"The Southern Cross"

The Hermanus Astronomy Centre Newsletter

SEPTEMBER 2023

MONTHLY MEETINGS

(Currently scheduled for the 3rd Monday of each month, with effect from **October 2023** this changes to the **3rd TUESDAY** with the exception of December**.** The day and date may change from time to time according to the 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)

Our last meeting was held on **Monday August 14th** (rescheduled due loadshedding):

Prof Du Toit Strauss presented *"Cosmic Rays and Space Travel"*

Most of us have at least heard of a Geiger counter, an instrument which measures radiation. Sensitive to charged particles, it is hoisted by a weather balloon to high altitudes within the atmosphere to measure the incoming radiation from the Sun and the universe. Why do we study this radiation? Added to their natural curiosity, scientists seek information on cosmic ray sources, propagation and energy, to determine its impact on human health, notably regarding space travel, and electronics such as in communication and energy networks and aviation, the last involving both technology and human health. These rays have the capability of changing the binomial sequences so fundamental to our computer operated environment, such as in cellphones.

For those who missed this presentation, herewith the YouTube link:

https://www.youtube.com/watch?v=qLK4dMLygO0

The next scheduled Monthly Meeting:

Monday September 18th to commence **18.30**

Dr Chris Engelbrecht presents *"Asteroseismology, Listening to the heartbeat of the stars"*

Chris Engelbrecht will speak on his research work on time-domain monitoring of stars and the techniques used to learn about the interior structure and evolution of stars by analysing variations in their light emissions.

SPECIAL INTEREST GROUP ACTIVITIES

Cosmology

(Currently scheduled for the 1st Monday of each month, with effect from **October 2023**, this changes to the **1st TUESDAY** of each month with the exception of January, again subject to the vagaries of load shedding)

This is a series of 17 videos entitled "COSMOLOGY, THE HISTORY OF THE UNIVERSE", a 17 part series.

At our meeting on **August 3rd** we watched episode 11 – ***Was the Universe Born from Nothing?***

The YouTube link:

https://www.youtube.com/watch?v=4IxuXuLbMoQ&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=10

The next Cosmology meeting is scheduled for **Monday September 4th.** "COSMOLOGY, THE HISTORY OF THE UNIVERSE", episode 12 – *"Was Our Current Universe already Inevitable at One Second Old?"*

For further information, please contact Derek Duckitt: derek.duckitt@gmail.com

Astrophotography

This SIG is scheduled for the 2nd Monday (**2nd Tuesday** from **October 2023**) of each month as requested by group members.

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

Study Group

Currently scheduled for the **last Monday** (**last Tuesday** from **October 2023**) of each month.

The last meeting was held on **August 28th**, the topic- **Prof Lee Berger** presented on video *"Homo Naledi, and the Many Questions Surrounding Rising Star"*.

Next scheduled for **Monday September 25th**, topic to be advised.

For further information, please contact Peter Harvey: petermh@hermanus.co.za

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Stargazing and Moonwatch

No events are currently planned. Be aware, these events are dependent on weather conditions and will be advised at short notice such as 2 or 3 days ahead.

You can check for updates on our website calendar – https://hermanusastronomy.co.za/ .

Future Trips

No outings are planned at present.

Website

Please check our website calendar for HAC scheduled events: https://www.hermanusastronomy.co.za

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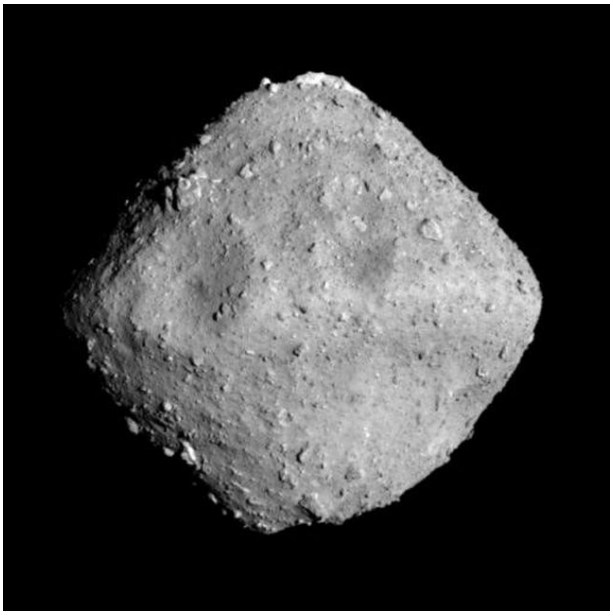
ASTRONOMY NEWS for SEPTEMBER 2023

(compiled by Pieter Kotzé)

Asteroid Ryugu Was Once a Planet Forming in The Outer Reaches of Our Solar System



Asteroid Ryugu. (JAXA, University of Tokyo and collaborators)

According to an analysis of grains collected from asteroid Ryugu, at least part of the carbon-rich rock started its life much farther from the Sun before ending up in the asteroid belt and then, ultimately, at roughly Earth's distance from the Sun. These findings reveal that asteroids can have complex histories involving multiple migrations through the Solar System before they end up at their current locations – and that they contain valuable records of different periods throughout the history of the Solar System. Launched in 2014 as a sample return mission, the Japan Aerospace Exploration Agency's (JAXA) Hayabusa2 probe surveyed Ryugu from 2018 to 2019, finally returning home in 2020. In addition to collecting samples, Hayabusa2 also discovered that the 900-meter (2,950-foot) asteroid is not one single big chunk of rock but what is called a "rubble pile", a loose collection of smaller rocks bound together by gravity. Ryugu has much in common with asteroid belt asteroids, particularly the Polana and Eulalia families. But a growing number of studies on the samples brought to Earth from Ryugu show that at least some of the minerals from the rubble pile are more consistent with material in the outer Solar System.

https://www.sciencealert.com/asteroid-ryugu-was-once-a-planet-forming-in-the-outer-reaches-of-our-solar-system

