"The Southern Cross"

The Hermanus Astronomy Centre Newsletter

OCTOBER 2023

Please note that, with effect from **October 2023**, all our meetings are scheduled for **TUESDAYS**, commencing at **18.00 (6 pm)**. 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.

MONTHLY MEETINGS

Monthly meetings are now held on the **Third Tuesday** of each month.

Our last meeting was held on **September 18th**.

Dr Chris Engelbrecht presented ***"Asteroseismology, Listening to the Heartbeat of the Stars".***

Chris Engelbrecht spoke 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.

(Please note: this YouTube link is not currently available but will be distributed as soon as it becomes so)

The next Monthly Meeting is scheduled for **Tuesday October 17th** and will be hybrid (physical and virtual), taking place at **Onrus Manor** clubhouse as well as on Zoom. Your physical attendance, requested by many members, will enable you to meet the presenter and to socialize with other centre members. We shall be commencing sharply at **18.00** (**6 pm**) in order to terminate by 19.00 at the latest.

Please consider arriving early, say from 17.30, as refreshments are available before the meeting but not after.

Dr Amoré Nel, of SANSA Hermanus, will speak on ***"A History of Geomagnetic Jerks"*** (we are assured this does not refer to the scientists who work in the field!)

Geomagnetic jerks are sudden changes in Earth's magnetic field. The underlying mechanism of these jerks has remained a mystery and has been a major obstacle in predicting the behaviour of Earth's field which protects us from harmful radiation. In this talk the history of geomagnetic jerks will be discussed, their morphology and characteristics, as well as the latest theories on how the geomagnetic jerks are formed.

SPECIAL INTEREST GROUP ACTIVITIES

Cosmology

With effect from **October 2023**, our meetings change to the **First Tuesday** of each month but with no meeting in January.

The September Cosmology meeting was held on Monday 4th. We are currently watching videos titled "THE ENTIRE HISTORY OF THE UNIVERSE", a 17 part series. Episode 12 – ***"Was Our Current Universe already Inevitable at One Second Old?"***

https://www.youtube.com/watch?v=9BEytifFFpc&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=12

The discussion: https://www.dropbox.com/scl/fi/0om6jmt8crz9eh0o4wojs/2023-09-04-HAC-Cosmology-The-History-of-the-Universe-Ep-Discussion.m4a?rlkey=yuwuv3q8ir6j2l54vrjn6t1uu&dl=0

Our October meeting, scheduled for **Tuesday 3rd**, is episode 13 – ***"How Many Universes Are There?"***

"We are probably nearing the limit of all we can know about Astronomy" – Simon Newcombe (1888). It's always a bad idea to bet against discoveries. The confines of our geographical knowledge of the past clouded the lands and seas around us, limiting our world to the Tigris and Euphrates rivers. Pioneering mariners and commercial travellers, pushing the limits aside, were to reveal the extent of the Mediterranean sea, Africa, the eastern lands and beyond.

Join us as we journey away from the flat earth, the very centre of the universe, to distant galaxies and the edge of space and time to reveal yet more uncharted territories and dimensions.

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

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Astrophotography

This SIG is scheduled for the **Second Tuesday** of each month from **October 2023** but only takes place 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 our e-mail notices and invites.

Study Group

Scheduled for the **Last Tuesday** of each month from **October 2023**.

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

https://www.youtube.com/watch?v=_JlnMs616Z0

The discussion: https://youtu.be/S62a8RNG_-Y

"The Internal Ramp Theory for the Great Pyramid of Egypt is one of the most interesting ideas ever proposed for its construction. French architect Jean-Pierre Houdin has spent more than 20 years developing and refining this idea. In October of 2022, Houdin published an update to his theory which reflects the ScanPyramids findings from the past six years. The ScanPyramids 'Big Void' is an intriguing clue that Houdin may be correct with his notion of the Grand Gallery being used as a counterweight ramp for the largest pyramid stones. The 'Big Void' may be another Grand Gallery-like space which could be used for the same purpose. Institutional Egyptology remains unreceptive to Houdin's publications, nor the extremely confident results from the ScanPyramids mission. This video takes a closer look at those conflicts, highlights some of Houdin's new model, and proposes some areas that could use improvement."

