# "The Southern Cross"

The Hermanus Astronomy Centre Newsletter

## MAY 2024

Please note that all our regular meetings are scheduled for **TUESDAYS,** commencing at **18.00 (6 pm)** unless otherwise advised. The day and date may change from time to time according to the current Hermanus load shedding status and/or according to venue availability for a physical meeting; such changes will be notified via e-mail and on our website.

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### *MONTHLY MEETING*

These meetings are scheduled for the **Third Tuesday** of each month except December. We commence at **18.00 (6 pm)**.

Our last Monthly meeting was held at Onrus Manor on **Tuesday April 16th**.

**DJ van Wyk**, of SANSA, spoke to us on *"Life and Science on Antarctic Ice"*.

From CT, via the research and ice-breaker ship SA Agulhas and a 50-year-old snow tractor, DJ and team travelled to SANAE IV base about 180 km across the ice shelf. Visibility in snowstorms can be so degraded that land navigation becomes totally dependent upon GPS. Shortage of water means melting snow which is not drinking water as it lacks minerals and nutrients but can be used for cooking and coffee. The base researches space weather between the Sun and Earth. Solar eruptive events are the main drivers of space weather, releasing huge amounts of energy. Instruments at SANAE IV include monitoring of magnetic fields, GPS and seismic disturbances which may indicate nuclear testing. With winds up to 210 km/hr, antennae can be ripped apart necessitating repairs by DJ and a colleague. Also included in the antenna range are the SuperDARN HF radar, a global auroral monitoring network.

A revisit to the video recording (54 minutes) is thoroughly recommended. Herewith the YouTube link:

https://www.youtube.com/watch?v=jE4U-yRikJI

The next Monthly meeting is planned for **Tuesday May 21st**.

**Amoré Nel** will speak to us on *"Black Auroras"* in person at Onrus Manor.

## *SPECIAL INTEREST GROUP ACTIVITIES*

### *Cosmology*

These meetings are scheduled for the **First Tuesday** of each month except January. We commence at **18.00 (6 pm)**.

On **Tuesday April 9th**, in episode 18 of "THE ENTIRE HISTORY OF THE UNIVERSE", we watched ***"How Did Our Universe Emerge From Chaos?"***

The YouTube video link:

https://www.youtube.com/watch?v=qr0wyKbm7m4&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=18&t=5s&pp=iAQB

and the YouTube discussion link:

https://www.youtube.com/watch?v=OzpySD9Gz8g

The next Cosmology meeting, episode 19:*"What is Beyond the Edge?",* is planned for **Tuesday May 7th** .

This series continues for another 14 episodes to episode 33. For further information, please contact Derek Duckitt: derek.duckitt@gmail.com.

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### *Astrophotography*

This SIG is no longer scheduled but can be arranged as requested by group members.

For further information, please contact Deon Krige: krige.deon44@outlook.com and please keep an eye on our website calendar and our e-mail notices and invites.

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### *Study Group*

Scheduled for the **Last Tuesday** of each month.

In our **April 30th** meeting, we watched videos and discussed ***"Windmills – Incredible Ancient Engineering"***

1. The video links: https://www.youtube.com/watch?v=3ugw7-BwsmI&pp=ygU3VGhlc2UgQW5jaWVudCBXaW5kbWlsbHMgV2VyZSBCdWlsdCBPdmVyIDEsMDAwIFllYXJzIEFnbw%3D%3D These Ancient Windmills 1.2 mins
2. https://www.youtube.com/watch?v=Uv3Pn2DFkDw Nashtifan 1000 yrs ago 6 mins

The discussion link: https://www.youtube.com/watch?v=Ml264W5h38Y

The next is scheduled for **May 28th**, the topic is yet to be finalised Please keep an eye on our website calendar on https://www.hermanusastronomy.co.za/

For further information regarding Study Group, please contact Peter Harvey petermh@hermanus.co.za

## *Observing*

This section includes recommended dates for **Stargazing**, **Moonwatch**, **Meteors**, **Solar observation** and whatever else deserves a close look.

For quick reference:

Optimal dates for **MAY 2024**:

**SUGGESTED EVENING OBSERVATION WINDOW**
*(Lunar observations notwithstanding)*

| *Date* | | *Moon* | *Dusk end* |
|---|---|---|---|
| **1st May** | *Rises* | **23h22 (50%)** | **19h26** |
| to **11th May** | *Sets* | **20h34 (11%)** | **19h19** |

**Moonwatch –** a few days either side of the **First Quarter** (Wednesday May 15th)

Please watch our activities calendar on the website – https://www.hermanusastronomy.co.za/

**Eclipses –** None observable from southern Africa.

**The Sun -** **The Sun and Auroral Activity**: Daily solar activity and predictions for auroral activity can be found at the following website: https://www.spaceweatherlive.com/en/solar-activity.html

**Meteors -** The **eta Aquariids** run from **April 19th** to **May 28th**. This is a fairly energetic shower with no sharp peak but rather a plateau of good rates that last approximately one week centred on **May 5th**.

