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"The Southern Cross"

The Hermanus Astronomy Centre Monthly Newsletter

March 2025

MONTHLY MEETINGS

*(These meetings are scheduled for the **Third Tuesday** of each month except December)*

The last meeting was held virtually on Zoom on **Tuesday 18th February**:

Our **Annual General Meeting** was followed by a short presentation by Pierre de Villiers outlining the progress of the Global Meteor Network (GMN). Apart from his detailed explanations of this important worldwide project, Pierre ended with an interesting and extremely useful overview of the use of Stellarium, a free software planetarium software for your PC or laptop.

For a refresher of the meeting, including the Chairman's Report and Pierre's presentation, herewith the YouTube link: https://www.youtube.com/watch?v=_s4hWU3pNH4

The next meeting, scheduled for **Tuesday 18th March**, will be presented by **Dr JJ van Zyl**, senior lecturer at Stellenbosch University, titled *"**Unlocking the Secrets of the Universe with Cosmic Rays: From Nuclear Security to Dark Matter!**"*

Imagine a particle so powerful it can travel through solid rock …

This will be a hybrid meeting at **Onrus Manor** in the **Activities Hall** and virtual on **Zoom**.

SPECIAL INTEREST GROUP ACTIVITIES

Cosmology

These meetings are scheduled for the **First Tuesday** of each month except January.

For further information regarding the Cosmology group, contact Derek Duckitt – derek.duckitt@gmail.com

On Tuesday 4th February we watched and discussed the first half of a very long video of the series THE ENTIRE HISTORY OF THE UNIVERSE, episode 26: *"How did the Universe Begin?"*.

The **March** meeting, scheduled for **Tuesday 4th**, will be the second half of episode 26: *"How did the Universe Begin?"*.

Study Group

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

Our last meeting, scheduled for 25th February, was postponed (mainly due loadshedding) to **Tuesday 11th March**.

Brian Greene and **Julian Barbour** discuss *"What Creates Time?"*

"The Universe has no angular momentum at all."

"Potential energy is fundamental, kinetic energy is a human creation."

"Each Kepler pair becomes a rod, clock and compass all in one."

These and much more are discussed to tease our intuitions.

Our next meeting is scheduled for **Tuesday 25th March** and is the second part of the above.

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

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Observing

This section includes suggested dates for observation of astronomical phenomena.

Optimal dates for **March 2024**:

SUGGESTED EVENING OBSERVATION WINDOWS

(Lunar observations notwithstanding)

Date	*Moon*		*Dusk end*
March 21	*Rises*	**22h52 (60%)**	**March 21**
to **March 31**	*Sets*	**19h48 (6%)**	to **March 31**

Skynotes	Moon feature ***Mare Crisium (Sea of Crisis)***
Skynotes	Object of the month: ***Planet Mars***
Moonwatch	Within a few days either side of the **First Quarter** (March 6th).
The Sun	The Sun and Auroral Activity: 19 Solar bulletin January 2025.pdf
Meteors	Observation prospects for the **γ Normids** look poor for the maximum date, March 14th.
Comets	From **Tim Cooper**

The latest observing circular, CAMNotes2025 No.1, is online and gives details of observations required for January to March.

https://assa.saao.ac.za/wp-content/uploads/sites/23/2024/12/ASSA-CAMnotes-2025-Number-1.pdf

MNASSA

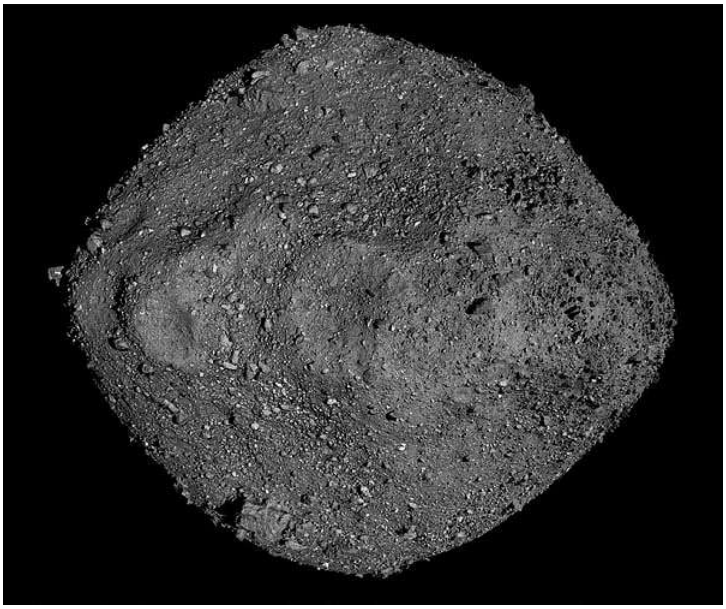
The Monthly Notes of the Astronomical Society of Southern Africa is available on

http://www.mnassa.org.za/

ASTRONOMY NEWS: January 2025 overleaf…

(Compiled by Pieter Kotzé)