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

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

Stargazing and Moonwatch

No events are currently planned. These events are weather dependent and will be advised in the website calendar on https://hermanusastronomy.co.za/ and confirmed at short notice such as 2 or 3 days ahead.

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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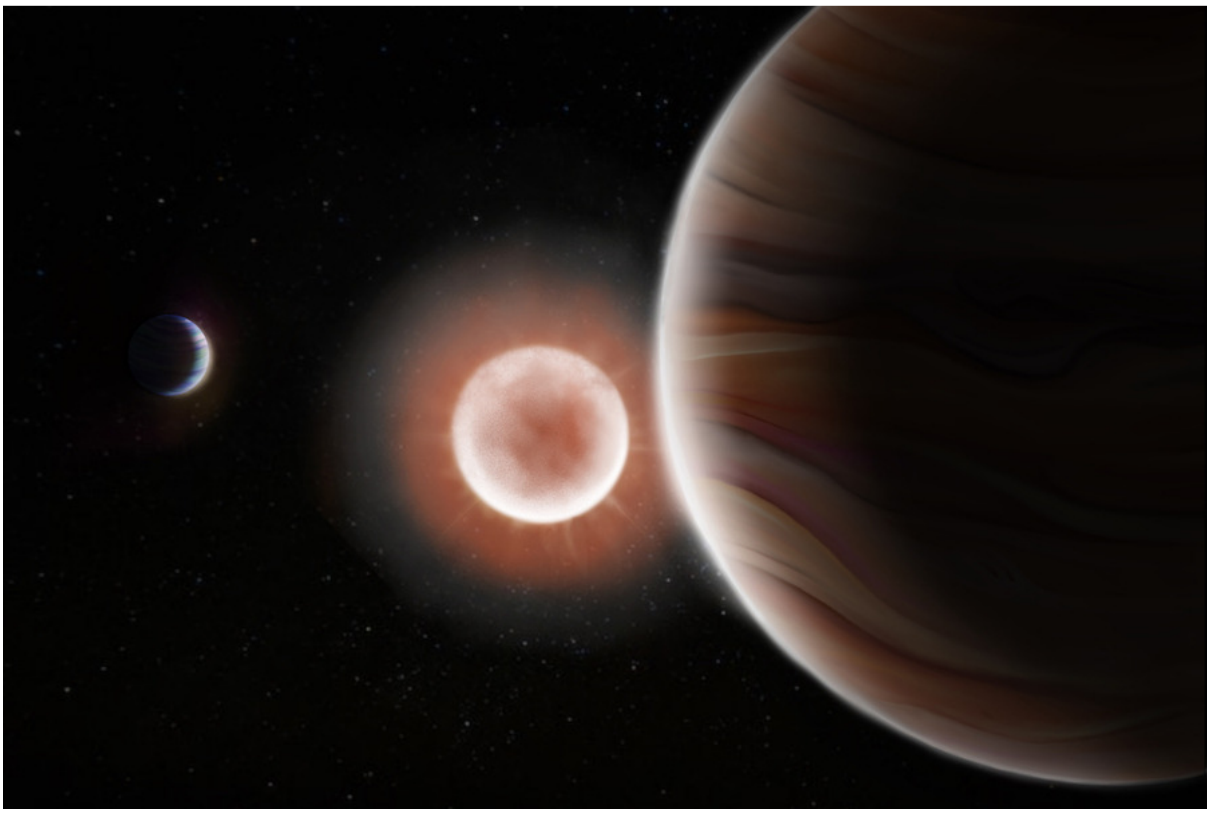
ASTRONOMY NEWS for OCTOBER 2023

(compiled by Pieter Kotzé)

Newly discovered planet has longest orbit yet detected by the TESS mission

The frosty gas giant was discovered in a system that also hosts a warm Jupiter.