Meteor enthusiasts please see page 4 in the May *Skynotes* and in the 2024 Sky Guide p. 86.

**Comet** https://www.marthastewart.com/rare-green-comet-12p-pons-brooks-8610933

No centre Stargazing or Moonwatch activities are planned at present. They do tend to be arranged at short notice for weather considerations.

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## *Future Trips*

No outings are planned at present.

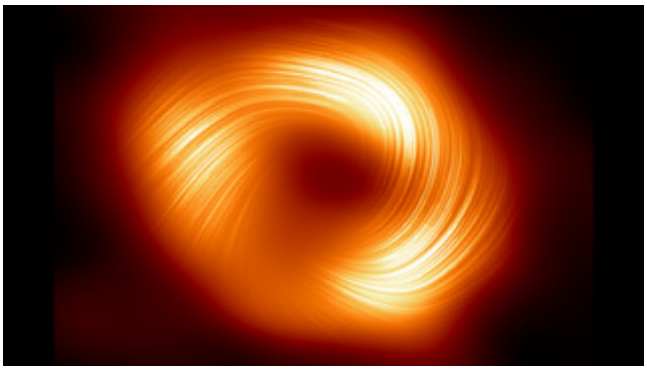
# *ASTRONOMY NEWS: APRIL 2024*

**(Compiled By Pieter Kotzé)**

## Comparing the magnetism of two monster black holes

Astronomers have captured the first view of polarized light and the magnetic fields that surround Sagittarius A* (Sgr A*), the supermassive black hole at the heart of the Milky Way. The historic observation made with the Event Horizon Telescope (EHT) has revealed the neatly ordered magnetic fields have similarities with those that surround the supermassive black hole at the heart of the galaxy M87. This is surprising given that Sgr A* has a mass of around 4.3 million times that of the sun, but M87* is much more monstrous, with a mass equivalent to around 6.5 billion suns.

The new EHT observation of Sgr A*, therefore, suggests that strong and well-organized magnetic fields could be common to all black holes. Also, because M87*'s magnetic fields drive powerful outflows or "jets," the results hint that Sgr A* could have a hidden and faint jet all of its own.



*The supermassive black hole at the heart of the Milky Way Sgr A* seen in polarized light for the first time. (Image credit: EHT Collaboration)*

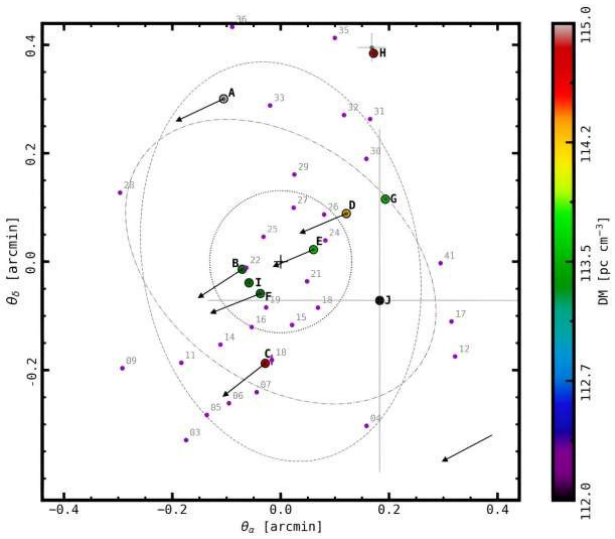
https://www.space.com/black-hole-milky-way-new-image-hidden-feature

## Long-period oscillations control the sun's differential rotation: Study

*Three-dimensional visualization of the high-latitude oscillations in the sun. Snapshot of streamlines of the long-period high-latitude oscillations in the convection zone. The red and blue colours denote the prograde (same as rotation) and retrograde (opposite to rotation) zonal flows, respectively. Credit: MPS / Y. Bekki*

The sun's differential rotation pattern has puzzled scientists for decades: While the poles rotate with a period of approximately 34 days, mid-latitudes rotate faster and the equatorial region requires only approximately 24 days for a full rotation. In addition, advances in helioseismology (i.e., probing the solar interior with the help of solar acoustic waves) have established that this rotational profile is nearly constant throughout the entire convection zone. This layer of the sun stretches from a depth of approximately 200,000 kilometres to the visible solar surface and is home to violent upheavals of hot plasma which play a crucial role in driving solar magnetism and activity.
https://phys.org/news/2024-03-period-oscillations-sun-differential-rotation.html

## Three new millisecond pulsars detected with MeerKAT




*Positions of all the pulsars in M62, plotted as east-west ($\theta\alpha$) and south-north ($\theta\delta$) offsets from the center of the GC. Credit: Vleeschower et al., 2024.*

