New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 31 Issue 2 — March 2023 *When Printed, this Newsletter costs VAS at least £1*

Society News

My Mistake

I managed to correct the Volume and Issue number for this issue. I seemed to ignore it last month, it should have read Volume 21 Issue 1. Sorry!

Outreach

Outreach events have been going well, even though the weather hasn't been too good, we've recently played host to Cub and Scout groups and another of Sea Scouts.

Last month's "Isle of Wight Dark Skies Festival" was a success for the Society with a lot of visitors to our stand and hopefully a few more members. Thanks to all VAS members who helped with the event.

There are more events in the pipeline so please contact our Outreach co-ordinator *Elaine Spear* if you can help

Late News

For Sale Items

There are two telescopes for sale on behalf of members, both used but are in good condition and working order.

1. **An Alter M56 MN f6 Maksutov-Newtonian**. This telescope is in particularly good condition. There is no case but it does have a motorised (tracking) HEQ E3 mount with tripod The telescope is unmarked with minimal dust on the optics.

2. **A Celestron Celestar 8 (8")** With a computerised mount with a collection of Celestron eyepieces and a sturdy tripod and mount.

Viewing of either at the Observatory can be arranged by contacting me on

07594 339950 or editor@wightastronomy.org

Brian Curd

VAS Website: wightastronomy.org

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

The Editor, New Zenith
Belvedere
St John's Crescent
Sandown
Isle of Wight
PO36 8EE
Tel: 07594 339950 or email: **editor@wightastronomy.org**

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

Registered Charity No 1046091

Observatory Diary

Monday, 19.30hrs	Members Only and by arrangement Telescope and night sky training.
Thursday	Members (19.30hrs) and Public (20.00hrs). Informal meeting and observing

VAS Website: wightastronomy.org

Contents this Month

2023 Monthly Meetings

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

Date	Subject	Speaker
24Mar	How to be a Better Observer, maximising your time at the eyepiece	John Slinn
28 Apr	Sundials	Peter Ransom
26 May	Not Booked	
23 Jun	**ZOOM only -** Stellar Evolution - the life cycle of a star and its implications for life in our Solar System	Dr Elizabeth Cunningham
28 Jul	Variable Stars	Bryn Davis
25 Aug	AGM	**Meeting in the Observatory**
22 Sep	Not Booked	
27 Oct	Not Booked	
24 Nov	EM-bridge technology and applications	Alan Thomson

Observatory Visits Booked

No bookings so far

Please phone me for the current situation (number on the front page)

It would be appreciated if members could avoid using the observatory at these times.

GDPR rules mean we must maintain accurate membership records, please tell us if any of your contact details changes

VAS Contacts 2023

President	Barry Bates president@wightastronomy.org
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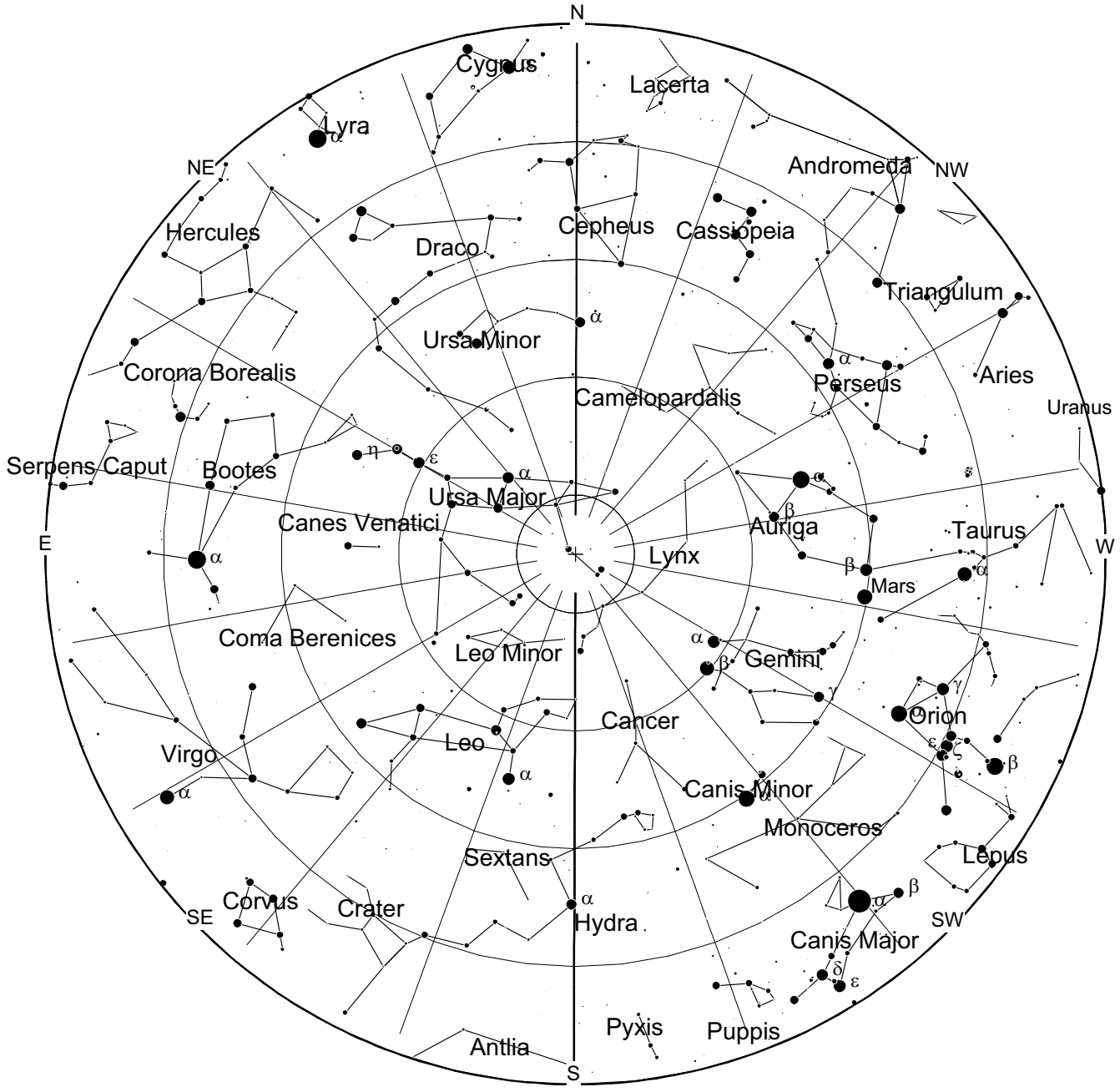
Important

