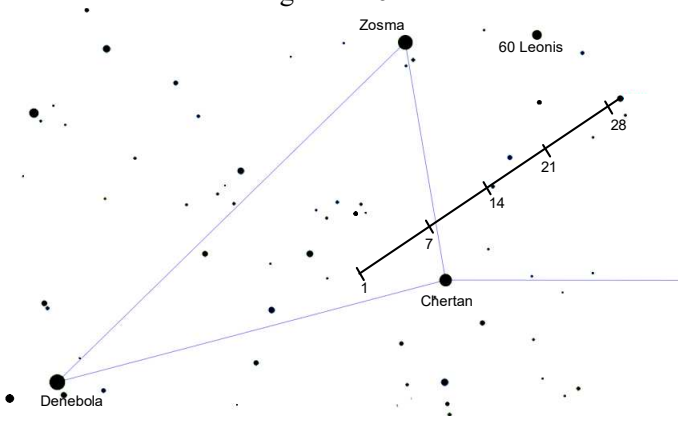
Although Saturn rises before Jupiter it is still very close to the horizon at sunrise and given its lower brightness will not be visible this month.

Uranus & Neptune

Both the outer planets are unfavourably placed for observation until later in the year.

Asteroid Vesta

The asteroid Vesta is at opposition in the constellation of Leo during March. At magnitude 6 this asteroid is within easy reach of binoculars. The finder chart shows stars down to below magnitude 6 at the rear of the lion.



Path of Vesta During March 2021

Deep Sky

M108 Galaxy
RA 11h 12m Dec 55° 38' mag 11.0

This edge on galaxy is quite easy to find being just below the bottom of the bowl of the Big Dipper at about 1.5 degrees from Merak, the pointer farthest from the pole star. Like M82 it shows signs of disturbance with a similar mottling of new star formation along its length.

M97 The Owl Nebula
RA 11h 15m Dec 54° 58' mag 12

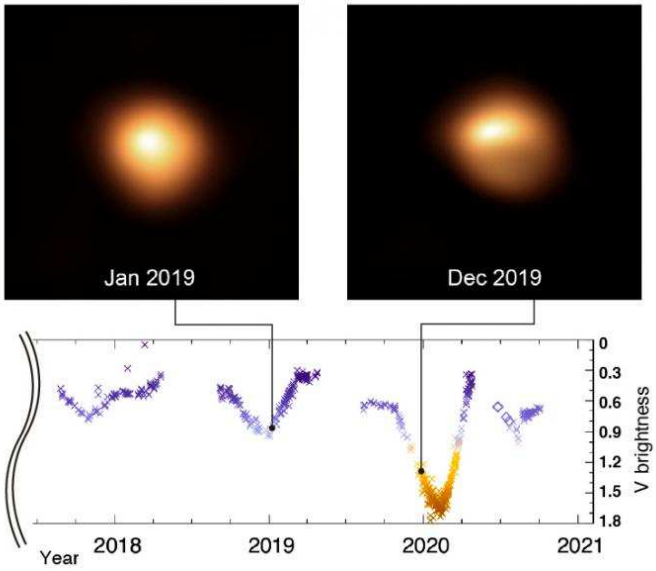
This faint planetary nebula can be found by following the line of the Big Dipper from Merak to Phecda for about 2 degrees then moving away from the dipper by about 3/4 of a degree. To become a planetary nebula is the fate that awaits our own star as it runs out of fuel, casts off its outer layers and contracts into a white dwarf. For a brief period the ultra violet radiation from the star causes the shell of gas to glow at it disperses into space and eventually fades away. A large telescope and dark skies are needed to see the owl's eyes, two dark voids in the gas.

M35 Open Cluster
RA 6h 9m Dec 24° 20' mag 5.5

A large bright cluster in which Lord Ross counted three hundred stars. Some of the brighter members form a V shape pointing almost to the centre of the cluster and snaking up the other side is a long curved chain like a very shallow S. A little to the south west in the same low power telescopic field is NGC2158, a small triangular shaped cluster.

Peter Burgess

Study of supergiant star Betelgeuse unveils the cause of its pulsations



Recent brightness variations of Betelgeuse. Stellar pulsation causes the star's brightness to vary, but the large dip in brightness in early 2020 is unprecedented. A comparison of direct images of the surface of Betelgeuse between Jan 2019 and Dec 2019 show that large portions of the star faded in Dec 2019, which could indicate a dust cloud appearing in front of it. The images were taken by the European Southern Observatory's Very Large Telescope.
(Credit: ESO/M. Montargès et al.)