Using the MeerKAT radio telescope in South Africa, an international team of astronomers has detected three new millisecond pulsars in the globular cluster Messier 62 (also known as NGC 6266). The finding was detailed in a research paper published March 18 on the pre-print server *arXiv*. Pulsars are highly-magnetized, rotating neutron stars emitting a beam of electromagnetic radiation. The most rapidly rotating pulsars, with rotation periods below 30 milliseconds, are known as millisecond pulsars (MSPs). Astronomers assume that they are formed in binary systems when the initially more massive component turns into a neutron star that is then spun up due to accretion of matter from the secondary star. https://phys.org/news/2024-03-millisecond-pulsars-meerkat.html

## Stardust analysis reveals secrets beyond Sol

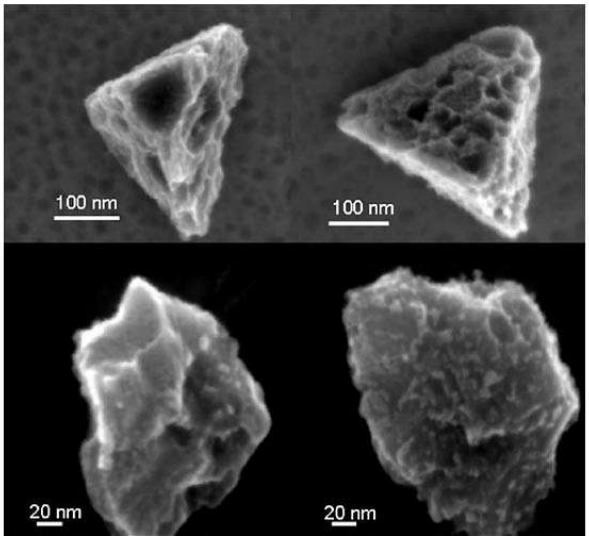



*illustration only*

A team led by Curtin University researchers has made a groundbreaking discovery, identifying a rare dust particle within an ancient meteorite that originates from a star beyond our Solar System. This significant finding was achieved under the guidance of lead researcher Dr. Nicole Nevill during her PhD tenure at Curtin, in collaboration with the Lunar and Planetary Science Institute and NASA's Johnson Space Centre. Meteorites, primarily composed of solar system material, occasionally house presolar grains-particles from stars that predate our sun. The origins of these grains are deduced by examining their elemental composition. Dr. Nevill utilized atom probe tomography, a sophisticated analytical technique, to dissect the particle's chemistry at the atomic level, revealing previously inaccessible information. "These grains serve as cosmic time capsules, offering glimpses into their progenitor stars' lives," stated Dr. Nevill. Unlike materials formed within our solar system, which exhibit predictable isotopic ratios, the examined particle presented a magnesium isotopic ratio unparalleled in our solar system's confines. https://www.spacedaily.com/reports/Stardust_analysis_reveals_secrets_beyond_Sol_999.html

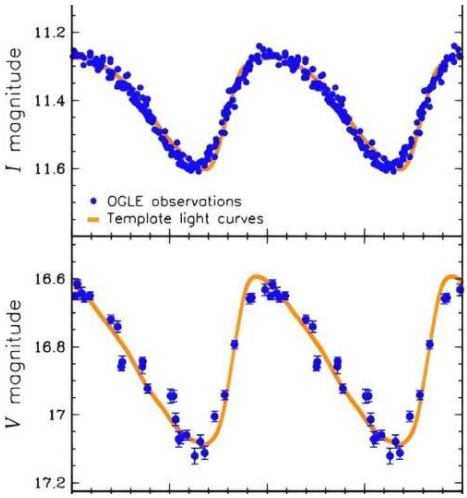
## The Large Magellanic Cloud isn't Very Metal

The Large Magellanic Cloud (LMC) is the Milky Way's most massive satellite galaxy. Because it's so easily observed, astronomers have studied it intently. They're interested in how star formation in the LMC might have been different than in the Milky Way. A team of researchers zeroed in on the LMC's most metal-deficient stars to find out how different.