Dust from asteroid Bennu shows: Building blocks of life and possible habitats were widespread in our solar system



It took two years for NASA's OSIRIS-REx space probe to return from asteroid Bennu before dropping off a small capsule as it flew past Earth, which was then recovered in the desert of the U.S. state of Utah on September 24, 2023. Its contents: 122 grams of dust and rock from asteroid Bennu. The probe had collected this sample from the surface of the 500-metre agglomerate of unconsolidated material in a touch-and-go manoeuvre that took just seconds. Since the capsule protected the sample from the effects of the atmosphere, it could be analyzed in its original state by a large team of scientists from more than 40 institutions around the world.

https://www.spacedaily.com/reports/Dust_from_asteroid_Bennu_shows_Building_blocks_of_life_and_possible_habitats_were_widespread_in_our_solar_system_999.html

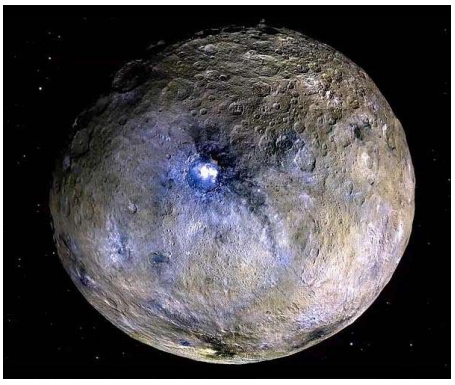
https://www.spacedaily.com/reports/Berkeley_Lab_helps_explore_mysteries_of_Asteroid_Bennu_999.html

https://www.spacedaily.com/reports/Traces_of_ancient_brine_discovered_on_the_asteroid_Bennu_contain_minerals_crucial_to_life_999.html

https://www.spacedaily.com/reports/Pristine_asteroid_samples_reveal_secrets_of_the_ancient_solar_system_999.html

https://www.spacedaily.com/reports/NASAs_Asteroid_Bennu_Sample_Reveals_Mix_of_Lifes_Ingredients_999.html

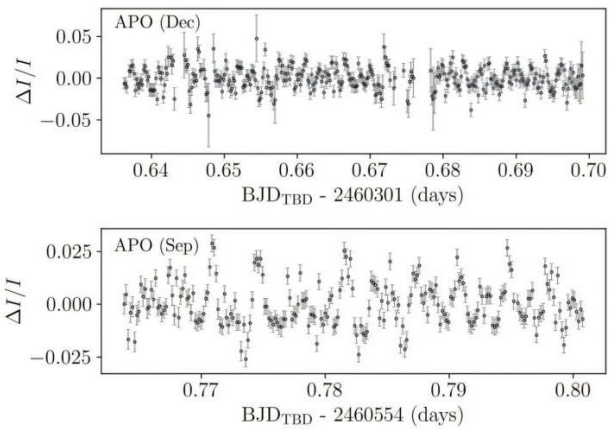
Dwarf planet Ceres has rare organic material delivered by asteroids



Organic molecules, critical components for life, have been identified on Ceres, the dwarf planet located within the asteroid belt between Mars and Jupiter. These molecules, formed from carbon, hydrogen, and other elements, are essential to life as we know it. Similar compounds have previously been discovered on distant Solar System bodies, such as comets and trans-Neptunian objects. These findings suggest that the building blocks of life may have been inherent in Solar System remnants from its early formation, potentially migrating to the inner Solar System over time. Ceres, situated in a transitional zone between inner and outer Solar System regions, has been the focus of studies aimed at understanding the origins of its organic materials. Scientists are investigating whether these compounds formed locally within the asteroid belt or were delivered from more distant regions.

https://www.spacedaily.com/reports/Dwarf_planet_Ceres_has_rare_organic_material_delivered_by_asteroids_999.html