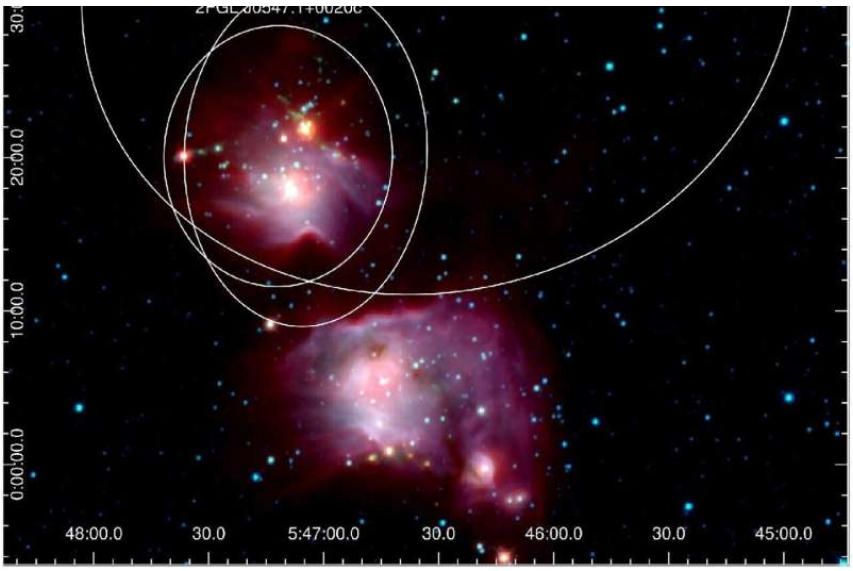


Of the more than 5,000 planets known to exist beyond our solar system, most orbit their stars at surprisingly close range. More than 80 percent of confirmed exoplanets have orbits shorter than 50 days, placing these toasty worlds at least twice as close to their star as Mercury is to our sun — and some, even closer than that. Astronomers are starting to get a general picture of these planets' formation, evolution, and composition. But the picture is much fuzzier for planets with longer orbital periods. Far-out worlds, with months- to years-long orbits, are more difficult to detect, and their properties have therefore been trickier to discern. Now, the list of long-period planets has gained two entries. Astronomers at MIT, the University of New Mexico, and elsewhere have discovered a rare system containing two long-period planets orbiting TOI-4600, a nearby star that is 815 light years from Earth. The team discovered that the star hosts an inner planet with an orbit of 82 days, similar to that of Mercury, while a second outer planet circles every 482 days, placing it somewhere between the orbits of Earth and Mars.

https://news.mit.edu/2023/newly-discovered-planet-has-longest-orbit-yet-detected-tess-mission-0830

First observational evidence of gamma-ray emission in young sun-like stars

A team of scientists from Argentina and Spain have reported the first observational evidence that a type of young low-mass star, known as "T Tauri stars," are capable of emitting gamma radiation. The study is published in *Monthly Notices of the Royal Astronomical Society*. Very energetic radiation from the sky cannot be easily observed from Earth. The high sensitivity of the Fermi satellite helps to solve this issue by observing the universe in gamma-rays, the most energetic region of the electromagnetic spectrum.



NGC 2071 (the nebula close to the centre of the image) obtained with the Wide-field Infrared Survey Explorer (WISE) using the 22 μ m (red), 4.6 μm (green), and 3.4 μm (blue) bands. In white, we show the 3σ significance Fermi error ellipses that positionally coincide with NGC 2071. 1FGL, 2FGL, and 3FGL are the first, second, and third Fermi catalog, respectively.

Credit: *Monthly Notices of the Royal Astronomical Society* (2023). DOI: 10.1093/mnras/stad2029

https://phys.org/news/2023-08-evidence-gamma-ray-emission-young-sun-like.html

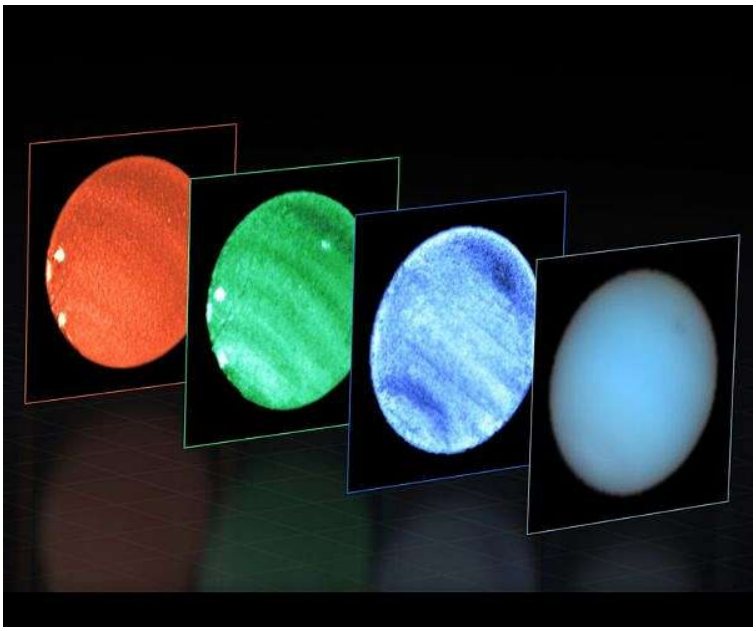
Thermometer molecule confirmed on exoplanet WASP-31b