Members using the observatory MUST enter a line or two in the Observatory Log Book.

On several occasions, lights, heaters and the Meade LX200 have been left on!

When leaving, please ensure all is secure and all lights, heaters and telescopes are TURNED OFF.

March 2023 - Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 March 2023

Venus is the second planet from the Sun. It is sometimes called Earth's **"**sister**"** or **"**twin**"** planet as it is almost as large and has a similar composition.

As an interior planet to Earth, Venus (like Mercury) appears in Earth's sky never far from the Sun, either as morning star or evening star.

Aside from the Sun and Moon, Venus is the brightest natural object in Earth's sky, capable of casting visible shadows on Earth in dark conditions and being visible to the naked eye in broad daylight

March 2023 - Night Sky

Vernal Equinox

The spring, or Vernal Equinox, the time at which the Sun crosses the equator on its way north, and day and night are of equal length is on March 20 at 21:24 UTC.

Moon Phases Jan

New	First Qtr	Full	Last Qtr
21st	27th	7th	15th
			

Planets

Mercury

This month Mercury makes it's best evening apparition of the year. On the 27th & 28th it is close conjunction with the brighter Jupiter. They are only about 10 degrees away from the Sun so the sky will still be quite bright and a pair of binoculars or small telescope will probably be needed to make an observation.

Azimuth & Altitude for Mercury At 19:30BST					
Date	Az	Alt	Date	Az	Alt
24 Mar	271	4.5	1 Apr	271	14
26 Mar	271	7	3 Apr	271	16
28 Mar	271	9.5	5 Apr	271	17.5
30 Mar	271	12	7 Apr	271.5	19
			9 Apr	272	20
			11 Apr	272.5	21

Venus

The evening star can be seen low in the west after sunset. It is bright enough that if the sky is very clear is can be seen just after the sun has set, and if you know where to look while the Sun is still above the horizon. On the first two days of the month Venus is in close conjunction with the other bright planet in the evening sky, Jupiter.

Mars

From sunset until around midnight Mars is well placed for observation in the southern and south-western sky. It is not as bright or as large as during the last few months, but is still easily seen and a worthwhile object for observation.

Jupiter

Jupiter is not well placed for observation this month, but can still be seen low in the west before sunset, and will be in conjunction with both Venus and \mercury before it finally disappears into the glare of the setting sun.

Saturn

Saturn is currently in the morning sky, but rises only about an hour before the Sun and in the bright pre-dawn sky is too close to the horizon to be observed from our latitude.

Uranus & Neptune

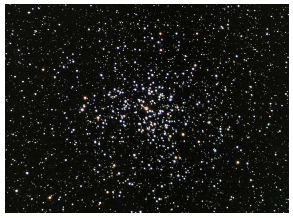
Both the outer planets are unsuitably placed for observation this month.

Deep Sky

M36 Open Cluster
RA 5h 37m Dec 34° 10' mag 6.5

This is a young cluster of bright blue stars their light dimmed by its 4100 light year journey across the winter Milky Way. While it is easy to find this cluster is not very impressive.