Ultra-massive white dwarf reveals 19 pulsation modes, a new record

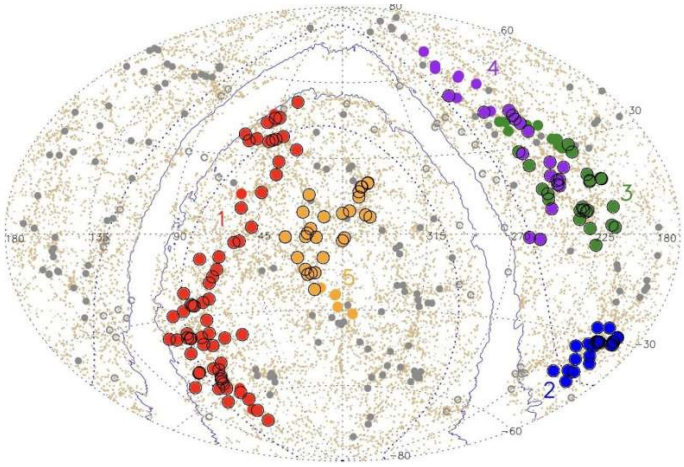


Light curve of WD J0135+5722 obtained with APO on December 23, 2023 (upper panel) and September 1, 2024 (bottom panel). Credit: arXiv (2025). DOI: 10.48550/arxiv.2501.13661

Using the Gran Telescopio Canarias (GTC) and the Apache Point Observatory (APO), an international team of astronomers has detected 19 pulsation modes in an ultra-massive white dwarf known as WD J0135+5722. The discovery, presented on the *arXiv* preprint server, makes WD J0135+5722 the richest pulsating ultra-massive white dwarf known to date. White dwarfs (WDs) are stellar cores left behind after a star has exhausted its nuclear fuel. Due to their high gravity, they are known to have atmospheres of either pure hydrogen or pure helium. However, a small fraction of WDs shows traces of heavier elements.In pulsating WDs, luminosity varies due to non-radial gravity wave pulsations within these objects. One subtype of pulsating WDs is known as DAVs, or ZZ Ceti stars—these are WDs of spectral type DA, having only hydrogen absorption lines in their spectra. Located some 165.5 light years away, WD J0135+5722 is a white dwarf with a mass of about 1.11 solar masses and an effective temperature of 12,415 K.

https://phys.org/news/2025-01-ultra-massive-white-dwarf-reveals.html

Astronomers find the largest structure in the universe and name it Quipu

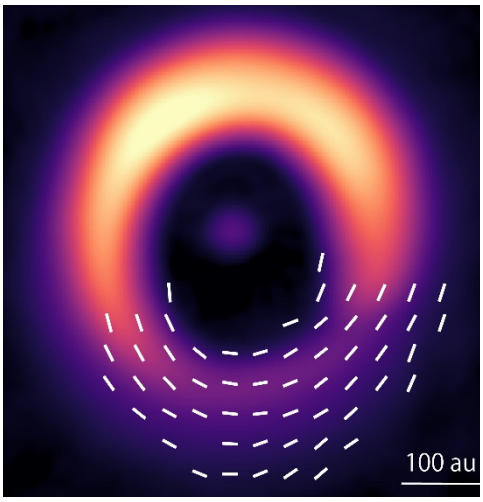


This image shows five newly discovered superstructures. Quipu (red) is the largest structure ever found in the universe. The others are Shapley (blue), Serpens-Corona Borealis (green), Hercules (purple) and Sculptor-Pegasus (beige). Credit: arXiv (2025). DOI: 10.48550/arxiv.2501.19236

Is it possible to understand the universe without understanding the largest structures that reside in it? In principle, not likely. In practical terms? Definitely not. Extremely large objects can distort our understanding of the cosmos. Astronomers have found the largest structure in the universe so far, named Quipu after an Incan measuring system. It contains a shocking 200 quadrillion solar masses. Astronomy is an endeavour where extremely large numbers are a part of daily discourse. But even in astronomy, 200 quadrillion is a number so large it's rarely encountered. And if Quipu's extremely large mass doesn't garner attention, its size surely does. The object, called a superstructure, is more than 400 megaparsecs long. That's more than 1.3 billion light-years.