*This image shows the Large and Small Magellanic Clouds in the sky over the ESO's Paranal Observatory and the four telescopes of the VLT. Image Credit: By ESO/J. Colosimo*

The LMC is about 163,000 light-years away and about 32,000 light-years across. Even though it's that large, it's still only 1/100th the mass of the Milky Way. It was probably a dwarf spiral galaxy before gravitational interactions with the Milky Way and the Small Magellanic Cloud warped its shape. Scientists predict it'll probably merge with the Milky Way in about 2.4 billion years. The LMC wasn't always this close to the Milky Way. It formed elsewhere in the Universe, out of a different reservoir of gas than the Milky Way. The LMC's stars preserve the environmental conditions they formed in. The first stars to form in the Universe were the most metal-poor stars. When they formed, only hydrogen and helium from the Big Bang were available. These stars are called Population 3 stars, and they're largely hypothetical. They were massive and many of them exploded as supernovae. These stars forged the heavier elements, called metals in astronomy, and then spread them out into space to be taken up by the next stars to form. That process continued generation by generation. https://www.universetoday.com/166459/the-large-magellanic-cloud-isnt-very-metal/

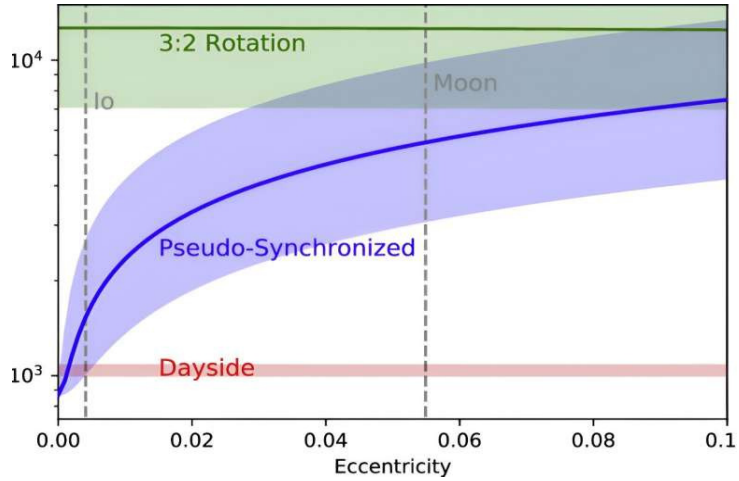
**Astronomers discover the longest-period classical Cepheid in our galaxy**




*Phase-folded I-band (upper panel) and V-band (middle panel) OGLE light curves of OGLE-GD-CEP-1884 and radial-velocity curve of this star from the Gaia Focused Product Release (Gaia Collaboration et al. 2023, lower panel). Credit: Soszyński et al., 2024.*

Astronomers from the University of Warsaw, Poland and elsewhere have detected a new classical Cepheid variable star. The newfound star, which received designation OGLE-GD-CEP-1884, has the longest pulsation period known among such variables in the Milky Way. The finding was detailed in a research paper published March 29 on the pre-print server *arXiv*. Cepheid variables (or Cepheids) are luminous, yellow, horizontal branch stars changing their brightness with time as a result of regular stellar pulsations. Given that their periods of variation are closely related to their luminosity, astronomers use them to measure interstellar and intergalactic distances. https://phys.org/news/2024-04-astronomers-longest-period-classical-cepheid.html

**First tidally locked super-Earth exoplanet confirmed**

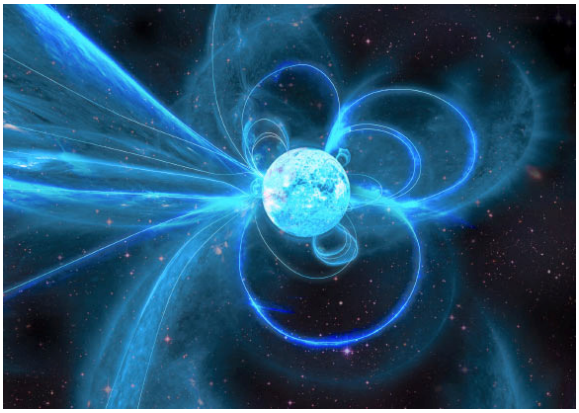



*Observed dayside brightness temperature of LHS 3844b (red; 1σ range), vs. the planet's theoretical dayside equilibrium temperature for two different rotation states (solid curves). The blue curve assumes pseudo-synchronous rotation, the green curve assumes Mercury-like 3:2 rotation. Shaded blue and green regions indicate the effect of increasing or decreasing LHS 3844b's tidal dissipation efficiency by 1 order of magnitude. Credit: The Astrophysical Journal (2024). DOI: 10.3847/1538-4357/ad2077*

An international team of astronomers and astrophysicists has confirmed the first known observance of a tidally locked super-Earth exoplanet. In their paper published in *The Astrophysical Journal*, the group describes the unique approach they took to confirm that the exoplanet LHS 3844b is tidally locked and what the finding suggests about other planets in the galaxy. Prior research has led astronomers to believe that some exoplanets are tidally locked, with one side that always faces the star they revolve around, but they have been unable until now to prove it. In this new effort, the research team picked a likely candidate and used a unique approach to study its attributes to ascertain its motion. https://phys.org/news/2024-04-tidally-super-earth-exoplanet.html

**Astronomers Detect Unusual Radio Pulses from Nearby Magnetar**

Astronomers using CSIRO's Parkes radio telescope (Murriyang) have detected unusual radio signals from **XTE J1810-197**, a radio magnetar (ultra-magnetic neutron star) located **8,100 light-years** away in the constellation of Sagittarius.