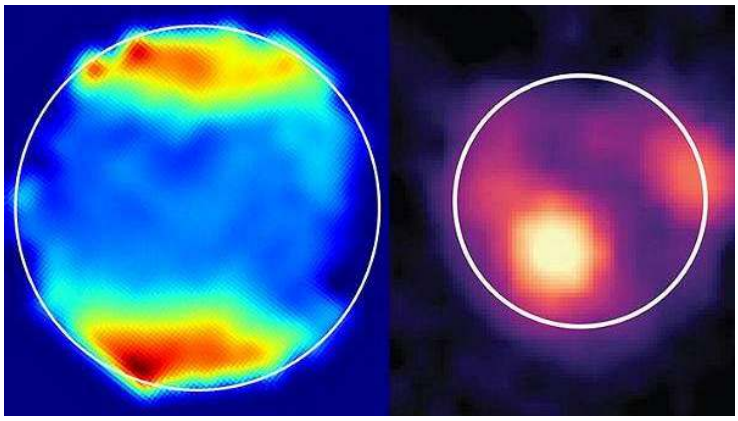
Astronomers shed new light on formation of mysterious fast radio bursts

More than 15 years after the discovery of fast radio bursts (FRBs) - millisecond-long, deep-space cosmic explosions of electromagnetic radiation - astronomers worldwide have been combing the universe to uncover clues about how and why they form. Nearly all FRBs identified have originated in deep space outside our Milky Way galaxy. That is until April 2020, when the first Galactic FRB, named FRB 20200428, was detected. This FRB was produced by a magnetar (SGR J1935+2154), a dense, city-sized neutron star with an incredibly powerful magnetic field. This groundbreaking discovery led some to believe that FRBs identified at cosmological distances outside our galaxy may also be produced by magnetars. However, the smoking gun for such a scenario, a rotation period due to the spin of the magnetar, has so far escaped detection. New research into SGR J1935+2154 sheds light on this curious discrepancy.In the July 28 issue of the journal Science Advances, an international team of scientists, including UNLV astrophysicist Bing Zhang, report on continued monitoring of SGR J1935+2154 following the April 2020 FRB, and the discovery of another cosmological phenomenon known as a radio pulsar phase five months later. https://www.spacedaily.com/reports/Astronomers_shed_new_light_on_formation_of_mysterious_fast_radio_bursts_999.html

James Webb Space Telescope sees Jupiter moons in a new light

With its sensitive infrared cameras and high-resolution spectrometer, the James Webb Space Telescope (JWST) is revealing new secrets of Jupiter's Galilean satellites, in particular Ganymede, the largest moon, and Io, the most volcanically active. In two separate publications, astronomers who are part of JWST's Early

Release Science program report the first detection of hydrogen peroxide on Ganymede and sulfurous fumes on Io, both the result of Jupiter's domineering influence.



A spectroscopic map of Ganymede (left) derived from JWST measurements shows light absorption around the poles characteristic of the molecule hydrogen peroxide. A JWST infrared image of Io (right) shows hot volcanic eruptions at Kanehekili Fluctus (center) and Loki Patera (right). The circles outline the surfaces of the two moons. (Image credit: Samantha Trumbo, Cornell [Ganymede], and Imke de Pater, UC Berkeley [Io])

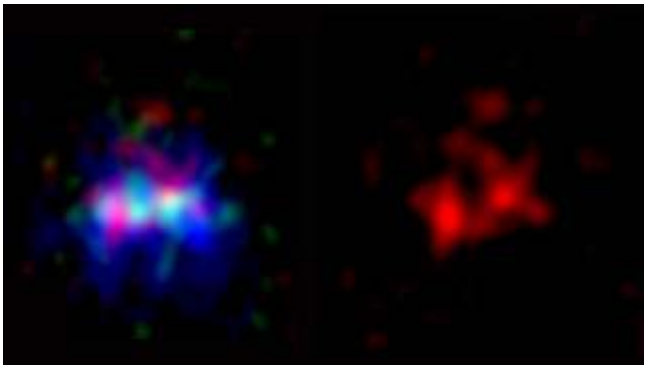
The astronomers argue that the peroxide is produced by charged particles hitting the frozen water ice around the poles and breaking the water molecules into fragments - a process called radiolysis - which then recombine to form H2O2. They suspected that radiolysis would occur primarily around the poles on Ganymede because, unlike all other moons in our solar system, it has a magnetic field that directs charged particles toward the poles. "Just like how Earth's magnetic field directs charged particles from the sun to the highest latitudes, causing the aurora, Ganymede's magnetic field does the same thing to charged particles from Jupiter's magnetosphere," she added. "Not only do these particles result in aurorae at Ganymede, as well, but they also impact the icy surface."

https://www.spacedaily.com/reports/James_Webb_Space_Telescope_sees_Jupiter_moons_in_a_new_light_999.html

Extremely distant galaxy reveals stories of stars from their cradles to their graves

Astronomers have discovered sites of star formation and destruction that existed just 600 million years post-Big Bang what might be the most distant site of star birth, and death, ever seen. The region is located in an interstellar cloud of gas and dust, called a nebula, that also dwells in a galaxy located some 13.2 billion light-years from Earth. This tells us that the area is seen as it was only about 600 million years after the Big Bang. The new observations were made by a team of astronomers led by Nagoya University scientist, Yoichi Tamura, using the Atacama Large Millimeter/submillimeter Array (ALMA), located in the Atacama Desert region of Northern Chile.

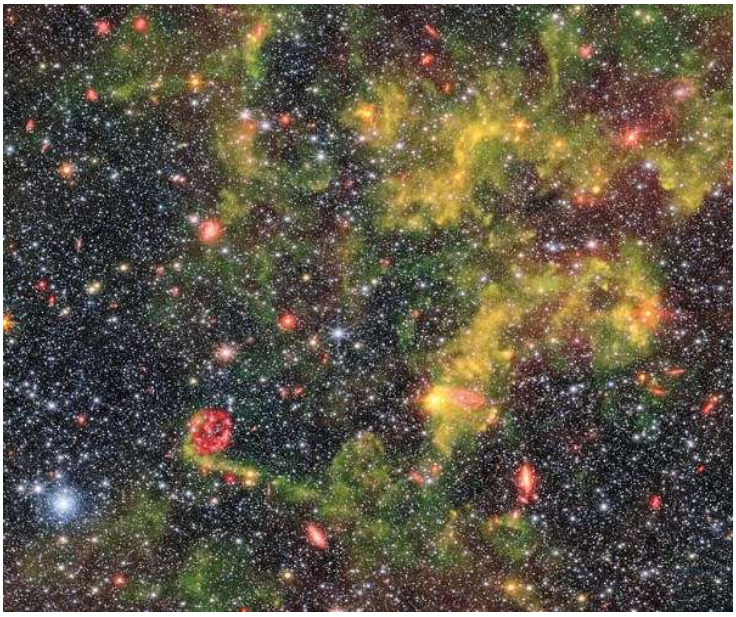
The team had observed this distant and early nebula previously, picking up radio waves emitted via oxygen and dust. Distribution of such matter can reveal how sites of stellar birth and death are spread throughout interstellar clouds, but at that time, the team didn't have the resolution necessary to observe the full nebular structure.