M37 Open Cluster
RA 5h 52m Dec 32° 32' mag 6.0



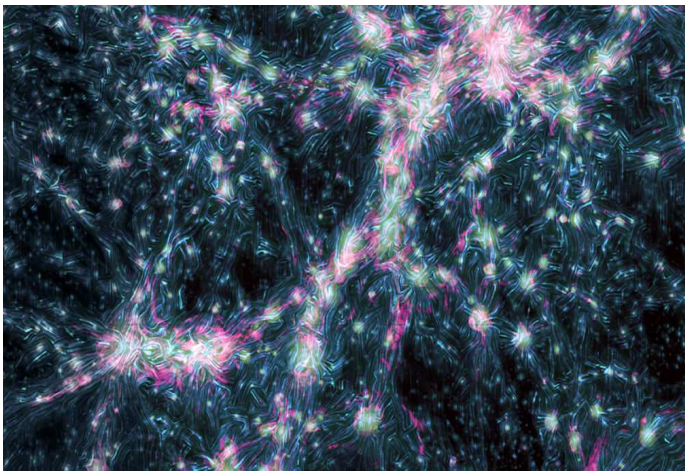
The most impressive of the Auriga clusters it is the brightest and most colourful. Particularly striking is the magnitude 9 red star at its heart. Careful observation reveals dark dust lanes through the centre of the cluster.

M38 Open Cluster
RA 5h 29m Dec 35° 52' mag 7.0

This is a good binocular object when viewed under dark skies. Through a telescope with patience the Greek letter Pi shape mentioned in Burnham's atlas can be discerned.

Peter Burgess

Astronomers spotted shock waves shaking the web of the universe for the first time



In this simulation of the cosmic web, shock waves along filaments and around clusters emit radio light (pink) as they ripple through magnetic fields (cyan). Credit: F. VAZZA, D. WITTOR AND J. WEST

For the first time, astronomers have caught a glimpse of shock waves rippling along strands of the cosmic web - the enormous tangle of galaxies, gas and dark matter that fills the observable universe.

Combining hundreds of thousands of radio telescope images revealed the faint glow cast as shock waves send charged particles flying through the magnetic fields that run along the cosmic web. Spotting these shock waves could give astronomers a better look at these large-scale magnetic fields, whose properties and origins are largely mysterious.

Finally, astronomers "can confirm what so far has only been predicted by simulations - that these shock waves exist," says astrophysicist Marcus Brüggen of the University of Hamburg in Germany, who was not involved in the new study.

At its grandest scale, our universe looks something like Swiss cheese. Galaxies aren't distributed evenly through space but rather are clumped together in enormous clusters connected by ropy filaments of dilute gas, galaxies and dark matter and separated by not-quite-empty voids.

Tugged by gravity, galaxy clusters merge, filaments collide, and gas from the voids falls onto filaments and clusters. In simulations of the cosmic web, all that action consistently sets off enormous shock waves in and along filaments.

Filaments make up most of the cosmic web but are much harder to spot than galaxies. While scientists have observed shock waves around galaxy clusters before, shocks in filaments "have never been really seen," says astronomer Reinout van Weeren of Leiden University in the Netherlands, who was not involved in the study. "But they should be basically all around the cosmic web."

Shock waves around filaments would accelerate charged particles through the magnetic fields that suffuse the cosmic web. When that happens, the particles emit light at wavelengths that radio telescopes can detect - though the signals are very weak.

A single shock wave in a filament "would look like nothing, it'd look like noise," says radio astronomer Tessa Vernstrom of the International Centre for Radio Astronomy Research in Crawley, Australia.

Instead of looking for individual shock waves, Vernstrom and her colleagues combined radio images of more than 600,000 pairs of galaxy clusters close enough to be connected by filaments to create a single "stacked" image. This amplified weak signals and revealed that, on average, there is a faint radio glow from the filaments between clusters.

"When you can dig below the noise and still actually get a result - to me, that's personally exciting," Vernstrom says.

The faint signal is highly polarized, meaning that the radio waves are mostly aligned with one another. Highly polarized light is unusual in the cosmos, but it is expected from radio light cast by shock waves, van Weeren says. "So that's really, I think, very good evidence for the fact that the shocks are likely indeed present."

The discovery goes beyond confirming the predictions of cosmic web simulations. The polarized radio emissions also offer a rare peek at the magnetic fields that permeate the cosmic web, if only indirectly.

"These shocks," Brüggen says, "are really able to show that there are large-scale magnetic fields that form [something] like a sheath around these filaments."

He, van Weeren and Vernstrom all note that it's still an open question how cosmic magnetic fields arose in the first place. The role these fields play in shaping the cosmic web is equally mysterious.

https://www.sciencenews.org/

Light from a long time ago reaches James Webb Space Telescope

Images of six candidate massive galaxies, seen 500-800 million years after the Big Bang. One of the sources (bottom left) could contain as many stars as our present-day Milky Way, but is 30 times more compact. These images are a composite of separate exposures taken by the James Webb Space Telescope using the NIRCam instrument using several filters.

Formed between 500 and 700 million years after the Big Bang, objects at the extreme limits of human observation have showed up on the James Webb Space Telescope (JWST), designed to uncover the early life of the 13.8 billion-year-old universe.

The observations are part of the first release of data from NASA's $10 billion space gadget that show galaxies more massive than had been expected for this early point in time.