https://phys.org/news/2025-02-astronomers-largest-universe-quipu.html

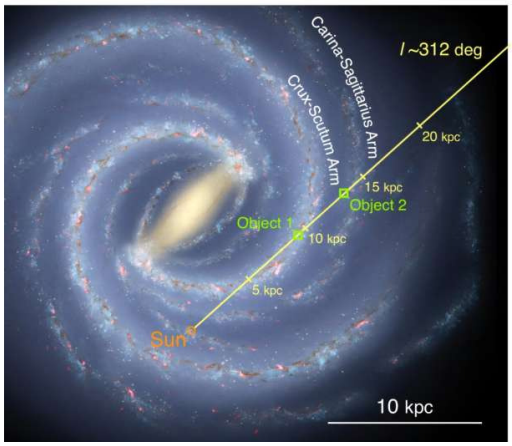
Dusting for a young star's magnetic fingerprint illuminates planet formation



ALMA observations of the protoplanetary disk around HD 142527. The white bars show the directions of the magnetic field revealed by the orientation of the dust grains. The strength of the magnetic field is 0.3 milligauss. For comparison, a typical refrigerator magnet has a magnetic field of about 1,000,000 milligauss. Credit: ALMA (ESO/NAOJ/NRAO), S. Ohashi et al.

For the first time, astronomers have succeeded in observing the magnetic field around a young star where planets are thought to be forming. The team was able to use dust to measure the three-dimensional structure "fingerprint" of the magnetic field. This will help improve our understanding of planet formation. Planets form in turbulent disks of gas and dust called protoplanetary disks around young stars. It is thought that the first step in planet formation is dust grains colliding and sticking together.https://phys.org/news/2025-02-young-star-magnetic-fingerprint-illuminates.html

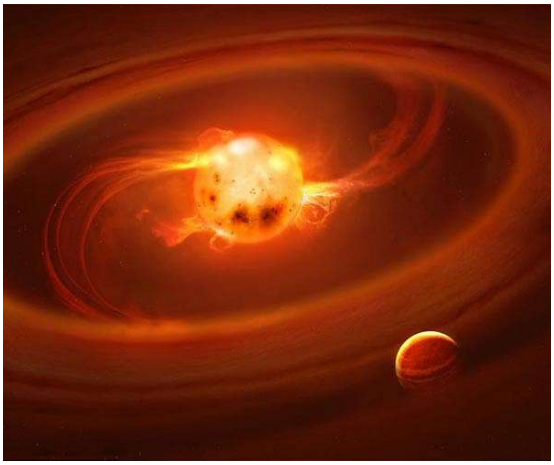
Peculiar icy objects in outer reaches of the Milky Way perplex astronomers



Direction of Object 1 and 2 (solid yellow line). The green squares represent their possible locations based on the kinematic distance estimates (see Section 4.3 and 4.4). The background is an artist's conception of the Milky Way (R. Hurt/NASA/JPL-Caltech/ESO). Credit: arXiv (2025). DOI: 10.48550/arxiv.2501.05008

A trio of astronomers from the University of Tokyo and Niigata University have found what they describe as "peculiar embedded icy objects" thousands of light years from Earth. Takashi Shimonishi, Itsuki Sakon and Takashi Onaka have posted a paper describing their discoveries and offering possible ideas regarding their nature on the *arXiv* preprint server.In 2021, two objects were discovered in data from the AKARI space telescope over the years 2006 to 2011. At the time, neither could be identified, leaving the team to wait for additional data from the ALMA array in Chile. Now, the new data have only made the nature of the two objects more mysterious. The research team has found that both objects, which are near to each other in the night sky but far apart in distance, seem to be ice balls of some sort. Both also reside in an outer part of the Milky Way galaxy. They note that either or both could be dense clouds of gas or a type of star that has not been seen before.https://phys.org/news/2025-01-peculiar-icy-outer-milky-perplex.html

Dust Uncovers Magnetic Fields in Young Star Systems

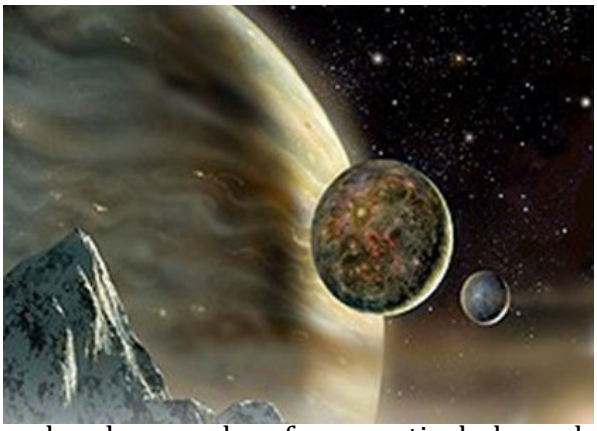


For the first time, astronomers have successfully detected and analyzed the magnetic field surrounding a young star in a region where planetary formation is believed to be underway. By using dust as a tracer, researchers have mapped out the three-dimensional structure of the magnetic field, shedding new light on the processes that shape planetary systems. Planets emerge within swirling clouds of gas and dust, known as protoplanetary disks, encircling young stars. The initial phase of planet formation involves tiny dust particles clumping together. These dust grains are subject to various forces, including magnetism, making the study of magnetic fields crucial for understanding planetary