ALMA observations of the nebula MACS0416_Y1 containing the most distant star forming region and site of stellat death ever seen(Image credit: LMA (ESO/NAOJ/NRAO), Y. Tamura et al)

https://www.space.com/distant-galaxy-stars-cradle-graves

The life and times of dust

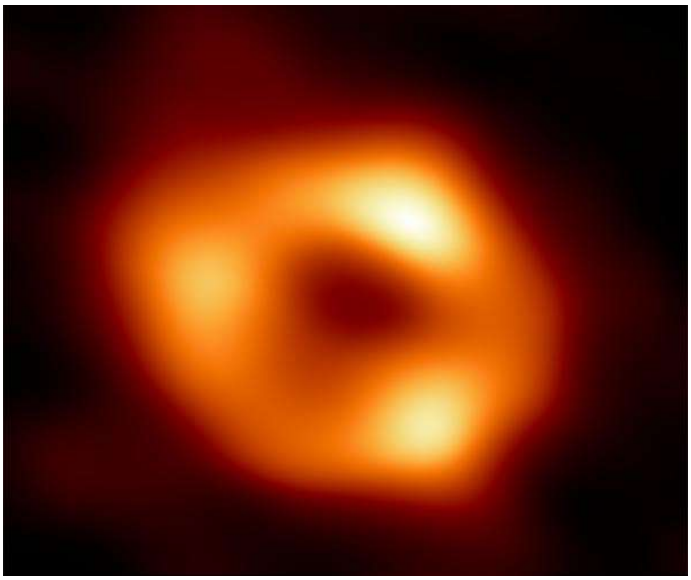


Irregular galaxy NGC 6822 as observed by the NIRCam and MIRI instruments onboard the Webb Telescope.

This image shows the irregular galaxy NGC 6822, which was observed by the Near-InfraRed Camera (NIRCam) and Mid-InfraRed Instrument (MIRI) mounted on the NASA/ESA/CSA James Webb Space Telescope. As their names suggest, NIRCam and MIRI probe different parts of the electromagnetic spectrum. This allows the instruments to observe different components of the same galaxy, with MIRI especially sensitive to its gas-rich regions (the yellow swirls in this image) and NIRCam suitable for observing its densely packed field of stars.NGC 6822 lies about 1.5 million light-years away, and is the Milky Way's nearest galactic neighbour that is not one of its satellites. It has a very low metallicity, meaning that it contains very low proportions of elements that are not hydrogen and helium. Metallicity is a key concept in astronomy, in part because elements other than hydrogen and helium are largely produced by stars over their lifetimes. Therefore, in the very early Universe (before the first generation of stars had been born, lived and died) everything had very low metallicity.
https://www.spacedaily.com/reports/The_life_and_times_of_dust_999.html

Astronomers Reveal New Features of Galactic Black Holes

Black holes are the most mysterious objects in the universe, with features that sound like they come straight from a sci-fi movie. Stellar-mass black holes with masses of roughly 10 suns, for example, reveal their existence by eating materials from their companion stars. And in some instances, supermassive black holes accumulate at the center of some galaxies to form bright compact regions known as quasars with masses equal to millions to billions of our sun. A subset of accreting stellar-mass black holes that can launch jets of highly magnetized plasma are called micro-quasars.



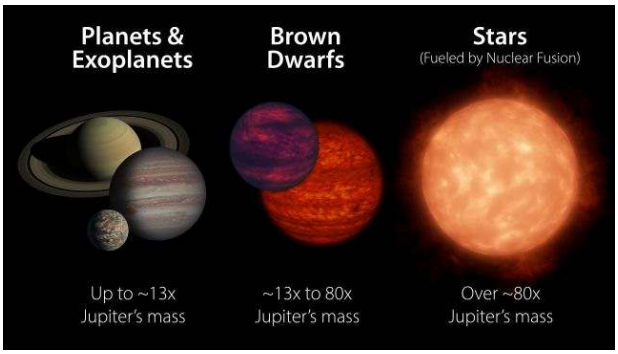
File image of the Milky Way's central black hole Sagittarius-A.

An international team of scientists, including UNLV astrophysicist Bing Zhang, reports in the July 26 issue of Nature a dedicated observational campaign on the Galactic microquasar dubbed GRS 1915+105. The team revealed features of a microquasar system that have never before been seen. Using the massive Five-hundred-meter Aperture Spherical radio Telescope (FAST) in China, astronomers discovered a quasi-periodic oscillation (QPO) signal in the radio band for the first time from any microquasar systems. QPOs are a phenomenon that astronomers use to understand how stellar systems like black holes function. And while they have been observed in X-rays from microquasars, their presence outside of this manner - as part of the system's radio emission - is unique.

https://www.spacedaily.com/reports/Astronomers_Reveal_New_Features_of_Galactic_Black_Holes_999.html

These Two Stars Orbit So Close, The Entire System Would Fit Inside Our Sun

A record-breaking binary system has been found with a rotation so tight, both objects could comfortably fit inside the Sun. Called ZTF J2020+5033, its just 457 light-years away and consists of a high-mass brown dwarf and a low-mass red dwarf that spin around each other on a dizzying 1.9-hour orbit. That's the closest orbit a brown dwarf has been found in yet by over a factor of 7, making the distance between the two objects less than half of the Sun's radius.