Prior to the result, galaxies with stellar masses as high as 100 billion times that of the Sun have been identified from one billion years after the Big Bang, but no earlier.

The team led by Ivo Labbe, astrophysics professor at Australia's Swinburne University of Technology, used the JWST to target galaxies with a high redshifts (z = 6.5 and z = 9.1), meaning they were within the first 750 million years of cosmic history.

Redshift indicates how fast the universe is expanding and is caused by the Doppler effect moving light to the red end of the spectrum. The higher the redshift, the further away an object is and the longer the light takes to reach Earth.

The researchers found six candidate massive galaxies with redshifts between z = 7.5 and z = 9.1 with masses up to 10 billion times that of our Sun, including one galaxy with a possible stellar mass 100 billion times that of the Sun, according to a study published in Nature.

"These objects are way more massive than anyone expected," said Joel Leja, assistant professor of astronomy and astrophysics at US Penn State University, who modeled light from these galaxies.

"We expected only to find tiny, young, baby galaxies at this point in time, but we've discovered galaxies as mature as our own in what was previously understood to be the dawn of the universe."

The result suggests galaxies early in the universe's history grew massive more quickly than previously thought. However, scientists want to verify the finding with spectroscopy, which studies the absorption and emission of light in chemistry.

The discovery shows objects as mature as the Milky Way, our own galaxy, during a period when the universe was a little more than 3 percent of its current age. But Leja suggests they may not be galaxies at all.

"This is our first glimpse back this far, so it's important that we keep an open mind about what we are seeing. While the data indicates they are likely galaxies, I think there is a real possibility that a few of these objects turn out to be obscured supermassive black holes. Regardless, the amount of mass we discovered means that the known mass in stars at this period of our universe is up to 100 times greater than we had previously thought. Even if we cut the sample in half, this is still an astounding change," he said in a statement.

More at: https://www.theregister.com/

Flat, Pancake-sized Metalens Images Lunar Surface in an Engineering First

Astronomers and amateurs alike know the bigger the telescope, the more powerful the imaging capability. To keep the power but streamline one of the bulkier components, a Penn State-led research team created the first ultrathin, compact metalens telescope capable of imaging far-away objects, including the moon.

Metalenses comprise tiny, antenna-like surface patterns that can focus light to magnify distant objects in the same way as traditional curved glass lenses, but they have the advantage of being flat. Though small, millimeters-wide metalenses have been developed in the past, the researchers scaled the size of the lens to eight centimeters in diameter, or about four inches wide, making it possible

to use in large optical systems, such as telescopes. They published their approach in Nano Letters.

"Traditional camera or telescope lenses have a curved surface of varying thickness, where you have a bump in the middle and thinner edges, which causes the lens to be bulky and heavy," said corresponding author Xingjie Ni, associate professor of electrical engineering and computer science at Penn State. "Metalenses use nano-structures on the lens instead of curvature to contour light, which allows them to lay flat."

That is one of the reasons, Ni said, modern cell-phone camera lenses protrude from the body of the phone: the thickness of the lenses take up space, though they appear flat since they are hidden behind a glass window.

Metalenses are typically made using electron beam lithography, which involves scanning a focused beam of electrons onto a piece of glass, or other transparent substrate, to create antenna-like patterns point by point. However, the scanning process of the electron beam limits the size of the lens that can be created, as scanning each point is time-consuming and has low throughput.

To create a bigger lens, the researchers adapted a fabrication method known as deep ultraviolet (DUV) photolithography, which is commonly used to produce computer chips.

"DUV photolithography is a high-throughput and high-yield process that can produce many computer chips within seconds," Ni said. "We found this to be a good fabrication method for metalenses because it allows for much larger pattern sizes while still maintaining small details, which allows the lens to work effectively."

Researchers divided the wafer, on which the metalens was fabricated, into four quadrants, which were further divided into 22 by 22 mm regions - smaller than a standard postage stamp. Using a DUV lithography machine at, they projected a pattern onto one quadrant through projection lenses, which they then rotated by 90 degrees and projected again. They repeated the rotation until all four quadrants were patterned.

"The process is cost-effective because the masks containing the pattern data for each quadrant can be reused due to the rotation symmetry of the metalens," Ni said. "This reduces the manufacturing and environmental costs of the method."

As the size of the metalens increased, the digital files required to process the patterns became significantly larger, which would take a long time for the DUV lithography machine to process. To overcome this issue, the researchers compressed the files using data approximations and by referencing non-unique data.

"We utilized every possible method to reduce the file size," Ni said. "We identified identical data points and referenced existing ones, gradually reducing the data until we had a usable file to send to the machine for creating the metalens."

Using the new fabrication method, the researchers developed a single-lens telescope and captured clear images of the lunar surface - achieving greater resolution of objects and much farther imaging distance than previous metalenses. Before the technology can be applied to modern cameras, however, researchers must address the issue of chromatic aberration, which causes image distortion and blurriness when different colors of light, which bend in different directions, enter a lens.

https://phys.org/news/2023-03-flat-pancake-sized-metalens-images-lunar.html

Ultracool Dwarf Binary Stars Break Records

Astrophysicists have discovered the tightest ultracool dwarf binary system ever observed. The two stars are so close that it takes them less than one Earth day to revolve around each other. In other words, each star's "year" lasts just 17 hours.