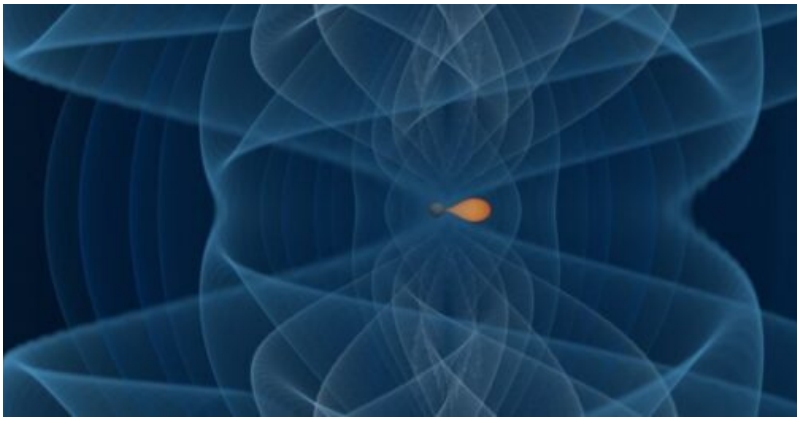


*An artist's impression of the radio magnetar XTE J1810-197. Image credit: Carl Knox, OzGrav / Swinburne University of Technology.*

Magnetars are a type of neutron star and the strongest magnets in the Universe. Most are known to emit polarised light, though the light this magnetar is emitting is circularly polarized, where the light appears to spiral as it moves through space. "The results are unexpected and totally unprecedented," said Dr. Marcus Lower, an astronomer at CSIRO. https://www.sci.news/astronomy/magnetar-radio-pulses-12836.html

**Incredibly Rare Cosmic Object Detected in Gravitational Waves For The First Time**

A gravitational wave detected in May of last year has given us a type of cosmic collision we've never seen before. One of the masses involved was a neutron star. So far, so normal.



*A visualization of the gravitational waves emitted by the merger.(I. Markin/Potsdam University, T. Dietrich/Potsdam University and Max Planck Institute for Gravitational Physics, H. Pfeiffer, A. Buonanno/Max Planck Institute for Gravitational Physics)*

But we don't know what the other object was. That's because it sits firmly in a niche known as the lower mass gap – the seemingly rare bodies with masses somewhere between the chonkiest neutron stars and the titchiest black holes. It's the first time we've seen a gravitational wave event involving a neutron star and a mass gap object, and although we aren't much closer to knowing what the latter actually is, the discovery excitingly suggests that these elusive mystery blobs could be common in the galaxy. "While previous evidence for mass-gap objects has been reported both in gravitational and electromagnetic waves, this system is especially exciting because it's the first gravitational-wave detection of a mass-gap object paired with a neutron star," says astrophysicist Sylvia Biscoveanu of Northwestern University in the US. "

The observation of this system has important implications for both theories of binary evolution and electromagnetic counterparts to compact-object mergers."https://www.sciencealert.com/incredibly-rare-cosmic-object-detected-in-gravitational-waves-for-the-first-time

https://www.space.com/gravitational-waves-reveal-black-hole-neutron-star-merging

**Monster star gains magnetic personality following stellar merger**

The stellar merger has also given the star a new lease of life, effectively de-aging it by one-and-a-half million years. Massive stars gain their magnetism by colliding and merging with other stars, according to evidence from a bizarre binary system surrounded by a dusty, element-rich nebula. Inside that bipolar nebula, which has the dual designation of NGC 6164/6165, is the star system HD 148937. Located some 3,800 light-years away, in the southern hemisphere constellation of Norma, HD 148937 contains two massive stars in orbit around one another. One of these stars is magnetic and, in fact, is the brightest and hottest massive star known to have a magnetic field. That's puzzling because, based on what we know about the interiors of stars, massive stars should *not* have magnetic fields.

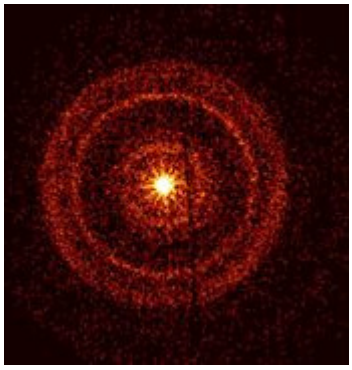
*An image of the bipolar nebula NGC 6164/6165, which hosts the magnetic binary star system HD 148937. The image was taken by the VLT Survey Telescope in Chile. (Image credit: ESO/VPHAS+ Team)*

Yet, somehow, about 7% of the most massive stars have been observed to possess a magnetic field. The question that has perplexed astronomers is: How?