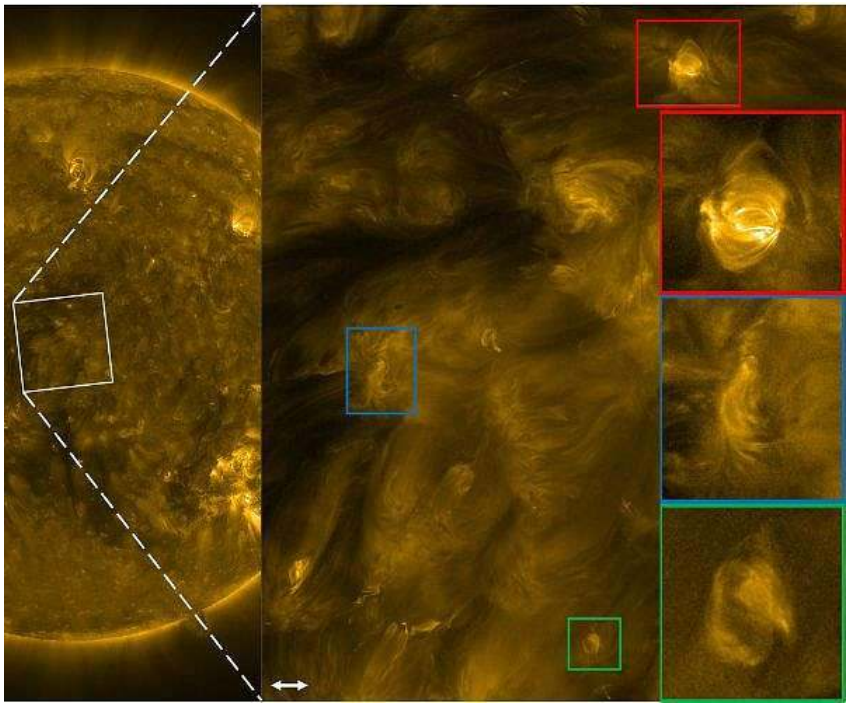
An illustration of the mass ranges of cosmic objects. (NASA/JPL-Caltech)

Very few brown dwarfs have been found in close binaries with other small stars. ZTF J2020+5033, according to a team led by astrophysicist Kareem El-Badry of the Harvard-Smithsonian Center for Astrophysics, could offer us some clues as to why -Brown dwarfs, technically, don't fall under the definition of stars, occupying the not-quite-either zone between tiny stars and massive planets. Roughly between 13 and 80 times the mass of Jupiter, they're massive enough to ignite fusion of deuterium in their cores, but not the hydrogen that powers full stars.

Being rather small and dim, they're difficult to spot. We know of around 5,000 brown dwarfs out there in the Milky Way, and most of those are isolated, just hanging out on their own. Only about 1 percent of Sun-like and lower mass stars are in binaries with brown dwarfs within a few astronomical units. Nevertheless, these binaries are sought by astronomers. Paired brown dwarfs that are interacting with a companion star can help us measure their properties and better understand their formation and evolution.

https://www.sciencealert.com/these-two-stars-orbit-so-close-the-entire-system-would-fit-inside-our-sun

Heat waves on the Sun



Full Sun observation taken on October 12, 2022 by EUI's Full Sun Imager (FSI) and a zoom on the center of the Sun taken by its High-Resolution Imager (HRI). The white arrow corresponds to a distance of about 10 000 km. Three smaller structures highlighted with red, blue, and green boxes, show magnetic waves that appear as a transverse motion. Click on the image to see a movie of the observations. Credit: Solar Orbiter/EUI Team/ESA and NASA.

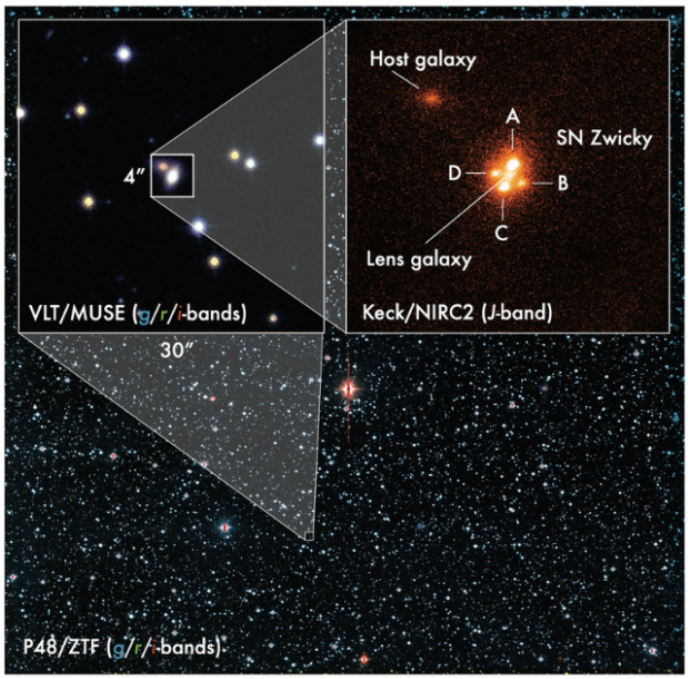
A joint scientific team led by the Royal Observatory of Belgium (ROB) and the KU Leuven has found that high-frequency magnetic waves could play an essential role in keeping the Sun's atmosphere at millions of degrees. This finding sheds a new light on the most intriguing solar mystery: what makes the Sun's atmosphere hotter than its surface?

The Sun's only heat source resides in its core. Yet the corona, the outermost layer of the solar atmosphere, is about 200 times hotter than the photosphere, the Sun's surface. Prof. Tom Van Doorsselaere at the KU Leuven says, "Over the past 80 years, astrophysicists have tried to solve this problem and now more and more evidence is emerging that the corona can be heated by magnetic waves."

https://www.spacedaily.com/reports/Heat_waves_on_the_Sun_999.html

Astronomers spot multiple images of a distant supernova

Gravitational lensing magnified SN Zwicky and copied its image four times, offering a glimpse into the distant universe.