Betelgeuse is normally one of the brightest, most recognizable stars of the winter sky, marking the left shoulder of the constellation Orion. But lately, it has been behaving strangely: an unprecedentedly large drop in its brightness has been observed in early 2020, which has prompted speculation that Betelgeuse may be about to explode.

To find out more, an international team of scientists, including Ken'ichi Nomoto at the Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU), conducted a rigorous examination of Betelgeuse. They concluded that the star is in the early core helium-burning phase (which is more than 100,000 years before an explosion happens) and has smaller mass and radius -- and is closer to Earth -- than previously thought. They also showed that smaller brightness variations of Betelgeuse have been driven by stellar pulsations, and suggested that the recent large dimming event involved a dust cloud.

The research team is led by Dr. Meridith Joyce from the Australian National University (ANU), who was an invited speaker at Kavli IPMU in January 2020, and includes Dr. Shing-Chi Leung, a former Kavli IPMU project researcher and a current postdoctoral scholar at the California Institute of Technology, and Dr. Chiaki Kobayashi, an associate professor at the University of Hertfordshire, who has been an affiliate member of Kavli IPMU.

The team analyzed the brightness variation of Betelgeuse by using evolutionary, hydrodynamic and seismic modelling. They achieved a clearer idea than before that Betelgeuse is currently burning helium in its core. They also showed that stellar pulsations driven by the so-called kappa-mechanism is causing the star to continuously brighten or fade with two periods of 185 (+-13.5) days and approximately 400 days. But the large dip in brightness in early 2020 is unprecedented, and is likely due to a dust cloud in front of Betelgeuse, as seen in the image.

Their analysis reported a present-day mass of 16.5 to 19 solar mass -- which is slightly lower than the most-recent estimates. The study also revealed how big Betelgeuse is, as well as its distance from Earth. The star's actual size has been a bit of a mystery: earlier studies, for instance, suggested it could be bigger than the orbit of Jupiter. However, the team's results showed Betelgeuse only extends out to two-thirds of that, with a radius 750 times the radius of the sun. Once the physical size of the star is known, it will be possible to determine its distance from Earth. Thus far, the team's results show it is a mere 530 light years from us, or 25 percent closer than previously thought.

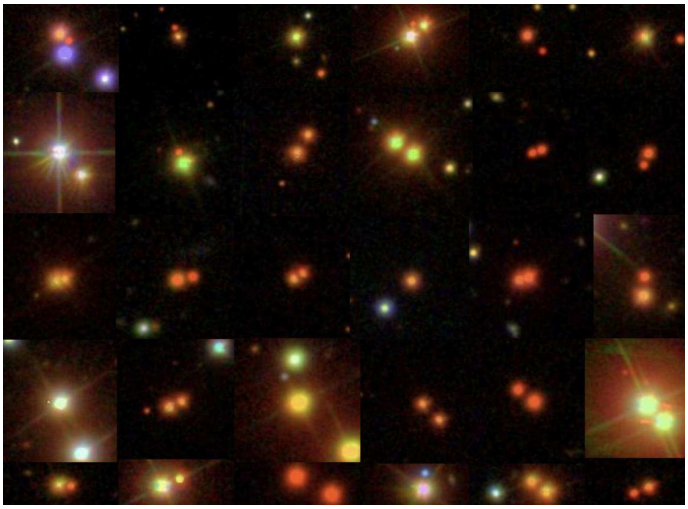
Their results imply that Betelgeuse is not at all close to exploding, and that it is too far from Earth for the eventual explosion to have significant impact here, even though it is still a really big deal when a supernova goes off. And as Betelgeuse is the closest candidate for such an explosion, it gives us a rare opportunity to study what happens to stars like this before they explode.

More: https://www.sciencedaily.com/

Mars Rover Perseverance Fact

The Perseverance mission features 23 cameras, more than any other interplanetary mission in history.

Binary stars are all around us, new map of solar neighborhood shows



A colorful collage of binary star pairs near Earth, courtesy of the Gaia survey. Credit: ESA/Gaia/DPAC

Star data from the Gaia space observatory has for the first time allowed astronomers to generate a massive 3D atlas of widely separated binary stars within about 3,000 light years of Earth - 1.3 million of them.