Chromium hydride (CrH), a molecule that's relatively rare and particularly sensitive to temperature, is useful as a "thermometer for stars," according to astronomer Laura Flagg, because it's abundant only in a narrow range between 1,200-2,000 degrees Kelvin. Chromium hydride has no previous confirmed detections in any exoplanet, and this marks the first detection of a metal hydride from a high-resolution exoplanet spectrum, the researchers wrote.

The definitive detection of metal hydrides in WASP-31b is an important advancement in the understanding of hot giant planet atmospheres, Flagg said, although the discovery doesn't give new information about the individual planet. Discovered in 2011, WASP-31b orbits an F5 star once every 3.4 days. It has an extremely low density, even for a giant planet, and the new study confirms its equilibrium temperature at 1,400 Kelvin - in range for chromium hydride.

https://www.spacedaily.com/reports/Thermometer_molecule_confirmed_on_exoplanet_WASP_31b_999.html

Mysterious Neptune dark spot detected from Earth for the first time



This image shows Neptune observed with the MUSE instrument at ESO's Very Large Telescope (VLT). At each pixel within Neptune, MUSE splits the incoming light into its constituent colours or wavelengths. This is similar to obtaining images at thousands of different wavelengths all at once, which provides a wealth of valuable information to astronomers.

Using ESO's Very Large Telescope (VLT), astronomers have observed a large dark spot in Neptune's atmosphere, with an unexpected smaller bright spot adjacent to it. This is the first time a dark spot on the planet has ever been observed with a telescope on Earth. These occasional features in the blue background of Neptune's atmosphere are a mystery to astronomers, and the new results provide further clues as to their nature and origin. Large spots are common features in the atmospheres of giant planets, the most famous being Jupiter's Great Red Spot.

On Neptune, a dark spot was first discovered by NASA's Voyager 2 in 1989, before disappearing a few years later. "Since the first discovery of a dark spot, I've always wondered what these short-lived and elusive dark features are," says Patrick Irwin, Professor at the University of Oxford in the UK and lead investigator of the study published in Nature Astronomy.

https://www.spacedaily.com/reports/Mysterious_Neptune_dark_spot_detected_from_Earth_for_the_first_time_999.html

Hot Jupiter blows its top

The planet HAT-P-32b is losing so much of its atmospheric helium that the trailing gas tails are among the largest structures yet known any planet outside our solar system. Simulation 'slice' through the orbital plane approximating the HAT-P-32

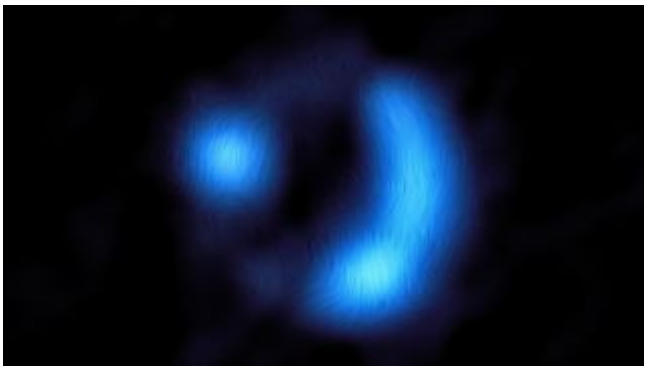
A planet about 950 light years from Earth could be the Looney Tunes' Yosemite Sam equivalent of planets, blowing its atmospheric 'top' in spectacular fashion.