The Zwicky Transient Facility spotted a distant supernova whose image had been magnified and copied four times by gravitational lensing. Credit: J. Johansson

Albert Einstein first recognized that a massive, dense object in the sky can act like a lens that can bend and focus light from behind it, known as gravitational lensing. Strong gravitational lenses can magnify and even create several copies of the background image. Recently, a team of scientists discovered a rare, quadruply-lensed supernova, copied four times. Studying its light could give us a deeper insight on dark matter, the expansion of the universe, and even help measure cosmic distances.

The supernova was first detected by the Zwicky Transient Facility (ZTF), so astronomers named it SN Zwicky. Using images from the W.M. Keck Observatory, the Very Large Telescope, and NASA's Hubble Space Telescope, the team was able to confirm the finding. "Such lensed objects can help us to uniquely probe the amount and distribution of matter at the inner core of galaxies," said team leader and director of the Oskar Klein Centre at Stockholm University, Ariel Goobar, in a press release.

https://www.astronomy.com/science/astronomers-spot-multiple-images-of-a-distant-supernova/

Webb Telescope unmasks Ring Nebula's cosmic dance

NASA's James Webb Space Telescope (JWST) has released exquisite new visuals of the famed Ring Nebula, or Messier 57, to the world. The unveiling was done by a global consortium of astronomers, a team steered by Professor Mike Barlow of UCL, UK, Dr Nick Cox of ACRI-ST, France, and with contributions from Professor Albert Zijlstra of The University of Manchester.

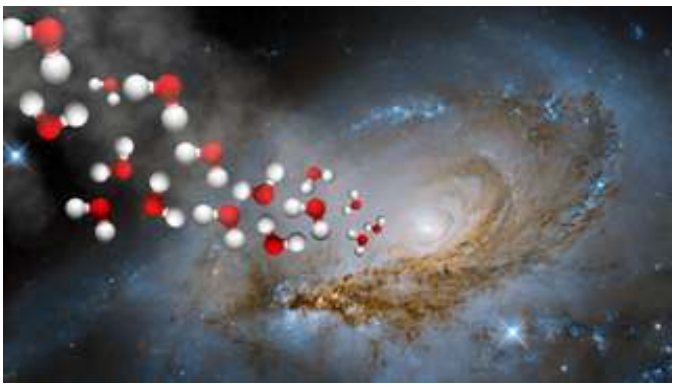
JWST/NIRcam composite image of the Ring Nebula. The images clearly show the main ring, surrounded by a faint halo and with many delicate structures. The interior of the ring is filled with hot gas. The star which ejected all this material is visible at the very centre. It is extremely hot, with a temperature in excess of 100,000 degrees. The nebula was ejected only about 4000 years ago. Technical details: The image was obtained with JWST's NIRCam instrument on August 4, 2022. Images in three different filters were combined to create this composite image: F212N (blue); F300M (green); and F335M (red).

The Ring Nebula, a luminous beauty in the Lyra constellation, is no stranger to stargazers. Visible throughout the summer months, even a small telescope will divulge its signature donut-shaped luminescence. This planetary nebula-colorful remnants left behind by dying stars after ejecting a significant portion of their mass - is an enigma that has long enticed human curiosity. The newly captured images by JWST now deliver an unparalleled perspective, enabling a deeper probe into the intricate processes that carved this cosmic marvel.

Situated roughly 2,600 lightyears from our home planet, the Ring Nebula was conceived from a star nearing its end, which expelled its outer layers into the cosmos. The sheer diversity of shapes and designs in these nebulae, from elegant radiant rings to expanding bubbles and intricate clouds, is a product of multiple physical processes still not fully grasped. The hot central star's radiance now lights up these layers.

https://www.spacedaily.com/reports/Webb_Telescope_unmasks_Ring_Nebulas_cosmic_dance_999.html

Galaxy from the 'teenage' universe reveals its water map for the 1st time



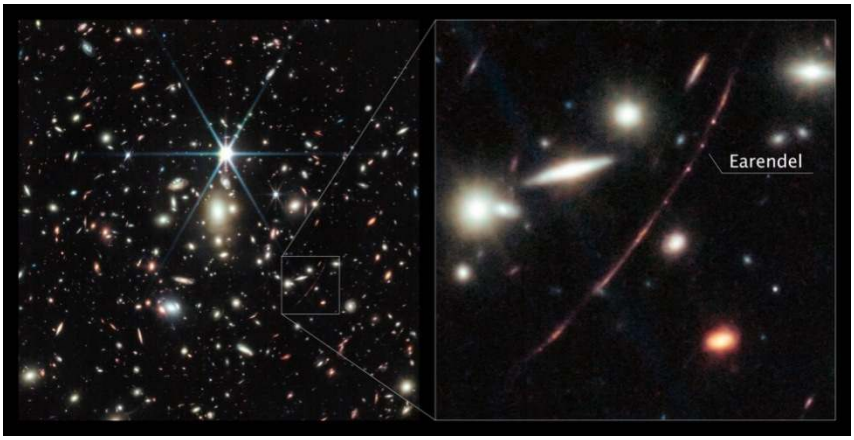
The galaxy, J1135, is located 12 billion light-years away and is seen as it was less than 2 billion years after the Big Bang.

Illustration shows water molecules seen in a vapor cloud around a galaxy, infrared emissions form these molecules can help track the formation of stars and black holes(Image credit: NASA, ESA, J. Dalcanton (University of Washington), R. Foley (University of California - Santa Cruz); Image processing: G. Kober (NASA Goddard/Catholic University of America)/ Robert Lea)

For the first time, scientists managed to develop a map of water distribution in a galaxy that existed when the 13.8-billion-year-old universe was just a cosmic teenager. The galaxy, designated J1135, is located around 12 billion light-years from Earth and is therefore seen as it was less than 2 billion years after the Big Bang. J1135's water map, created as part of a ScuolaInternazionale Superiore di Studi Avanzati (SISSA) study conducted by the Galaxy Observational and Theoretical Astrophysics (GOThA) team, also has an unprecedented resolution that could reveal never-before-seen dynamics of early universe galaxies. https://www.space.com/galaxy-from-teenage-universe-reveals-water-map-1st-time