evolution. Until now, measuring these fields within a protoplanetary disk had not been possible.

https://www.spacedaily.com/reports/Dust_Uncovers_Magnetic_Fields_in_Young_Star_Systems_999.html

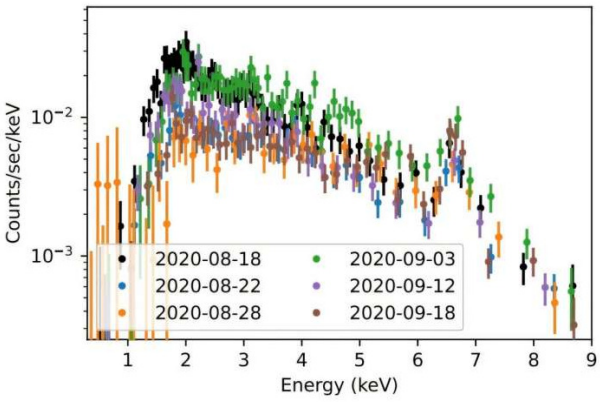
Wobbling Stars Lead to Discovery of Hidden Celestial Bodies in Gaia Data



Researchers using data from the European Space Agency's Gaia mission have identified an enormous exoplanet and a brown dwarf, marking a first in planetary discovery via Gaia's ability to detect stellar wobbles caused by gravitational interactions. These objects, found orbiting low-mass stars, present an unusual scenario that challenges established theories of planetary formation. A new study published this week details the confirmation of two enigmatic celestial objects using ESA's Gaia spacecraft data. Named Gaia-4b and Gaia-5b, these entities-a 'Super-Jupiter' exoplanet and a brown dwarf, respectively-have been detected orbiting relatively low-mass stars, a rare occurrence in astrophysics.Gaia-4b, a gas giant twelve times Jupiter's mass, orbits Gaia-4, a seemingly typical star situated 244 light-years away. Gaia-5b, a 21-Jupiter-mass brown dwarf, circles its host star, Gaia-5, at a distance of 134 light-years from Earth. The discovery of these objects in our galactic neighbourhood provides valuable insights into planetary system formation.

https://www.spacedaily.com/reports/Wobbling_Stars_Lead_to_Discovery_of_Hidden_Celestial_Bodies_in_Gaia_Data_999.html

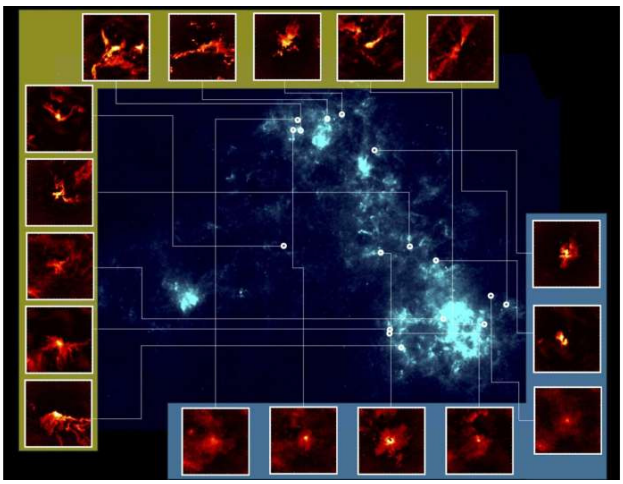
Observations investigate long-term X-ray variability of young stellar object HL Tauri



XMM-Newton EPIC-PN spectra from each of the six ~40-ks observations (represented by different colors as listed in the legend) in the 2020 monitoring campaign. Spectra are binned by 15 counts per bin. Credit: arXiv (2025). DOI: 10.48550/arxiv.2502.07900