The answer to this secret may lie within HD 148937.

"When doing background reading, I was struck by how special this system seemed," said the European Southern Observatory's Abigail Frost in a press statement.

Frost and Hugues Sana of KU Leuven in Belgium led efforts to study HD 148937 more closely, using nine years' worth of observations from the ESO's Very Large Telescope Interferometer, which combines the powers of four eight-meter telescopes in Chile. "After a detailed analysis, we could determine that the more massive star appears much younger than its companion, which doesn't make any sense since they should have formed at the same time," said Frost. The more massive of the two stars, with between 50 and 60 times the mass of the sun, is the magnetic one. Based on its temperature, it appears 1.5 million years younger than its companion. This is a significant age difference for massive stars, which typically only live for a few million years before going supernova. https://www.space.com/monster-star-magnetic-stellar-merger



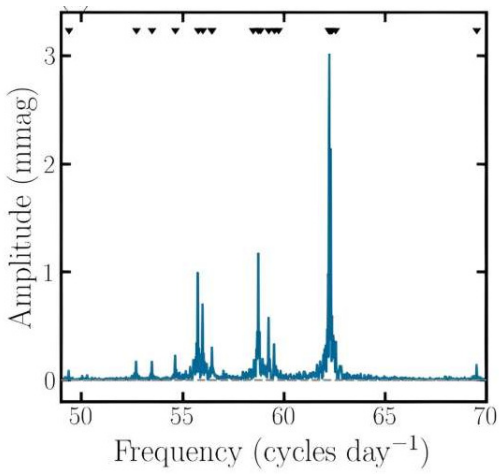
**Scientists identify origin of the 'BOAT' — the brightest cosmic blast of all time**

Using the James Webb Space Telescope (JWST), scientists have finally solved the mysterious origins of the "BOAT," possibly the biggest cosmic explosion since the Big Bang.

*The brightest gamma-ray burst ever seen as observed by the Swift X-Ray Telescope around an hour after it erupted. (Image credit: NASA/Swift/A. Beardmore (University of Leicester))*

The brightest gamma-ray burst of all time (hence the acronym the Brightest Of All Time), aka the BOAT, seems to have been launched by a supernova explosion that accompanied the death and collapse of a massive star located around 2.4 million light-years away. This is an event that probably also led to the birth of a black hole. By solving this cosmic mystery, however, the team of astrophysicists has opened up yet another celestial puzzle. That's because traces of heavy elements like gold and platinum, traces one would expect to linger around this kind of supernova, are nowhere to be found. https://www.space.com/boat-brightest-cosmic-blast-of-all-time-source-massive-star-death

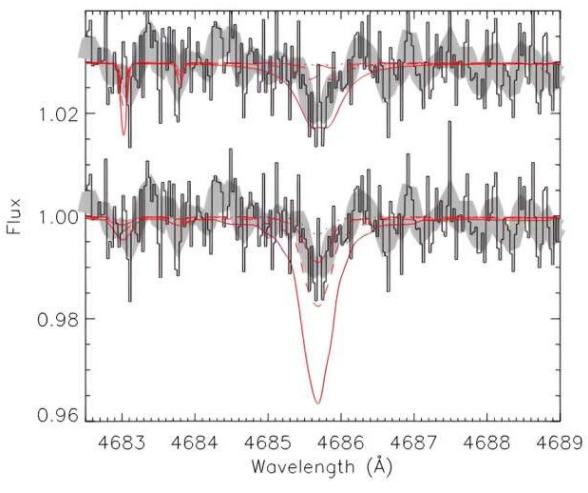
**HD 21997 is a high-frequency Delta Scuti pulsator, observations find**




*TESS amplitude spectrum of HD 21997 zoomed in on the region of significant pulsations. Credit: Sepulveda et al., 2024.*

Using NASA's Transiting Exoplanet Survey Satellite (TESS), astronomers have observed a young star designated HD 21997. Results of the new observations indicate that the studied object is a high-frequency Delta Scuti pulsator. The finding was described in a paper published March 28 on the pre-print server *arXiv*. Detecting and studying variable stars could offer important hints into aspects of stellar structure and evolution. Investigation of variables could be also helpful for a better understanding of the distance scale of the universe. In general, there are two main-sequence A-F type pulsating variables: Delta Scuti and Gamma Doradus stars. Delta Scuti stars are pulsating variables with spectral types between A0 and F5, named after the Delta Scuti variable in the constellation Scutum. They exhibit radial and non-radial pulsations spanning periods from 20 minutes to eight hours. Studying pulsation behaviour of Delta Scuti variables could help us advance our knowledge about stellar interiors. https://phys.org/news/2024-04-hd-high-frequency-delta-scuti.html