Webb Reveals Colours of Earendel, Most Distant Star Ever Detected

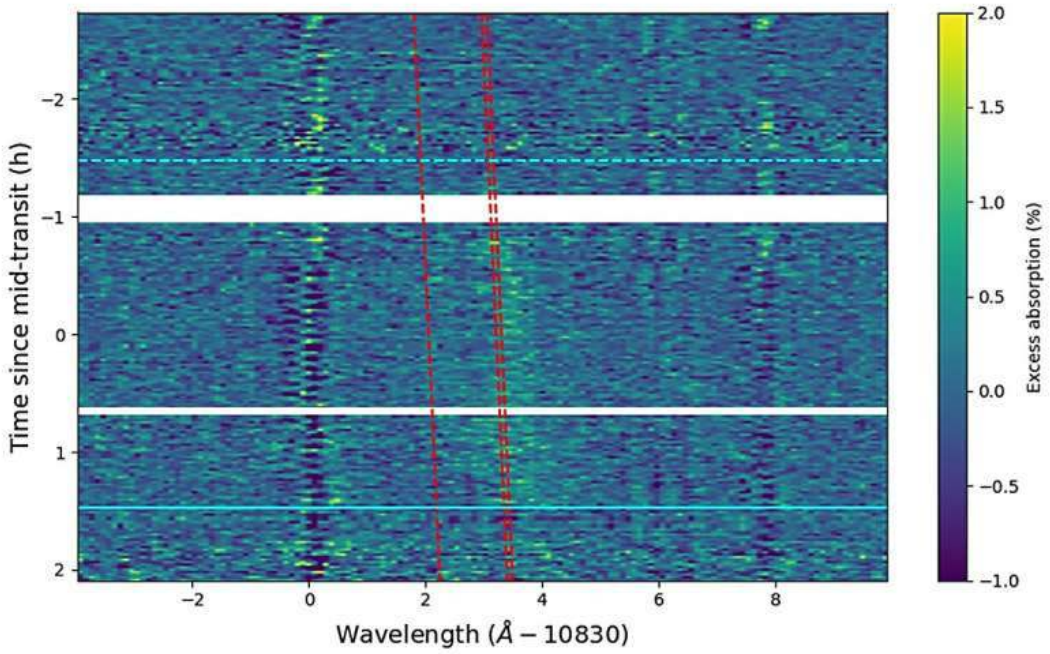
NASA's James Webb Space Telescope has followed up on observations by the Hubble Space Telescope of the farthest star ever detected in the very distant universe, within the first billion years after the big bang. Webb's NIRCam (Near-Infrared Camera) instrument reveals the star to be a massive B-type star more than twice as hot as our Sun, and about a million times more luminous. The star, which the research team has dubbed Earendel, is located in the Sunrise Arc galaxy and is detectable only due to the combined power of human technology and nature via an effect called gravitational lensing. Both Hubble and Webb were able to detect Earendel due to its lucky alignment behind a wrinkle in space-time created by the massive galaxy cluster WHL0137-08. The galaxy cluster, located between us and Earendel, is so massive that it warps the fabric of space itself, which produces a magnifying effect, allowing astronomers to look through the cluster like a magnifying glass.



Webb's NIRCam (Near-Infrared Camera) instrument reveals the star, nicknamed Earendel, to be a massive B-type star more than twice as hot as our Sun, and about a million times more luminous. Credits: Image: NASA, ESA, CSA, D. Coe (STScI/AURA for ESA; Johns Hopkins University), B. Welch (NASA's Goddard Space Flight Center; University of Maryland, College Park). Image processing: Z. Levay.https://www.nasa.gov/feature/goddard/2023/webb-reveals-colors-of-earendel-most-distant-star-ever-detected

https://www.sciencealert.com/its-official-this-red-blob-is-one-of-the-earliest-galaxies-ever-seen

Helium escapes from the atmosphere of a nearby exoplanet, observations find



Percent excess absorption from TOI-2134 b as a function of time and wavelength (stellar rest frame). Credit: Zhang et al., 2023.

Astronomers from the University of Chicago and elsewhere report the detection of an outflowing helium from the atmosphere of a nearby mini-Neptune exoplanet known as TOI-2134 b. The finding was detailed in a research paper published August 3 on the pre-print server *arXiv*. Atmospheric escape is a process during which atmospheric gas leaves the planet's gravitational source and disperses into space. This process fundamentally shapes the properties of exoplanets.

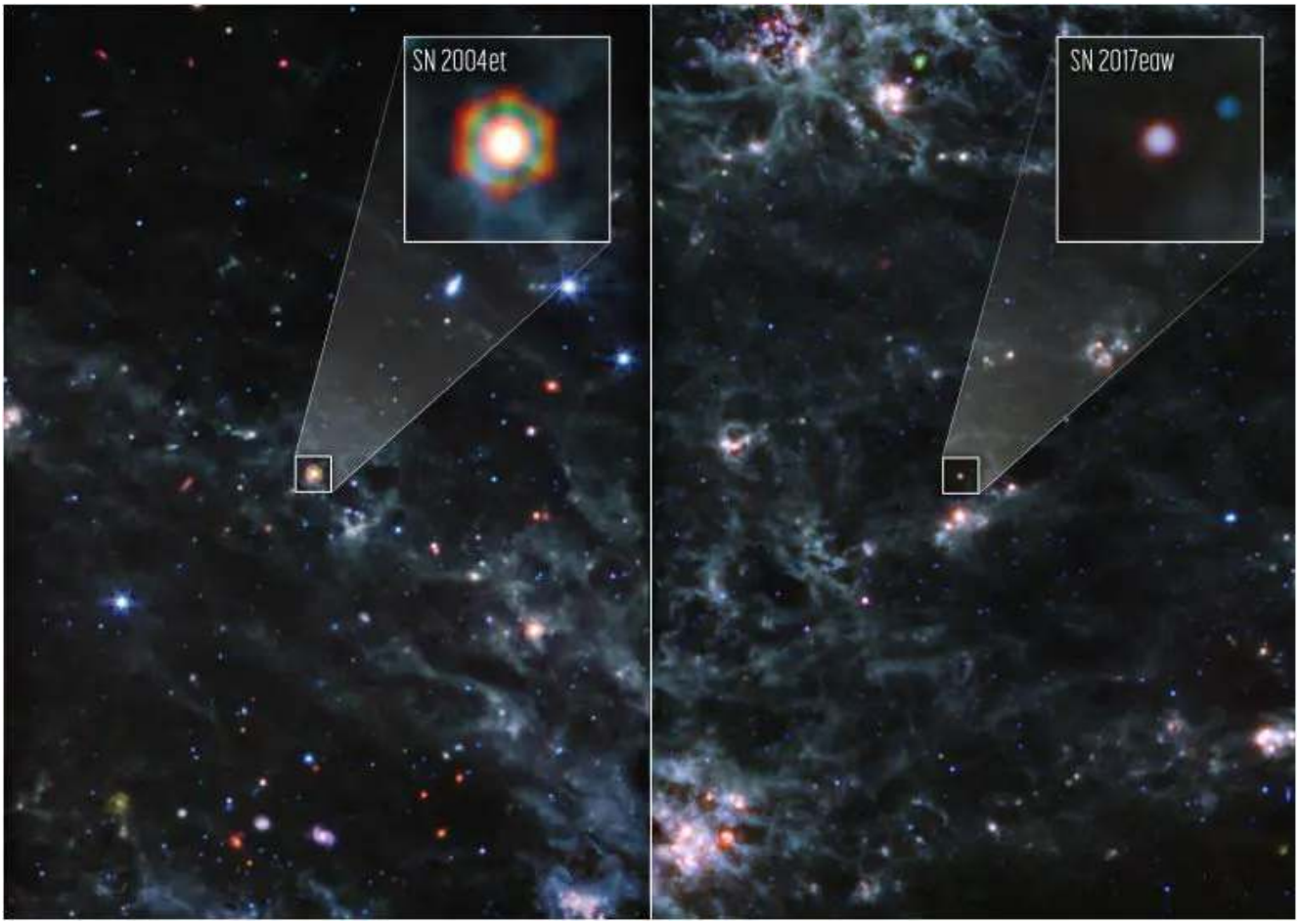
https://phys.org/news/2023-08-helium-atmosphere-nearby-exoplanet.html