Using ESA's XMM-Newton satellite and NASA's Chandra X-ray observatory, astronomers have observed a young stellar object known as HL Tauri. Results of the observation campaign, presented Feb. 11 on the *arXiv* pre-print server, yield important insights into long-term X-ray variability and properties of this object. Young stellar objects (YSOs) are stars in the early stages of evolution; in particular, protostars and pre-main sequence stars. They are usually observed embedded in dense molecular clumps, environments containing plenty of molecular gas and interstellar dust. Based on their evolutionary stage and spectral energy distribution, YSOs are divided into several categories—from Class 0 to Class III. Class I YSOs have begun to clear their thick surrounding envelope and are developing a circumstellar disk. Located some 450 light years away in the Taurus molecular cloud, HL Tauri (or HL Tau for short) is one of the most well-studied Class I YSOs. The star is less than 100,000 years old, has an estimated mass of about 0.7–1.2 solar masses, and hosts one of the most thoroughly studied protoplanetary disks.https://phys.org/news/2025-02-term-ray-variability-young-stellar.html

Small Magellanic Cloud observations provide insight into early universe star formation

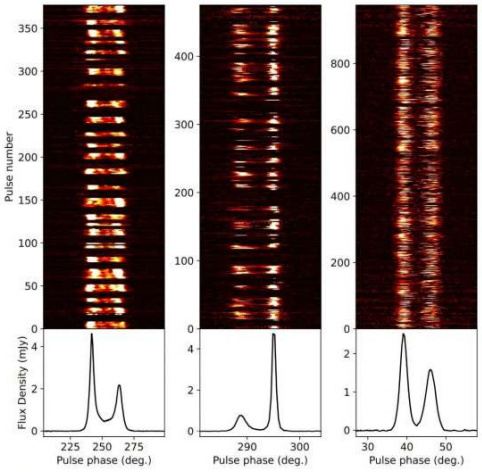


A far infrared image of the Small Magellanic Cloud as observed by the European Space Agency's (ESA) Herschel Space Observatory. Circles indicate the positions observed by the ALMA telescope, with the corresponding enlarged image of the observed molecular cloud from radio waves emitted by carbon monoxide. The enlarged pictures framed in yellow indicate filamentary structures. The pictures in the blue frame indicate fluffy shapes. Credit: ALMA (ESO/NAOJ/NRAO), Tokuda et al., ESA/Herschel

Stars form in regions of space known as stellar nurseries, where high concentrations of gas and dust coalesce to form a baby star. Also called molecular clouds, these regions of space can be massive, spanning hundreds of light-years and forming thousands of stars. And while we know much about the life cycle of a star thanks to advances in technology and observational tools, precise details remain obscure. For example, did stars form this way in the early universe?

In an article published in *The Astrophysical Journal*, researchers from Kyushu University, in collaboration with Osaka Metropolitan University, have found that in the early universe, some stars may have formed in "fluffy" molecular clouds. The results were obtained from observations of the Small Magellanic Cloud and may provide a new perspective on star formation throughout the history of the universe.https://phys.org/news/2025-02-small-magellanic-cloud-insight-early.html

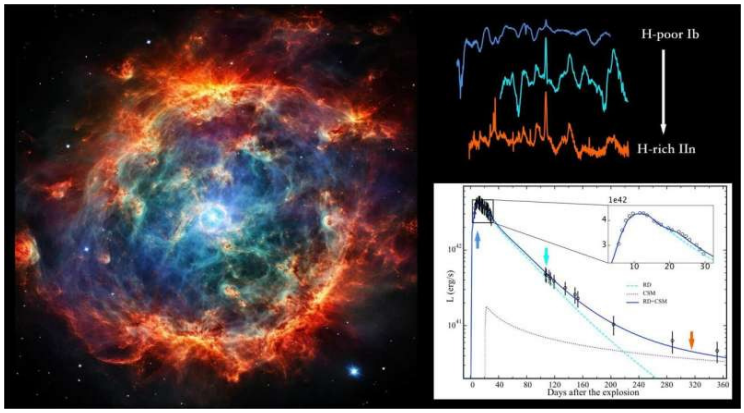
FAST uncovers emission properties of three long-period pulsars



The single-pulse sequence (upper panel) and the associated integrated pulse profile (lower panel) are shown for PSRJ1945+1211 (left), PSR J2323+1214 (middle) and PSR J1900−0134 (right), respectively. Credit: arXiv (2025). DOI: 10.48550/arxiv.2502.03830