The one-of-a-kind atlas, created by Kareem El-Badry, an astrophysics Ph.D. student from the University of California, Berkeley, should be a boon for those who study binary stars - which make up at least half of all sunlike stars - and white dwarfs, exoplanets and stellar evolution, in general. Before Gaia, the last compilation of nearby binary stars, assembled using data from the now-defunct Hipparcos satellite, included about 200 likely pairs.

"This is just a massive increase in sample size," said El-Badry. "And it is an increase in what kinds of evolutionary phases we find the binaries in. In our sample, we have 17,000 white dwarfs alone. This is a much bigger census."

White dwarfs are the end stages of most stars; the sun will likely end up as a compact white dwarf in 5 billion years. El-Badry's atlas includes 1,400 systems that consist of two white dwarfs and 16,000 binaries that consist of a white dwarf and another type of star

With such a large sample size, El-Badry said, it's possible to do population demographics of these stellar twins, asking questions such as: What is the distribution of mass ratios of the two stars in all these binary systems? How are their separations or eccentricities distributed?

El-Badry plans to focus in the future on the white dwarf binaries, because white dwarfs can be assigned an age more precisely than is possible with regular stars. Main sequence stars like the sun can look the same for billions, or even tens of billions, of years, while white dwarfs change -- for one thing, they cool down at a well-defined rate. And since binary pairs are birthed at the same time, the age of the white dwarf tells astronomers the age of its main-sequence twin, or of any planets around the stars.

"For a white dwarf, in general, it is easy to tell how old it is - not just how old since it became a white dwarf, but what its total age is," he said. "You can also measure their masses, because white dwarfs have a well-understood mass-radius relation."

As an example, El-Badry and colleagues recently used the Gaia data to estimate the age of a Jupiter-sized gas giant discovered by the TESS satellite around a white dwarf-K dwarf pair. That exoplanet, TOI-1259Ab, turned out to be about 4 billion years old, based on the age of the white dwarf.

"In this catalog, there are something like 15 systems like this: star plus planet plus white dwarf," he said, "and there are another few hundred that are star plus planet plus another star. Those are also potentially interesting because, in some cases, the other star will do something dynamically to the planet."

Binary stars

Until Gaia was launched by the European Space Agency in 2013 to precisely measure the distances and motions of millions of nearby stars, the only way to find binaries was to look for stars close together in the sky. This can be tricky, because stars that look very close from Earth could be hundreds to thousands of light-years from one another, merely sitting along the same line of site.

Ruling out a chance alignment requires lots of observing time to confirm that the two candidates are actually at the same distance and moving together. Because of Earth's motion around the sun, nearby stars appear to change position in the sky, and that parallax can be used to calculate how far away they are. The star's motion across the sky, known as proper motion, helps determine its velocity.

Gaia conducts this tedious astrometry continuously for all nearby stars in the sky, 24/7, from its orbit at the Earth-Sun Lagrange point. The space telescope's survey is most useful for stars within about 3,000 light years of Earth, however, because beyond that, the parallax is usually too small to measure.

El-Badry first looked for binary stars in Gaia data after the mission's second release of star measurements in 2018, with the help of colleagues Hans-Walter Rix, director of the Max-Planck Institute for Astronomy in Heidelberg, Germany, and Tyler Heintz, a graduate student at Boston University. They developed computational techniques to identify stars moving together through space and at the

same distance from Earth. The technique basically projects each star's movement over thousands of years, based on its proper motion today, and pulls out stars that are moving in the same direction. If they also turn out to be at the same distance based on parallax, they're probably bound to one another, he said.

He and his colleagues focus primarily on wide-binaries -- those separated by a distance of 10 AU (astronomical units) or more -- that is, 10 or more times the distance between Earth and the sun. Stars closer than that typically appear as one point of light and require other spectroscopic techniques to distinguish whether they are true binaries.

To get first crack at Gaia's latest data, El-Badry arose at 3 a.m. on the release date, Dec. 3 of last year, and joined some 100 other astronomers from around the world on Zoom. He quickly ran pre-programmed queries on the data to extract the catalog information he needed to create the 3D map.

The initial queries returned some 1.8 million binary candidates from Gaia's catalog of 1.8 billion stars, so El-Badry first had to assess the likelihood that some of the pairs were at the same distance and moving in similar directions just by chance, not because they are paired. He estimates that nearly 1.3 million pairs had at least a 90% chance of being bound, and 1.1 million had a 99% chance.