The planet called HAT-P-32b is losing so much of its atmospheric helium that the trailing gas tails are among the largest structures yet known of an exoplanet, a planet outside our solar system, according to observations by astronomers. "We have monitored this planet and the host star with long time series spectroscopy, observations made of the star and planet over a couple of nights. And what we found is there's a gigantic helium gas tail that is associated with the planet. The tail is large - about 53 times the planet's radius - formed by gas that's escaping from the planet," said Zhoujian Zhang, a postdoctoral fellow in the Department of Astronomy and Astrophysics, University of California Santa Cruz.

https://www.spacedaily.com/reports/Hot_Jupiter_blows_its_top_999.html

Earliest magnetic galaxy ever detected offers clues about Milky Way history

The discovery of a magnetic field in a galaxy that existed less than 2.5 billion years after the Big Bang is evidence for the integral role such fields play in the evolution of galaxies.



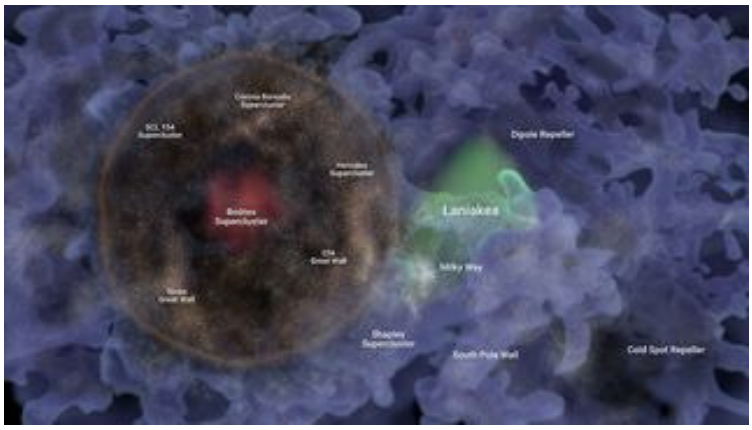
A false-color representation of the galaxy 9io9 as seen by ALMA. The contours represent the polarization of the light from the dust grains aligned with the galaxy's magnetic field.(Image credit: ALMA (ESO/NAOJ/NRAO)/J. Geach et al.)

A magnetic field 16,000 light years across has been detected in an ancient galaxy from which light is being magnified by a gravitational lens. Because it sits so utterly far away from us, we're seeing this galaxy as it was when it existed over 11 billion years ago. While all galaxies contain a giant magnetic field, astronomers have never detected galactic magnetism this early in the universe before.

The discovery was made with the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile, by a team of multinational team of astronomers led by astrophysicist Jim Geach of the University of Hertfordshire in the UK.

https://www.space.com/ancient-galaxy-magnetic-fields-earliest-detected

Bubble of galaxies spanning 1 billion light-years could be a fossil of the Big Bang



An illustration of the billion light year wide bubble of galaxies named Ho'oleilana. (Image credit: Frédéric Durillon, Animea Studio; Daniel Pomarède, IRFU, CEA University Paris-Saclay.)

Astronomers have discovered an immense bubble of galaxies that could be a fossilized remnant leftover from the Big Bang. The cosmic bubble is located around 820 million light-years from Earth and is a staggering one billion light-years wide. It sits within a web of galaxies and has been given the name "Ho'oleilana," which is a term from the Hawaiian creation chant Kumulipo. Ho'oleilanadescribes the origin of structure and relates to the stars and the moon. Massive structures such as Ho'oleilana are predicted to arise in the universe as a result of tiny ripples in the hot, dense and mostly uniform sea of matter which existed at the beginning of time. These density ripples, called Baryon Acoustic Oscillations (BAOs), grew as the universe underwent a period of rapid inflation (we call that the Big Bang). The ripples are also known to have given rise to major cosmic structures while influencing the distribution of galaxies.

https://www.space.com/billion-light-year-wide-galaxy-bubble-big-bang

Brightest supernova of past 420 years revealed in stunning new James Webb telescope images

This supernova signalled the explosive death of a supergiant star in the nearby Large Magellanic Cloud.