Using the Five-hundred-meter Aperture Spherical radio Telescope (FAST), astronomers have investigated the emission properties of three long-period pulsars. Results of the observational campaign are presented in a research paper published Feb. 6 on the *arXiv* preprint server. Pulsars are highly magnetized, rotating neutron stars emitting a beam of electromagnetic radiation. They are usually detected in the form of short bursts of stable radio emission; however, some of them are also observed via optical, X-ray and gamma-ray telescopes. Observations show that pulsars may exhibit intriguing variability manifested as phenomena such as nulls (phases of diminished or entirely absent emission), mode changing, bright pulses and microstructures. FAST is one of the powerful tools capable of exploring these pulsar phenomena.

https://phys.org/news/2025-02-fast-uncovers-emission-properties-period.html



A rare type of supernova: Researchers reveal its explosion mechanisms

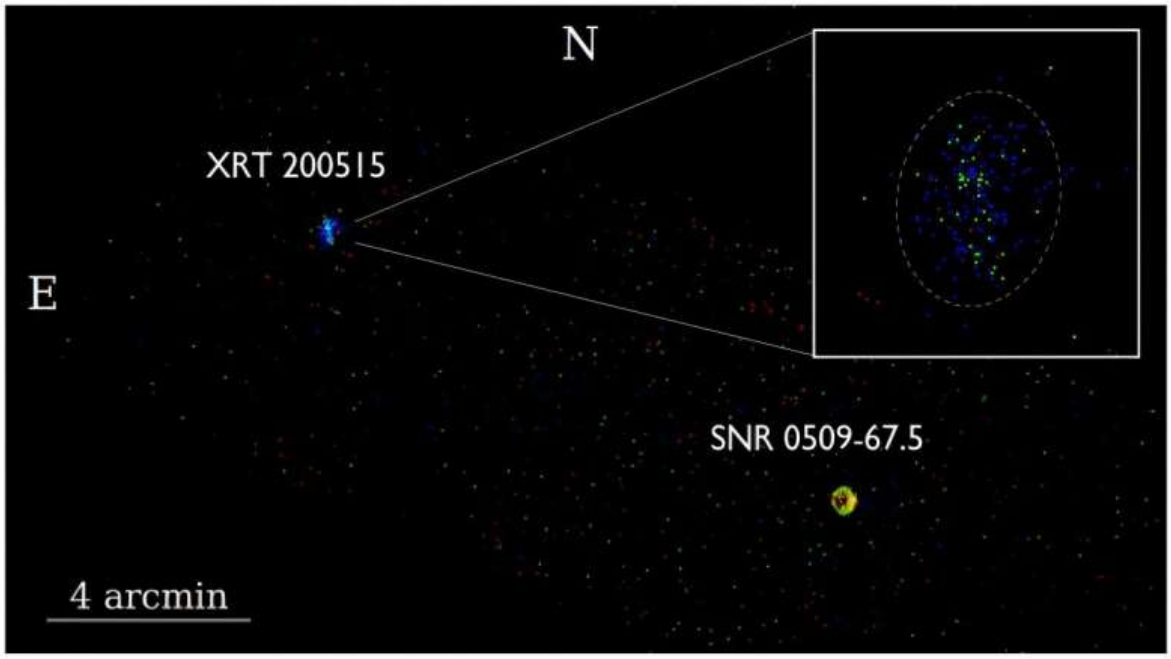
Left: A schematic diagram of SN 2014C and its outer CSM, showing the gradual interaction between the SN ejecta (blue-white circle in the

middle) and the outer CSM after the explosion. Top-right: Spectral evolution from a hydrogen-poor SN Ib to a hydrogen-rich SN IIn. Bottom-right: Bolometric luminosity and its model fitting, revealing the additional energy provided by the SN-CSM interaction present from the early stages. The coloured arrows indicate the corresponding light curve epochs for the spectral evolution shown above. Credit: Zhai Qian

An international research team led by the Yunnan Observatories of the Chinese Academy of Sciences has made significant advancements in the observational study of the metamorphic supernova SN 2014C. Their work provides crucial insights into the explosion mechanisms of this rare type of supernova and the final evolutionary stages of its progenitor star. This study is published in *The Astrophysical Journal*.SN 2014C is a well-known supernova that has undergone a remarkable transformation in its spectral classification, evolving from an initially hydrogen-poor Type Ib to a hydrogen-rich Type IIn. This transformation suggests that the progenitor star of SN 2014C had nearly completely shed its outer hydrogen envelope before the explosion, leaving behind a dense circumstellar material (CSM) in its vicinity. This rare and complex phenomenon has intrigued astronomers for the past decade.