“About half of all sun-like stars are binaries, many of them too close to distinguish, but we find something like 25% of all sun-like stars have a binary companion at separations of more than 30 AU, about the distance to Pluto,” he said. “The distribution peaks at a separation of 30 or 50 AU.”

Some pairs are separated by as much as a parsec - 260,000 AU, or 3.26 light years - though most are within 1,000 AU of one another.

“One thing we already found that is cool - we discovered this with Gaia DR2, but now we can study it better with this sample - is that binaries like to be identical twins,” he said. “That is really weird, because most of these are separated by hundreds or thousands of AU, so they are so far apart that, by conventional star formation theories, their masses should be random. But the data tells a different story: They know something about their companions' masses.”

The implication, he said, is that they formed much closer together in a process that tended to equalize their masses and then migrated apart, perhaps because of interactions with other nearby stars.

Link: https://www.eurekalert.org/

Hubble Takes Portrait of Nebula

This image from the NASA/ESA Hubble Space Telescope features an impressive portrait of M1-63, a beautifully captured example of a bipolar planetary nebula located in the constellation of Scutum (the Shield).

A nebula like this one is formed when the star at its center sheds huge quantities of material from its outer layers, leaving behind a spectacular cloud of gas and dust.

It is believed that a binary system of stars at the center of the bipolar nebula is capable of creating hourglass or butterfly-like shapes like the one in this image.

This is because the material from the shedding star is funneled toward its poles, with the help of the companion, creating the distinctive double-lobed structure seen in nebulae such as M1-63.

Link: https://phys.org/

Astronomers Confirm Solar System's Most Distant Known Object is Indeed Farfarout

With the help of the international Gemini Observatory, a Program of NSF's NOIRLab, and other ground-based telescopes, astronomers have confirmed that a faint object discovered in 2018 and nicknamed "Farfarout" is indeed the most distant object yet found in our Solar System. The object has just received its designation from the International Astronomical Union.

Farfarout was first spotted in January 2018 by the Subaru Telescope, located on Maunakea in Hawaii. Its discoverers could tell it was very far away, but they weren't sure exactly how far. They needed more observations.

"At that time we did not know the object's orbit as we only had the Subaru discovery observations over 24 hours, but it takes years of observations to get an object's orbit around the Sun," explained co-discoverer Scott Sheppard of the Carnegie Institution for Science. "All we knew was that the object appeared to be very distant at the time of discovery."

Sheppard and his colleagues, David Tholen of the University of Hawaii and Chad Trujillo of Northern Arizona University, spent the next few years tracking the object with the Gemini North telescope (also on Maunakea in Hawaii) and the Carnegie Institution for Science's Magellan Telescopes in Chile to determine its orbit. They have now confirmed that Farfarout currently lies 132 astronomical units (au) from the Sun, which is 132 times farther from the Sun than Earth is. (For comparison, Pluto is, on average, 39 au from the Sun.)

Farfarout is even more remote than the previous Solar System distance record-holder, which was discovered by the same team and nicknamed "Farout." Provisionally designated 2018 VG18, Farout is 124 au from the Sun.

However, the orbit of Farfarout is quite elongated, taking it 175 au from the Sun at its farthest point and around 27 au at its closest, which is inside the orbit of Neptune. Because its orbit crosses Neptune's, Farfarout could provide insights into the history of the outer Solar System.

"Farfarout was likely thrown into the outer Solar System by getting too close to Neptune in the distant past," said Trujillo. "Farfarout will likely interact with Neptune again in the future since their orbits still intersect."

Farfarout is very faint. Based on its brightness and distance from the Sun, the team estimates it to be about 400 kilometers (250 miles) across, putting it at the low end of possibly being designated a dwarf planet by the International Astronomical Union (IAU).

The IAU's Minor Planet Center in Massachusetts announced today that it has given Farfarout the provisional designation 2018 AG37. The Solar System's most distant known member will receive an official name after more observations are gathered and its orbit becomes even more refined in the coming years.

"Farfarout takes a millennium to go around the Sun once," said Tholen. "Because of this, it moves very slowly across the sky, requiring several years of observations to precisely determine its trajectory."

Farfarout's discoverers are confident that even more distant objects remain to be discovered on the outskirts of the Solar System, and that its distance record might not stand for long.