The JWST's NIRCam image of the expanding remnant of supernova 1987A.(Image credit: NASA, ESA, CSA, Mikako Matsuura (Cardiff University), Richard Arendt (NASA-GSFC, UMBC), Claes Fransson (Stockholm University), Josefin Larsson (KTH))

The remains of a star that exploded 36 years ago have fallen under the gaze of the James Webb Space Telescope (JWST) — and this observatory's Near Infrared Camera (NIRCam) captured the expanding stellar debris in unprecedented resolution, revealing brand new details about this burgeoning supernova remnant. The closest observed supernova since Kepler's Supernova lit up the Milky Way in 1604, this star explosion was first identified in 1987 and is aptly known as Supernova 1987A. It sits about 168,000 light-years away from Earth in the Large Magellanic Cloud and represents the destruction of a blue supergiant star called Sanduleak–69 202. Before it exploded, that star was thought to hold a mass about 20 times that of the sun.

https://www.livescience.com/space/astronomy/brightest-supernova-of-past-420-years-revealed-in-stunning-new-james-webb-telescope-images

Furthest ever detection of a galaxy's magnetic field

File image of the ALMA array.

Using the Atacama Large Millimeter/submillimeter Array (ALMA), astronomers have detected the magnetic field of a galaxy so far away that its light has taken more than 11 billion years to reach us: we see it as it was when the Universe was just 2.5 billion years old. The result provides astronomers with vital clues about how the magnetic fields of galaxies like our own Milky Way came to be.

Lots of astronomical bodies in the Universe have magnetic fields, whether it be planets, stars or galaxies. "Many people might not be aware that our entire galaxy and other galaxies are laced with magnetic fields, spanning tens of thousands of light-years," says James Geach, a professor of astrophysics at the University of Hertfordshire, UK, and lead author of the study published in Nature. "We actually know very little about how these fields form, despite their being quite fundamental to how galaxies evolve," adds Enrique Lopez Rodriguez, a researcher at Stanford University, USA, who also participated in the study. It is not clear how early in the lifetime of the Universe, and how quickly, magnetic fields in galaxies form because so far astronomers have only mapped magnetic fields in galaxies close to us. Now, using ALMA, in which the European Southern Observatory (ESO) is a partner, Geach and his team have discovered a fully formed magnetic field in a distant galaxy, similar in structure to what is observed in nearby galaxies. The field is about 1000 times weaker than the Earth's magnetic field, but extends over more than 16 000 light-years.

https://www.spacedaily.com/reports/Furthest_ever_detection_of_a_galaxys_magnetic_field_999.html

Scientists Discover Amino Acid Essential for Life in Interstellar Space

Researchers discovered evidence of the amino acid tryptophan in the interstellar material of the IC348 star system using data from the Spitzer Space Observatory. This finding suggests that protein-building amino acids are prevalent in areas where stars and planets develop, hinting at the potential for life in exoplanetary systems. Dr. Susana Iglesias-Groth from The Instituto de Astrofísica de Canarias (IAC) has used Spitzer space observatory data to uncover signs of the amino acid tryptophan in the interstellar material in a nearby star-forming region. The research was recently published in the journal *Monthly Notices of the Royal Astronomical Society*. High amounts of tryptophan were detected in the Perseus Molecular Complex, specifically in the IC348 star system, a star-forming region that lies 1000 light years away from Earth — relatively close in astronomical terms. The region is generally invisible to the naked eye, but shines brightly when viewed in infrared wavelengths. The study suggests that the emission lines associated with tryptophan may also be present in other star-forming regions and that their presence is common in the gas and dust from which stars and planets form.

https://scitechdaily.com/scientists-discover-amino-acid-essential-for-life-in-interstellar-space/