https://phys.org/news/2025-02-rare-supernova-reveal-explosion-mechanisms.html

'Remarkable' cosmic explosion discovered in decades-old X-ray data



The "remarkable" XRT 200515 cosmic explosion observed by NASA's Chandra X-ray Observatory. Credit: Steven Dillmann

The "needle in the haystack" discovery of a powerful explosion from a mysterious unknown object outside our galaxy has excited astronomers. It went unnoticed for years within a vast, two decade-long archive of observations by NASA's Chandra X-ray Observatory, before being unearthed and described in a new paper published in *Monthly Notices of the Royal Astronomical Society*. Astronomers led by Stanford University and Harvard believe the "remarkable" cosmic explosion could either be the first X-ray burster ever discovered in the Large Magellanic Cloud (LMC), a rare flare from a magnetar—one of the most mysterious objects in the universe—or something entirely new and unheard of.

https://phys.org/news/2025-02-remarkable-cosmic-explosion-decades-ray.html
https://www.spacedaily.com/reports/Mystery_Surrounds_Newly_Discovered_Cosmic_Explosion_Hidden_for_Years_999.html

Flickers and flares: JWST reveals Milky Way's central black hole constantly bubbles with light

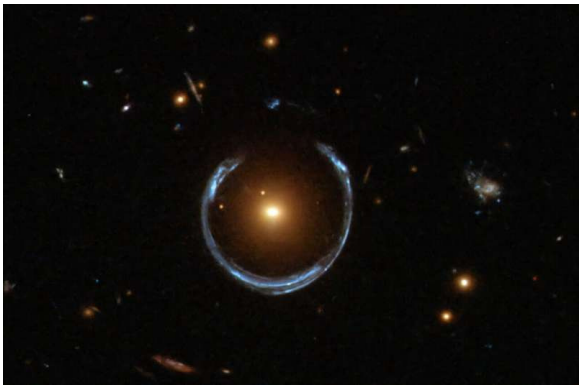
Credit: CC0 Public Domain

The supermassive black hole at the centre of the Milky Way appears to be having a party—and it is weird, wild and wonderful. Using NASA's James Webb Space Telescope (JWST), a Northwestern University-led team of astrophysicists has gained the longest, most detailed glimpse yet of the void that lurks in the middle of our galaxy. The swirling disk of gas and dust (or accretion disk) orbiting the central supermassive black hole, called Sagittarius A*, is emitting a constant stream of flares with no periods of rest, the researchers found. While some flares are faint flickers, lasting mere seconds, other flares are blindingly bright eruptions, which spew daily. There also are even fainter flickers that surge for months at a time. The level of activity occurs over a wide range of time—from short interludes to long stretches. The new findings could help physicists better understand the fundamental nature of black holes, how they interact with their surrounding environments and the dynamics and evolution of our own galactic home.

https://phys.org/news/2025-02-flickers-flares-jwst-reveals-milky.html

https://www.spacedaily.com/reports/Flickering_Light_Show_Milky_Ways_Supermassive_Black_Hole_Emits_Continuous_Flares_999.html

One of the most massive black holes in the universe lurks at the centre of the Cosmic Horseshoe



The notable gravitational lens known as the Cosmic Horseshoe was discovered in 2007. New research reveals a presence of an Ultra Massive Black Hole containing 36 billion solar masses. Credit: NASA/ESA/Hubble

In 2007, astronomers discovered the Cosmic Horseshoe, a gravitationally lensed system of galaxies about 5.5 billion light-years away. The foreground galaxy's mass magnifies and distorts the image of a distant background galaxy whose light has travelled for billions of years before reaching us. The foreground and background galaxies are in such perfect alignment that they create an Einstein ring. New research into the Cosmic Horseshoe reveals the presence of an ultra-massive black hole (UMBH) in the foreground galaxy with a staggering 36 billion solar masses.

https://phys.org/news/2025-02-massive-black-holes-universe-lurks.html

COMMITTEE MEMBERS

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Peter Harvey	(Secretary, Membership, "Skynotes", "Southern Cross", Study Group SIG co-ordinator, Observing co-ordinator)	081 212 9481 petermh@hermanus.co.za
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Pieter Kotzé	("Southern Cross" Astronomy News, Speaker Selector)	082 581 3233

Non-committee member with portfolio:

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