"The discovery of Farfarout shows our increasing ability to map the outer Solar System and observe farther and farther towards the fringes of our Solar System," said Sheppard. "Only with the advancements in the last few years of large digital cameras on very large telescopes has it been possible to efficiently discover very distant objects like Farfarout. Even though some of these distant objects are quite large -- the size of dwarf planets -- they are very faint because of their extreme distances from the Sun. Farfarout is just the tip of the iceberg of objects in the very distant Solar System."

Link: https://www.sciencedaily.com/

Why Did NASA Send a Helicopter to Mars?

An illustration of the Ingenuity Mars helicopter. Credit: NASA/JPL-Caltech

"For some years," wrote Wilbur Wright in 1900, "I have been afflicted with the belief that flight is possible to man. My disease has increased in severity and I feel that it will soon cost me an increased amount of money if not my life."

That may be the most poetic thing Wilbur or his brother Orville ever said. But what the Wright brothers did three years later had a natural poetry to it: They flew. They borrowed the magic of birds. And so a sort of magic has been conferred on them. We remember them more eloquently than they probably lived.

An American spacecraft is now on Mars. There's magic to that, too. If ever there was life on that now-frigid world, NASA's Perseverance rover is designed to find signs of it.

But it's complicated to explain. It requires discussion of organic chemistry, Martian geology, and a lot of engineering. You have to know why stromatolites are important, and what a spectrometer does. Perseverance is looking for past life, but if it tripped across something living today (it won't, not at least at its planned landing site; Mars is frozen and bombarded by cosmic radiation), its instruments wouldn't be able to tell. The plan is for the rover to drill into the Martian surface, take rock and soil samples, and save them, probably for years, in super-sterilized containers that would be returned to Earth by a future mission that is as yet only partly designed, and not yet approved or funded. The samples might not get back here until the early 2030s, if they ever do. The rover does not lend itself to a simple summation.

Which is why it's nice that Perseverance is carrying with it an almost entirely separate, second vehicle. It's a tiny robotic helicopter, nicknamed Ingenuity - essentially, a drone, designed to fly on Mars. The first flying machine ever sent to another world.

"This is really a Wright brothers moment, but on another planet," says MiMi Aung, the Ingenuity project manager at NASA's Jet Propulsion Laboratory in California. She and her colleagues repeat that mantra at every opportunity.

The four-pound drone, built for about $80 million, probably won't outshine the 2,200-pound rover, with its budget somewhere north of $2.46 billion and its ambitious goals. But the drone's mission is refreshingly simple. It has been sent to fly - probably no more than 20-30 feet high and 1,000 feet horizontally, and for no more than 90 seconds at a time. That's all. But if it works, it could, for a moment, steal the imagination.

Bob Balaram is chief engineer for the helicopter project. "I think about what the little Sojourner rover proved," he says. Sojourner was NASA's first Martian rover, back in 1997. "The reason it went there was you wanted to drive on Mars. We wanted to drive, and now we want to fly."

It does seem like a simple idea, but if there's anything the engineers learned as they designed and built Ingenuity, it's that it's awfully complicated to fly on Mars. The rules of aeronautics are the same, but everything feels different.

For starters, the Martian atmosphere, mostly carbon dioxide, is about a hundredth as thick as the air at ground level on Earth. Nighttime temperatures regularly drop to 130 degrees below zero Fahrenheit - great for killing Ingenuity's six lithium-ion batteries. So the helicopter had to be very sturdy, and very light. The fuselage, containing a microprocessor, radio, heater, accelerometer, altimeter, and two cameras, is about the size of a box of tissues. There is a small solar panel on top. It turned out power would mostly be needed not to fly but to keep the drone's electronics warm inside. Mission planners briefly considered insulating them with aerogel, an ultralight foam used on previous Mars probes that's sometimes been called "solid smoke," but they decided it was too heavy.

And there was more. If you have watched an earthly helicopter revving up, you probably noticed that the rotor blades tend to be a bit floppy - which is good if you want them to bend but not break in our nice, thick atmosphere, but probably fatal if you're trying to maintain control in the wispy air of Mars. The Ingenuity team solved the problem with two stiffened carbon-fiber rotors, one on top of the other, each about four feet long, spinning in opposite directions at about 2,400 rotations per minute. (A typical helicopter on Earth does less than 500 rpm.) If the drone went any slower it would never get airborne; any faster and the tips of the blades might flirt with supersonic speed, causing shock waves that would make control all but impossible.