The newly discovered system, named LP 413-53AB, is composed of a pair of ultracool dwarfs, a class of very low-mass stars that are so cool that they emit their light primarily in the infrared, making them completely invisible to the human eye. They are nonetheless one of the most common types of stars in the universe.

"It's exciting to discover such an extreme system," said Chih-Chun "Dino" Hsu, a Northwestern astrophysicist who led the study. "In principle, we knew these systems should exist, but no such systems had been identified yet."

The team first discovered the strange binary system while exploring archival data. Hsu developed an algorithm that can model a star based on its spectral data. By analyzing the spectrum of light emitted from a star, astrophysicists can determine the star's chemical composition, temperature, gravity and rotation. This analysis also shows the star's motion as it moves toward and away from the observer, known as radial velocity.

When examining the spectral data of LP 413-53AB, Hsu noticed something strange. Early observations caught the system when the stars were roughly aligned and their spectral lines overlapped, leading Hsu to believe it was just one star. But as the stars moved in their orbit, the spectral

lines shifted in opposite directions, splitting into pairs in later spectral data. Hsu realized there were actually two stars locked into an incredibly tight binary.

Using powerful telescopes at the W.M. Keck Observatory, Hsu decided to observe the phenomenon for himself. On March 13, 2022, the team turned the telescopes toward the constellation Taurus, where the binary system is located, and observed it for two hours. Then, they followed up with more observations in July, October and December as well as January 2023.

"When we were making this measurement, we could see things changing over a couple of minutes of observation," Burgasser said. "Most binaries we follow have orbit periods of years. So, you get a measurement every few months. Then, after a while, you can piece together the puzzle. With this system, we could see the spectral lines moving apart in real time. It's amazing to see something happen in the universe on a human time scale."

The observations confirmed what Hsu's model predicted. The distance between the two stars is about 1% of the distance between the Earth and the sun. "This is remarkable, because when they were young, something like 1 million years old, these stars would have been on top of each other," said Burgasser.

The team speculates that the stars either migrated toward each other as they evolved, or they could have come together after the ejection of a third -- now lost -- stellar member. More observations are needed to test these ideas.

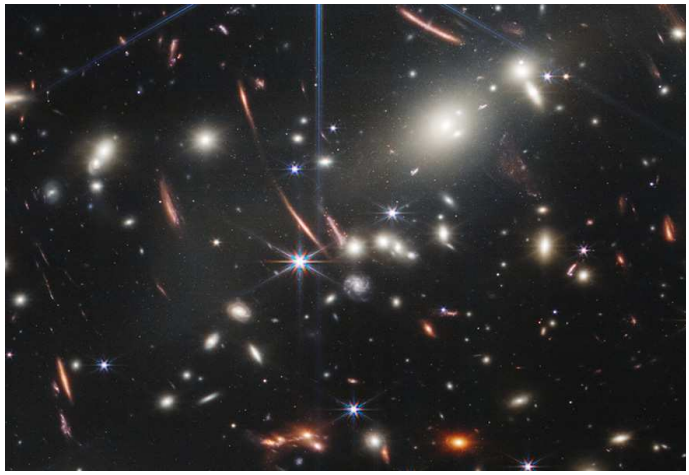
"These ultracool dwarfs are neighbors of our sun," Hsu said. "To identify potentially habitable hosts, it's helpful to start with our nearby neighbors. But if close binaries are common among ultracool dwarfs, there may be few habitable worlds to be found."

"These systems are rare," said Chris Theissen, study co-author and a Chancellor's Postdoctoral Fellow at UC San Diego. "But we don't know whether they are rare because they rarely exist or because we just don't find them. That's an open-ended question. Now we have one data point that we can start building on. This data had been sitting in the archive for a long time. Dino's tool will enable us to look for more binaries like this."

https://www.sciencedaily.com/releases/2023/03/230301162706.htm

"The Sparkler" Might Be Our Milky Way's Long-lost Twin

Astronomers are using compact groups of stars to probe the history of a galaxy in the adolescent universe dubbed "The Sparkler."



In the image of the galaxy cluster SMACS 0723, there are multiple images of the background galaxy dubbed The Sparkler. One of these appears at the center of this image (to the upper right of the diffraction-spiked star): a stick-shaped galaxy surrounded by gold-tinged sparkles.
NASA / ESA / CSA / STScI

The Sparkler is a small galaxy residing 9 billion years ago in the adolescent universe. It has only one-hundredth of the Milky Way's mass in stars; however, over the eons it will grow to become the size of our galaxy. Looking back in time at this developing galaxy is enabling astronomers examine a growth spurt similar to what our own galaxy might have experienced.