"Dirty" Surprise: Webb Space Telescope Locates Dust Reservoirs in Two Supernovae

Researchers using NASA's James Webb Space Telescope have made major strides in confirming the source of dust in early galaxies. Observations of two Type II supernovae, Supernova 2004et (SN 2004et) and Supernova 2017eaw (SN 2017eaw), have revealed large amounts of dust within the ejecta of each of these objects. The mass found by researchers supports the theory that supernovae played a key role in supplying dust to the early universe.

"Direct evidence of this phenomenon has been slim up to this point, with our capabilities only allowing us to study the dust population in one relatively nearby supernova to date – Supernova 1987A, 170,000 light-years away from Earth," said lead author Melissa Shahbandeh of Johns Hopkins University and the Space Telescope Science Institute in Baltimore, Maryland. "When the gas cools enough to form dust, that dust is only detectable at mid-infrared wavelengths provided you have enough sensitivity."

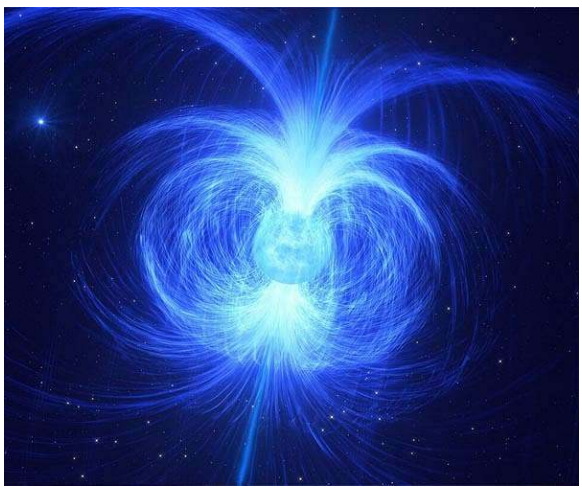
For supernovae more distant than SN 1987A like SN 2004et and SN 2017eaw, both in NGC 6946 (see image above) about 22 million light-years away, that combination of wavelength coverage and exquisite sensitivity can only be obtained with Webb's MIRI (Mid-Infrared Instrument).



Images from NASA's James Webb Space Telescope's MIRI (Mid-Infrared Instrument) reveal large amounts of dust within two Type II supernovae, Supernova 2004et (SN2004 et) and Supernova 2017eaw (SN 2017eaw), located 22 million light-years away from Earth in spiral galaxy NGC 6946. The large amounts of dust found around these supernovae support the theory that supernovae played a key role in supplying dust to the early universe. SN 2004et is highlighted in the left panel of this image, and SN 2017eaw in the right panel. Webb's exquisite sensitivity and capability to observe in the mid-infrared allow it to detect the cooler dust that survived the internal shocks reverberating in the aftermath of the dying stars' explosions. In these images, the bluer colors indicate hotter dust, while red is cooler dust.

Credit: NASA, ESA, CSA, Ori Fox (STScI), Melissa Shahbandeh (STScI), Alyssa Pagan (STScI)

https://scitechdaily.com/dirty-surprise-webb-space-telescope-locates-dust-reservoirs-in-two-supernovae/?expand_article=1