"Imagine a breeze on Earth," says Teddy Tzanetos, the flight test conductor lead. "Now imagine having 1% of that to bite into or grab onto for lift and control." It turned out that gusts of Martian wind were one of the few things the engineers didn't have to worry about; the air is simply too thin to push the drone around with any force.

The plan is that after the rover has landed, been checked out, and found an appropriately flat spot, it will gently drop the helicopter upright to the ground. That should happen about 60 Martian days, or sols, after landing. (A sol is about 24 hours and 39 minutes long.) The rover would then move about 100 yards away, cameras at the ready, and watch the drone try to fly.

Ingenuity is slated for a maximum of five flights over a period of 30 sols, but if it flies just once, says Tzanetos, "we'll all go out and celebrate."

NASA says that if Ingenuity succeeds, it may lead to future flying machines that can go scouting ahead of rovers or astronauts, or explore cliffs or volcanoes that are too steep to be reached by wheeled vehicles or on foot. Balaram suggests a drone might be the way to look at the icecaps at the Martian poles.

NASA has become expert at communicating what it's up to. Searching for biosignatures of past microbial life in the Martian soil? That's important but complicated. Flying on another world? That only takes ingenuity.

"NASA management, some in Congress were interested, I think, by some aspects of the excitement of exploration," Balaram says. "But at JPL I think it was more a case of thinking, if this works, this is a new way of exploring Mars, and that's what we're in the business of."

Link: https://slate.com/

Mars Rover Perseverance Fact

Perseverance made the 64-million-mile journey to Mars in about six months and landed on the Red Planet in February 2021.

Study Reveals a "Boring" Era when Earth was Flat, with No Mountains

Research teams studied europium crystals to show that Earth was mostly flat in its middle ages. The planet had no mountains and little evolution of life. This period of time is known as the "Boring Billion".

Scientists discovered that Earth was likely quite flat during it's so-called middle ages. Not flat as in conspiracies that don't believe our planet is round, but lacking in mountains. It was also a period of little growth of life. This stretch of time from 1.8 billion to 0.8 billion years ago is also known as the "Boring Billion" and referred to as "the dullest period in Earth's history."

Nothing dull about what the researchers found, however, by studying the chemical element europium, embedded in zircon crystals. Their analysis revealed that during the Boring Billion, the absence of tectonic activity that's crucial to mountain creation also slowed the nutrient cycling vital for the evolution of life.

This involved studying zircon crystals from around the globe. Researchers based their work on previous findings that showed a connection between the amount of europium located inside a zircon crystal and the thickness of the Earth's crust when the crystal was formed. A larger amount of the europium meant more pressure pushing down on it from above indicating that the crust was thicker.

The scientists found that during the so-called middle or "Boring" period, Earth's crust was thinner than now. There were no mountains and the surface was all oceans and flat land masses. This indicated to the researchers that tectonic activity likely stopped or at least slowed majorly for about 1 billion years. Tectonic activity pushes mountains up, leading also to erosion that enriches oceanic environments and fosters evolving life. If such a cycle was disrupted, evolution would have slowed to a crawl.

Why did the tectonic activity stop? And why for such a long time? The researchers do not know yet, but think the answers may lie in the creation of the ancient Nuna-Rodina supercontinent, which could have affected the thermal structure of the planet's mantle.

Link: https://bigthink.com/

Aquatic Planets are Common in Our Milky Way Galaxy, Study Suggests

In a study published in the journal Science Advances, a team of European astronomers shows that water can be delivered to a terrestrial planet in the form of 'pebble snow' in the early phases of the planet's growth.

"All our data suggest that water was part of Earth's building blocks, right from the beginning," said Professor Anders Johansen, a researcher in the Centre for Star and Planet Formation at the University of Copenhagen and Lund Observatory.

"And because the water molecule is frequently occurring, there is a reasonable probability that it applies to all planets in the Milky Way."

"The decisive point for whether liquid water is present is the distance of the planet from its star."

Using a computer model, Professor Johansen and colleagues calculated how quickly planets are formed, and from which building blocks.

Their results indicate that 4.5 billion years ago, millimeter-sized dust particles of ice and carbon accreted in the formation of what would later become Earth.

"Up to the point where Earth had grown to 1% of its current mass, our planet grew by capturing masses of pebbles filled with ice and carbon," Professor Johansen said.