Discovered in one of the first James Webb Space Telescope images to be released, the Sparkler is distorted into a stick shape via the gravitational lensing of a foreground galaxy cluster. Gold-tinged star clusters surround the galaxy - hence its nickname. Of the two-dozen objects, dubbed "sparkles," five are likely to be globular clusters, dense clumps of ancient stars.

Lamiya Mowla (University of Toronto) and colleagues first analyzed the sparkles last fall, determining the clusters' ages and chemical composition. They found that the Sparkler's globular candidates are chemically enriched, indicating several previous generations of stars had already lived and died within them. Other sparkles, which appear more extended than the compact globulars, are metal-poor.

Now, in a new study, Duncan Forbes (Swinburne University, Australia) and Aaron Romanowsky (San Jose State University and University of California, Santa Cruz)

are comparing the Sparkler's star clusters to those around galaxies closer to home - namely, our own - to understand the galaxy's history.

The Milky Way hosts more than 150 known globular clusters, most of them orbiting well outside its spiral disk of stars. Some of these globulars probably formed early on; although their origins aren't well understood, they must somehow have been incorporated into our infant galaxy as it came together. Other globulars joined the Milky Way as it gobbled up other galaxies and their accoutrement.

A second group of reference points are the globulars around the Milky Way's largest satellite galaxy, the Large Magellanic Cloud. That is about the same size now that the Sparkler was all those 9 billion years ago. Eventually, if the LMC is absorbed after multiple passes, its globulars would join the Milky Way's collection.

A final point of comparison is the dwarf galaxy Gaia-Enceladus. It no longer exists - the Milky Way's gravity tore it to shreds 9 billion years ago - exactly the timeframe at which we're seeing the Sparkler. But its globulars survived to join our galaxy's stellar halo. Other astronomers have been able to identify which ones originally belonged to Gaia-Enceladus dwarf.

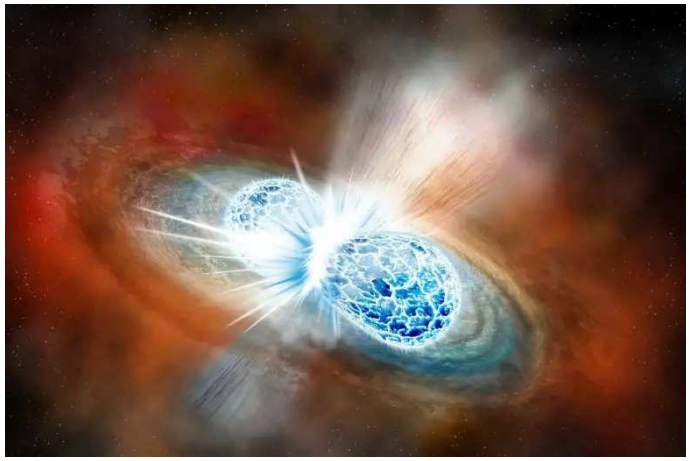
Forbes and Romanowsky ultimately compared the ancient sparkles to dozens of globular clusters around the Milky Way and the LMC. They find that the globular sparkles are like the metal-rich globulars around the Milky Way, which probably formed with our galaxy and orbit close to its disk.

Two of the more extended sparkles, which are metal-poor, appear to be akin to the globulars around the LMC and Gaia-Enceladus. Forbes and Romanowsky thus speculate that these two objects might actually also be globular clusters, only they're newly formed and belong to a dwarf galaxy that's falling into the Sparkler.

Astronomers have used age and composition measurements to conduct a sort of archaeology in our own galaxy, deriving the merger history of the Milky Way. But such analysis is complicated enough when we have the reams of data on the Milky Way that several sky surveys have provided. For distant galaxies residing in the long-ago universe, measurements become more uncertain.

https://skyandtelescope.org/

Astrophysicists Discover a Mysterious Perfect Explosion



When neutron stars collide they produce an explosion that, contrary to what was believed until recently, is shaped like a perfect sphere. Although how this is possible is still a mystery, the discovery may provide a new key to fundamental physics and to measuring the age of the Universe. The discovery was made by astrophysicists from the University of Copenhagen and has just been published in the journal Nature.

Kilonovae - the giant explosions that occur when two neutron stars orbit each other and finally collide - are responsible for creating both great and small things in the universe, from black holes to the atoms in the gold ring on your finger and the iodine in our bodies. They give rise to the most extreme physical conditions in the Universe, and it is under these extreme conditions that the Universe creates the heaviest elements of the periodic table, such as gold, platinum, and uranium.

But there is still a great deal we do not know about this violent phenomenon. When a kilonova was detected at 140 million light-years away in 2017, it was the first time scientists could gather detailed data. Scientists around the world are still interpreting the data from this colossal explosion, including Albert Sneppen and Darach Watson from the University of Copenhagen, who made a surprising discovery.

"You have two super-compact stars that orbit each other 100 times a second before collapsing. Our intuition, and all previous models, say that the explosion cloud created by the collision must have a flattened and rather asymmetrical shape," says Albert Sneppen, PhD student at the Niels Bohr Institute.

This is why he and his research colleagues are surprised to find that this is not the case at all for the kilonova from 2017. It is completely symmetrical and has a shape close to a perfect sphere.