**Astronomers discover the most metal-poor extreme helium star**

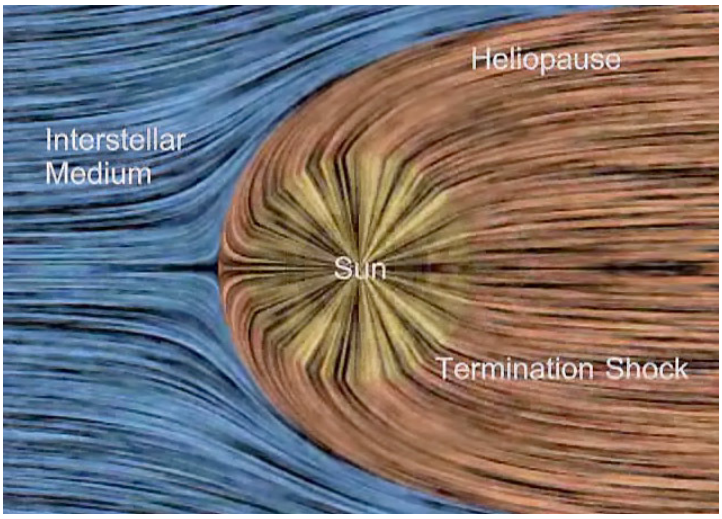



*The HRS spectrum of EC 19529−4430. Credit: Jeffery et al., 2024.*

Using the Southern African Large Telescope (SALT), astronomers have performed high-resolution observations of a recently detected extreme helium star designated EC 19529–4430. It turned out that EC 19529–4430 is the most metal deficient among the population of known extreme helium stars. The finding was reported in a research paper published April 5 on the pre-print server *arXiv*. Extreme helium (EHe) stars are supergiants much larger and hotter than the sun, but less massive. They are almost devoid of hydrogen, which is unusual, as hydrogen is the most abundant chemical element in the universe. EC 19529−4430 is a recently discovered EHe in the Galactic halo, located at a distance of about 15,500 light years. It has an effective temperature of 18,540 K and its surface appears to be composed primarily of carbon-nitrogen-oxygen (CNO)-processed helium. SALT observations found that EC 19529−4430 has an effective temperature of 20,700 K and an overall metallicity at a level of -1.3 dex. The nitrogen was found to be 1.2 dex overabundant, while carbon and oxygen were measured to be 1.5 and 0.7 dex underabundant, respectively. https://phys.org/news/2024-04-astronomers-metal-poor-extreme-helium.html

**Voyager 2 Proves Solar System is Squashed**

NASA's Voyager 2 spacecraft has followed its twin, Voyager 1, into the solar system's final frontier, a vast region at the edge of our solar system where the solar wind runs up against the thin gas between the stars.

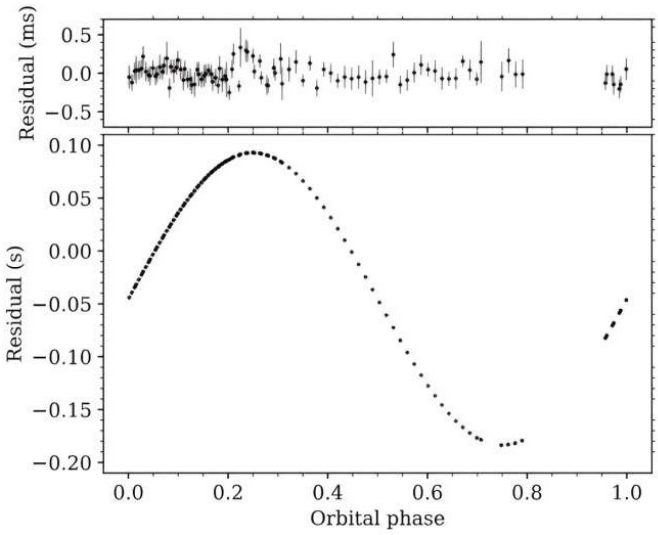



*Artist's concept of our solar system.*
*NASA*

However, Voyager 2 took a different path, entering this region, called the heliosheath, on Aug. 30, 2007. Because Voyager 2 crossed the heliosheath boundary, called the solar wind termination shock, about 16 billion kilometres (10 billion miles) away from Voyager 1 and almost 1.6 billion kilometres (a billion miles) closer to the sun, it confirmed that our solar system is "squashed" or "dented"– that the bubble carved into interstellar space by the solar wind is not perfectly round. Where Voyager 2 made its crossing, the bubble is pushed in closer to the sun by the local interstellar magnetic field.

https://science.nasa.gov/missions/voyager-program/voyager-2-proves-solar-system-is-squashed/