New type of star gives clues to mysterious origin of magnetars

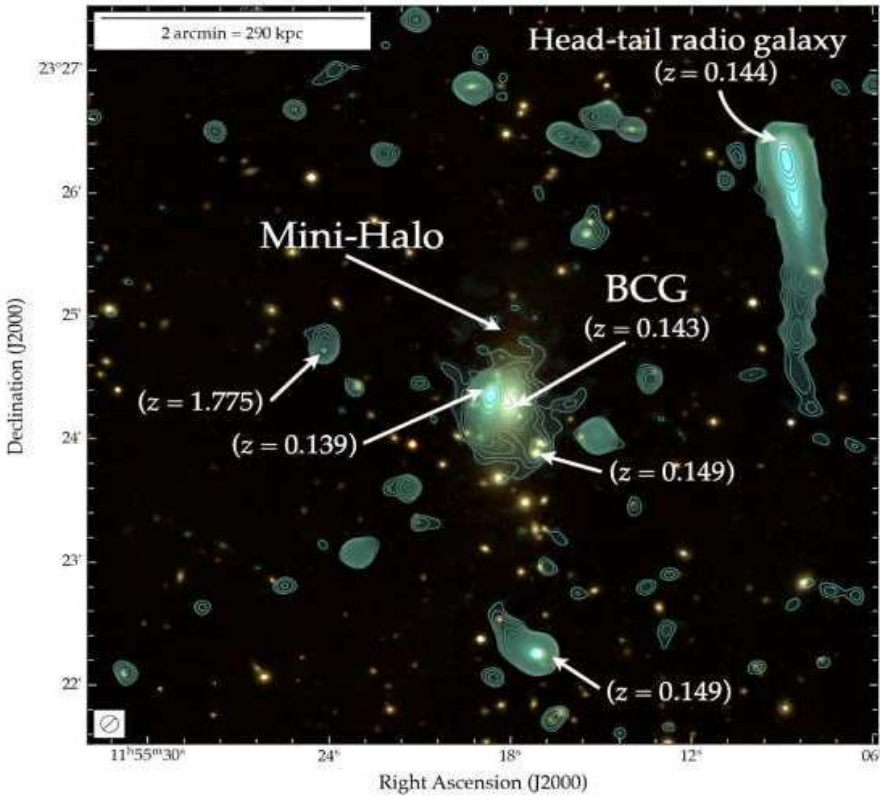
Artist's impression of HD 45166, the star that might become a magnetar

Magnetars are the strongest magnets in the Universe. These super-dense dead stars with ultra-strong magnetic fields can be found all over our galaxy but astronomers don't know exactly how they form. Now, using multiple telescopes around the world, including European Southern Observatory (ESO) facilities, researchers have uncovered a living star that is likely to become a magnetar. This finding marks the

discovery of a new type of astronomical object - massive magnetic helium stars - and sheds light on the origin of magnetars. Despite having been observed for over 100 years, the enigmatic nature of the star HD 45166 could not be easily explained by conventional models, and little was known about it beyond the fact that it is one of a pair of stars, is rich in helium and is a few times more massive than our Sun.This observation marks the discovery of the very first massive magnetic helium star.

https://www.spacedaily.com/reports/New_type_of_star_gives_clues_to_mysterious_origin_of_magnetars_999.html

Radio observations inspect galaxy cluster Abell 1413



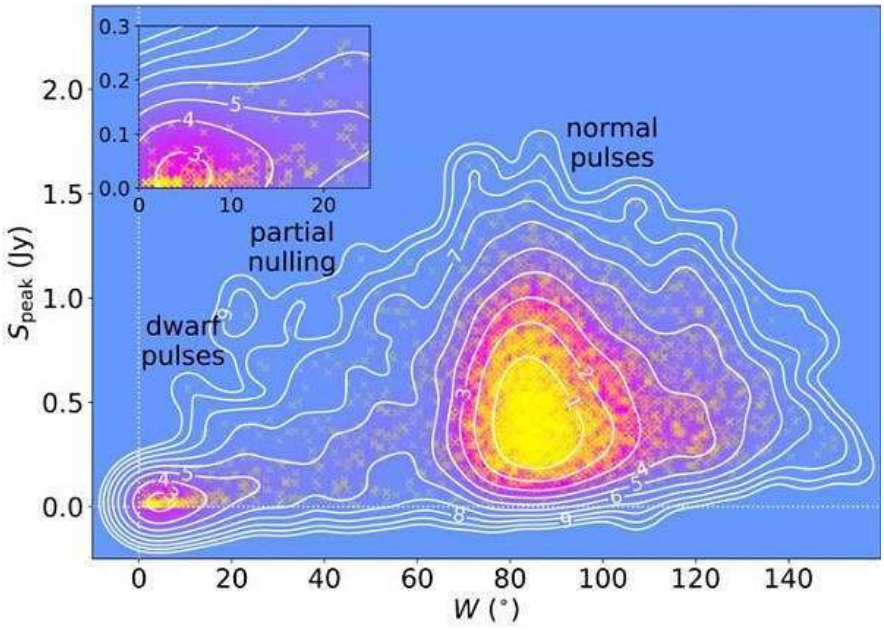
Color-composite image of Abell 1413. Credit: Riseley et al., 2023.

Using the LOw-Frequency ARray (LOFAR) and MeerKAT telescope, European astronomers have performed radio observations of a galaxy cluster known as Abell 1413. Results of the observational campaign, published August 1 in the *Monthly Notices of the Royal Astronomical Society* journal, shed more light on the properties of this cluster.

Galaxy clusters contain up to thousands of galaxies bound together by gravity. They are the largest known gravitationally bound structures in the universe, could serve as excellent laboratories for studying galaxy evolution and cosmology. Located some 2.1 billion light years away, Abell 1413 is a type I galaxy cluster containing about 300 galaxies and hosting a mini-halo. The cluster showcases a slightly disturbed X-ray morphology, elongated in the north-south direction, however, no strong evidence of a recent merger has been found to date. The mass of Abell 1413 is estimated to be approximately 600 trillion solar masses. A team of astronomers led by Christopher Riseley of the University of Bologna in Italy, decided to take a closer look at Abell 1413 in order to get more insights into its peculiar morphology and general properties. For this purpose they conducted deep MeerKAT observations covering the frequency range 872−1,712 MHz, and LOFAR high-band antenna (HBA) observations covering the frequency range 120−168 MHz.

https://phys.org/news/2023-08-radio-galaxy-cluster-abell.html

Scientists use FAST to discover a new population of 'dwarf' pulses



Dwarf pulses from pulsar B2111+46 exhibit distinct differences in pulse width and radiation energy compared to normal pulses, suggesting a new emission state different from ordinary pulsar radiation.

Using the Five-hundred-meter Aperture Spherical radio Telescope (FAST), a research team led by Prof. HAN Jinlin from the National Astronomical Observatories of the Chinese Academy of Sciences (NAOC) has detected distinct "dwarf pulses" from a bright pulsar PSR B2111+46, and studied the radio emission in unprecedented details and probed the unknown physics in the magnetosphere.

https://www.spacedaily.com/reports/Scientists_use_FAST_to_discover_a_new_population_of_dwarf_pulses_999.html

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