"No one expected the explosion to look like this. It makes no sense that it is spherical, like a ball. But our calculations clearly show that it is. This probably means that the theories and simulations of kilonovae that we have been considering over the past 25 years lack important physics," says Darach Watson, associate professor at the Niels Bohr Institute and second author on the study.

The Spherical Shape is a Mystery

But how the kilonova can be spherical is a real mystery. According to the researchers, there must be unexpected physics at play:

"The most likely way to make the explosion spherical is if a huge amount of energy blows out from the center of the explosion and smooths out a shape that would otherwise be asymmetrical. So the spherical shape tells us that there is probably a lot of energy in the core of the collision, which was unforeseen," says Albert Sneppen.

When the neutron stars collide, they are united, briefly as a single hypermassive neutron star, which then collapses to a black hole. The researchers speculate whether it is in this collapse that a large part of the secret is hidden:

"Perhaps a kind of 'magnetic bomb' is created at the moment when the energy from the hypermassive neutron star's enormous magnetic field is released when the star collapses into a black hole. The release of magnetic energy could cause the matter in the explosion to be distributed more spherically. In that case, the birth of the black hole may be very energetic," says Darach Watson.

However, this theory does not explain another aspect of the researchers' discovery. According to the previous models, while all elements produced are heavier than iron, the extremely heavy elements, such as gold or uranium, should be created in different places in the kilonova than the lighter elements such as strontium or krypton, and they should be expelled in different directions. The researchers, on the other hand, detect only the lighter elements, and they are distributed evenly in space. They therefore believe that the enigmatic elementary particles, neutrinos, about which much is still unknown, also play a key role in the phenomenon.

"An alternative idea is that in the milliseconds that the hypermassive neutron star lives, it emits very powerfully, possibly including a huge number of neutrinos. Neutrinos can cause neutrons to convert into protons and electrons, and thus create more lighter elements overall. This idea also has shortcomings, but we believe that neutrinos play an even more important role than we thought," says Albert Sneppen.

A New Cosmic Ruler

The shape of the explosion is also interesting for an entirely different reason:

"Among astrophysicists there is a great deal of discussion about how fast the Universe is expanding. The speed tells us, among other things, how old the Universe is. And the two methods that exist to measure it disagree by about a billion years. Here we may have a third method that can complement and be tested against the other measurements," says Albert Sneppen.

The so-called "cosmic distance ladder" is the method used today to measure how fast the Universe is growing. This is done simply by calculating the distance between different objects in the universe, which act as rungs on the ladder.

"If they are bright and mostly spherical, and if we know how far away they are, we can use kilonovae as a new way to measure the distance independently – a new kind of cosmic ruler," says Darach Watson and continues:

"Knowing what the shape is, is crucial here, because if you have an object that is not spherical, it emits differently, depending on your sight angle. A spherical explosion provide much greater precision in the measurement."

He emphasizes that this requires data from more kilonovae. They expect that the LIGO observatories will detect many more kilonovae in the coming years.

https://scitechdaily.com/astrophysicists-discover-a-mysterious-perfect-explosion-in-space-it-makes-no-sense/

The Milky Way may be spawning many more stars than thought

The Milky Way is churning out far more stars than previously thought, according to a new estimate of its star formation rate.

Gamma rays from aluminum-26, a radioactive isotope that arises primarily from massive stars, reveal that the Milky Way converts four to eight solar masses of interstellar gas and dust into new stars each year, researchers report in work submitted to arXiv.org on January 24. That range is two to four times the conventional estimate and corresponds to an annual birthrate in our galaxy of about 10 to 20 stars, because most stars are less massive than the sun.

At this rate, every million years - a blink of the eye in astronomical terms - our galaxy spawns 10 - 20 million new stars. That's enough to fill roughly 10,000 star clusters like the beautiful Pleiades cluster in the constellation Taurus. In contrast, many galaxies, including most of the ones that orbit the Milky Way, make no new stars at all.

"The star formation rate is very important to understand for galaxy evolution," says Thomas Siegert, an astrophysicist at the University of Würzburg in Germany. The more stars a galaxy makes, the faster it enriches itself with oxygen, iron and the other elements that stars create. Those elements then alter star-making gas clouds and can change the relative number of large and small stars that the gas clouds form.

Siegert and his colleagues studied the observed intensity and spatial distribution of emission from aluminum-26 in our galaxy. A massive star creates this isotope during both life and death. During its life, the star blows the aluminum into space via a strong wind. If the star explodes when it dies, the resulting supernova forges more. The isotope, with a half-life of 700,000 years, decays and gives off gamma rays.

Like X-rays gamma rays penetrate the dust that cloaks the youngest stars. "We're looking through the entire galaxy," Siegert says. "We're not X-raying it; here we're gamma-raying it."

The more stars our galaxy spawns, the more gamma rays emerge. The best match with the observations, the researchers find, is a star formation rate of four to eight solar masses a year. That is much higher than the standard estimate for the Milky Way of about two solar masses a year.