"Earth then grew faster and faster until, after five million years, it became as large as we know it today."

"Along the way, the temperature on the surface rose sharply, causing the ice in the pebbles to evaporate on the way down to the surface so that, today, only 0.1% of the planet is made up of water, even though 70% of Earth's surface is covered by water."

The team's pebble accretion theory is that planets are formed by pebbles that are clumping together, and that the planets then grow larger and larger.

"The water molecule is found everywhere in our Galaxy, and that the theory therefore opens up the possibility that other planets may have been formed in the same way as Earth, Mars and Venus," Professor Johansen said.

"All planets in the Milky Way may be formed by the same building blocks, meaning that planets with the same amount of water and carbon as Earth — and thus potential places where life may be present — occur frequently around other stars in our Galaxy, provided the temperature is right."

If planets in our Galaxy had the same building blocks and the same temperature conditions as Earth, there will also be good chances that they may have about the same amount of water and continents as our planet.

"With our model, all planets get the same amount of water, and this suggests that other planets may have not just the same amount of water and oceans, but also the same amount of continents as here on Earth. It provides good opportunities for the emergence of life," said Professor Martin Bizzarro, a researcher in the Centre for Star and Planet Formation at the University of Copenhagen.

"If, on the other hand, it was random how much water was present on planets, the planets might look vastly different. Some planets would be too dry to develop life, while others would be completely covered by water."

Link: http://www.sci-news.com/

Mars Rover Perseverance Fact

The Perseverance rover will collect at least 20 samples from Mars using a handy drill, literally attached to the robot's arm.
The rock samples will be stored away in tubes in a well-identified place on the Martian surface, and left there to be returned to Earth by a future sample return mission to the Red Planet.

THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

Virtual Monthly Meetings

Thanks to the efforts of our Programme Organiser Simon Gardner, we now have events booked for the next four months. See page 2 for details.

All these meetings are ONLINE ONLY

Please do not visit the Observatory or Pavilion as both are closed

Meetings use the application Zoom and you can join using the following link:

https://us02web.zoom.us/j/87183717129?pwd=NXU4b1IjWit2aXJqTTZsYWN5bTIaQT09

Meeting ID: 871 8371 7129

Passcode: 821137

You can join us from 18.45 - the meeting starts at 19.00

The March Meeting is

Space Traffic Control

When the early aviation pioneers took to the skies, they did not require permission to take off and land. Over time, and for good reason, a system of standards and regulations was developed to enable safe, reliable international air travel. For similar reasons, we have now reached that juncture in space. This demands urgent action - both political and technical. Satellites, such as the global positioning system (GPS), form part of the infrastructure that is relied upon worldwide on a daily basis. The loss of such critical international infrastructure would have global consequences. Space Traffic Control considers the systems and procedures which can provide solutions to the problem of space debris and concludes with recommended approaches.

Speaker is **Dr Stuart Eves**

Stuart Eves, Ph.D., worked as a mission concepts engineer for Surrey Satellite Technology Limited in the UK, and formerly at Astrium. He is a fellow of the Royal Astronomical Society and has chaired the UK's Space Information Exchange forum as well as the UK Space Security and Defence Committee. Stuart has previously given talks to VAS in 2012, 2014 and 2016 on subjects including 'Mysteries of the Solar System' and 'William Hershel and the Rings of Uranus'.

Free Podcasts

The BBC Sky at Night Magazine is advertising a wide range, about 60 or so, astronomy related podcasts for free.

Get your fill: https://www.skyatnightmagazine.com/podcasts/

Mars Rover Perseverance Fact

Perseverance rover is set to spend at least one Martian year on the planet — the equivalent of 687 days on Earth.

At The Observatory

1. **Please bring a torch.**
2. **Make sure you close and lock the car park gate if you are the last to leave.**

Articles Needed

NZ needs astronomy related content. Contact details on page 1.

"The Hubble Telescope can see the farthest galaxies. The Webb Telescope will see the farthest stars"
Heidi Hammel

"The Universe is under no obligation to make sense to you"
Neil deGrasse Tyson

"They say any landing you can walk away from is a good one"
Alan Shepard

"Real stupidity beats artificial intelligence every time"
Terry Pratchett

"We are stuck with technology when what we really want is just stuff that works"
Douglas Adams

"We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology"
Carl Sagan