**Pulsating Snake: First millisecond pulsar discovered in the galactic centre**



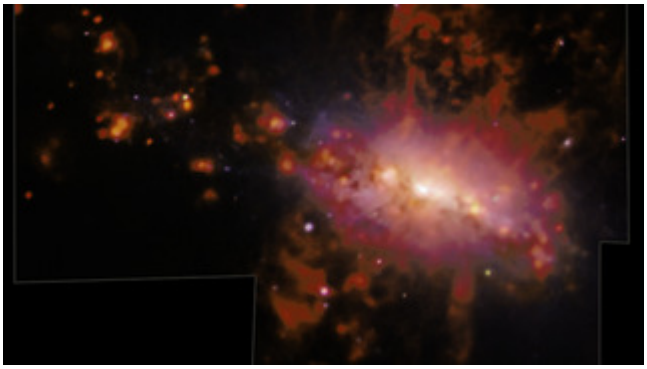

*Top panel shows the pulsar timing residuals of PSR J1744−2946 as a function of orbital phase. Bottom panel assumes a binary semi-major axis of zero to demonstrate the influence of the companion object. Credit: Lower et al., 2024.*

Astronomers from the Australia Telescope National Facility (ATNF) report the discovery of a new millisecond pulsar in the "Snake"—a radio filament in the galactic centre. It is the first millisecond pulsar detected in the centre of our galaxy. The finding was detailed in a paper published April 13 on the pre-print server *arXiv*. Pulsars are highly magnetized, rotating neutron stars emitting a beam of electromagnetic radiation. The most rapidly rotating pulsars, with rotation periods below 30 milliseconds, are known as millisecond pulsars (MSPs). Astronomers assume that they are formed in binary systems when the initially more massive component turns into a neutron star that is then spun up due to accretion of matter from the secondary star. Now, a team of astronomers led by ATNF's Marcus E. Lower has detected a new MSP using the Murriyang Ultra-Wideband Low (UWL) receiver system at the 64-m Parkes radio telescope in Australia. They investigated a recently discovered radio point source (designated G359.13142−0.2000) in G359.1−0.2, dubbed the Snake—one of the most prominent radio filaments in the centre of the Milky Way.

https://phys.org/news/2024-04-pulsating-snake-millisecond-pulsar-galactic.html#google_vignette

**Cosmic fountain is polluting intergalactic space with 50 million suns' worth of material**

The 20,000-light-year-long fountain of gas is moving at 450 times the top speed of a jet fighter.

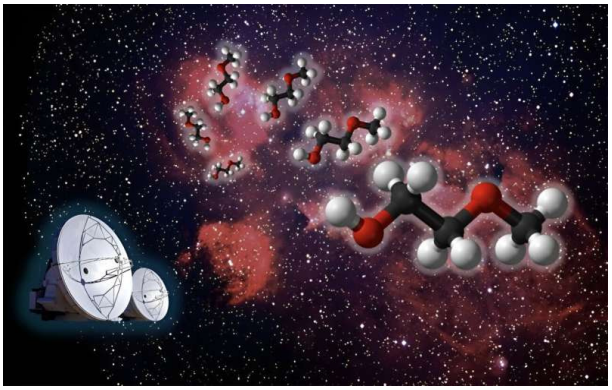


*The galaxy NGC 4383 evolves as gas flows from its core at tremendous speeds.(Image credit: ESO/A. Watts et al.)*

Tremendous explosions in a galaxy close to the Milky Way are pouring material equivalent to around 50 million suns into its surroundings. Astronomers mapped this galactic pollution event in high resolution, obtaining important hints about how the space between galaxies becomes filled with chemical elements that eventually become the building blocks of new stars. The findings came about when the international team studied NGC 4383, a spiral galaxy in the Coma Berenices constellation, using a Very Large Telescope (VLT) instrument called the Multi Unit Spectroscopic Explorer (MUSE). Located around 62 million light-years from Earth, NGC 4383 is part of the Virgo Cluster and is undergoing a strange and turbulent evolution. This includes the galaxy spitting out an outflow of gas so great it stretches across 20,000 light-years of space. This gas jet, containing enormous amounts of hydrogen and heavier elements is travelling at speeds as great as 671,000 miles per hour. For context, that is around 450 times as fast as the top speed of a Lockheed Martin F-16 jet fighter.

https://www.space.com/gas-outflow-galaxy-space-pollution-cosmic-fountain

**Researchers detect a new molecule in space**



*Scientists detected 2-Methoxyethanol in space for the first time using radio telescope observations of the star-forming region NGC 6334I. Credit: Massachusetts Institute of Technology*

New research from the group of MIT Professor Brett McGuire has revealed the presence of a previously unknown molecule in space. The team's open-access paper, "Rotational Spectrum and First Interstellar Detection of 2-Methoxyethanol Using ALMA Observations of NGC 6334I," was published in the April 12 issue of *The Astrophysical Journal Letters*. https://phys.org/news/2024-04-molecule-space.html

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|---|---|
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