Siegert cautions that it is difficult to tell how far the gamma rays have travelled before reaching us. In particular, if some of the observed emission arises nearby - within just a few hundred light-years of us - then the galaxy has less aluminum-26 than the researchers have calculated, which means the star formation rate is on the lower side of the new estimate. Still, he says it's unlikely to be as low as the standard two solar masses per year.

In any event, the Milky Way is the most vigorous star creator in a collection of more than 100 nearby galaxies called the Local Group. The largest Local Group galaxy, Andromeda, converts only a fraction of a solar mass of gas and dust into new stars a year. Among Local Group galaxies, the Milky Way ranks second in size, but its high star formation rate means that we definitely try a lot harder.

https://www.sciencenews.org/

Other Interesting Science

Scientists Have Discovered an Enzyme That Converts Air Into Electricity

Australian researchers discovered an enzyme capable of transforming air into energy. The study shows that the enzyme utilizes small amounts of hydrogen in the air to generate an electrical current.

Recent work by the team has shown that many bacteria use hydrogen from the atmosphere as an energy source in nutrient-poor environments. "We've known for some time that bacteria can use the trace hydrogen in the air as a source of energy to help them grow and survive, including in Antarctic soils, volcanic craters, and the deep ocean," Professor Greening said. "But we didn't know how they did this, until now."

The researchers used advanced microscopy to determine its atomic structure and electrical pathways and also a technique called electrochemistry to demonstrate the purified enzyme creates electricity at minute hydrogen concentrations.

Huc is a "natural battery" that produces a sustained electrical current from air or added hydrogen. While this research is at an early stage, the discovery of Huc has considerable potential to develop small air-powered devices, for example as an alternative to solar-powered devices.

https://scitechdaily.com/

How Pedestrians Inadvertently Self-Organize

Mathematical research from the University of Bath in the United Kingdom has shed new light on the formation and behavior of crowds.

Have you ever pondered how people, without having a discussion or even giving it a second thought, instinctively form lanes when walking through a crowded area?

A new theory, developed by mathematicians at the University of Bath in the UK and led by Professor Tim Rogers, explains this phenomenon. This theory is able to predict when lanes will be straight but also when they will be curved.

The theory can even describe the tilt of a wonky lane when people are in the habit of passing on one side rather than the other

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THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

How the Speed Demons of the Universe Tell us Something about the Milky Way

The fastest stars in the Milky Way hurtle along at over a thousand kilometers per second. Ph.D. candidate Fraser Evans has conducted research into these elusive hypervelocity stars and discovered that they have a lot to teach us about black holes and supernovae, for example.

Hypervelocity stars (HVS) are stars that move so fast they can escape the gravity of the Milky Way. In 2019, astronomers discovered a star - the S5-HVS1 - which covers an astounding 1,755 kilometers per second. Dozens of these stars have since been found. But there are probably about a thousand of them within our galaxy.

https://phys.org/news/2023-03-demons-universe-milky.html

Do Diamonds Rain on the Ice Giants?

New research shows diamonds might condense out of Neptune's mantle, but not Uranus', explaining a decades-old discrepancy.

In 2005 astronomers used the Hubble Space Telescope to photograph the delicate ring system of Uranus, as well as a southern collar of clouds and a bright, discrete cloud in the northern hemisphere.

Below the frosty hydrogen-helium atmospheres of Neptune and Uranus lie fluid mantles rich in water, ammonia, methane, and possibly something far more dazzling: diamonds. Scientists have long suspected these dense gems might rain out of the ice giants' mantles and into their rocky cores.

However, Uranus' interior might not be as glitzy as previously thought. Theoretical results published February 27th in Nature Communications suggest that while ideal diamond-forming conditions could occur within Neptune's mantle, they might not exist on Uranus. But the ice giants' interiors are still so mysterious that confidently forecasting diamond drizzles on either world will have to wait for future missions to the outer solar system, other researchers say.

"Planets with the mass of Uranus and Neptune seem to be quite common in the in the galaxy," says Ravit Helled (University of Zurich), who wasn't involved in the study. Understanding what goes on inside the ice giants, she adds, is "very important for the characterization of exoplanets, as well as our understanding of our own origin."

https://skyandtelescope.org/astronomy-news/do-diamonds-rain-on-the-ice-giants/

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 relevant content. Contact details on page 1.

Strange Facts

Each person has a unique tongue print

Your skin is renewed every 27 days. Most people throughout their lives are changing the skin around 1,000 time

Your eyes take about an hour to get used to the darkness, but after that they become 100,000 times more sensitive to light

Insects annually consume 10 percent of the total stock of food in the world

Mosquitoes are very attracted to people who have recently eaten bananas

New research provided suggests that NASA craft, Voyager 1, has left our solar system – making it the first man-made object to leave the solar system! Launched in 1977, the Voyager 1 probe is not set to run out of propellant energy until 2025, meaning by then it could have delved even deeper into interstellar space

Nomophobia is the fear of not having a mobile phone

You have a 1 in 1,461 chance of being born on leap day