400 Quadrillion Times Brighter Than the Sun – Scientists Detect Most Energetic Ultraviolet/Optical Flare Ever

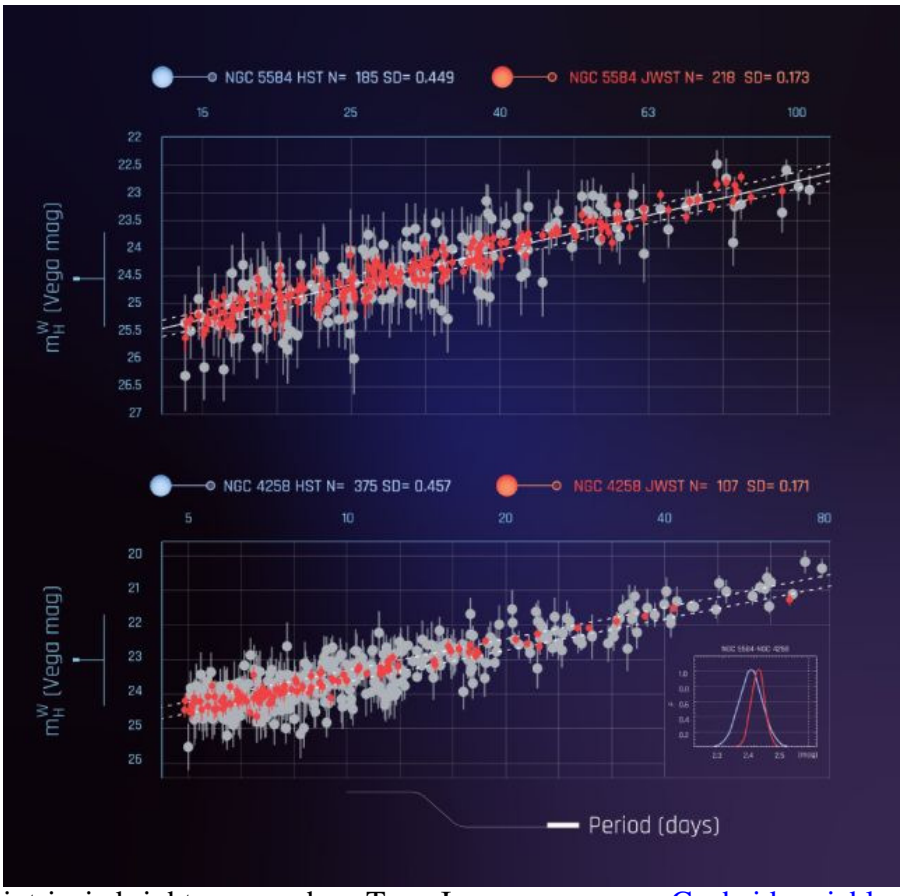
Gamma-ray bursts (GRBs) are the most violent explosions in the universe. Their prompt radiation is mainly in the soft gamma-ray band and lasts briefly (i.e., from milliseconds to at most hours). The prompt emission is then followed by the X-ray, optical, and radio afterglow emission, which lasts for weeks or even years.

Scientists from Purple Mountain Observatory (PMO) of the Chinese Academy of Sciences and the Italian National Institute for Astrophysics have introduced a new method to measure moderately saturated sources of the Ultra-Violet Optical Telescope onboard the Swift satellite (Swift/UVOT). Additionally, they have identified GRB 220101A as the most energetic ultraviolet/optical flare ever detected. The luminosity of GRB 220101A is approximately 400 quadrillion times that of the Sun, which breaks the 14-year record held by GRB 080319B. It also suggests a new astrophysical process, demonstrating the diversity of physical origins of super-bright optical-ultraviolet bursts.

(Artist's concept of a gamma-ray burst.)

https://scitechdaily.com/400-quadrillion-times-brighter-than-the-sun-scientists-detect-most-energetic-ultraviolet-optical-flare-ever/

JWST Just Measured The Expansion Rate of The Universe. Astronomers Are Stumped.



Cepheid variable distance measurements taken with Hubble (gray) and JWST (red). (NASA, ESA, CSA, J. Kang/STScI; Science: A. Riess/STScI)

The James Webb Space Telescope has measured the expansion rate of the Universe, and the results are not great news for the biggest crisis in cosmology. The finding is in agreement with measurements made by the Hubble Space Telescope. This means that there's no error in the Hubble data, and we're still at an impasse. A disagreement between different measurement methods known as the Hubble tension remains intact – so we're going to have to rely on some other way of figuring out how fast our Universe is expanding.

Another way is by measuring the distances to objects with known intrinsic brightness, such as Type Ia supernovae, or Cepheid variable stars, the light of which fluctuates with a regularity that is linked to their intrinsic brightness.

https://www.sciencealert.com/jwst-just-measured-the-expansion-rate-of-the-universe-astronomers

Heart of the 'Squid Galaxy' reveals how supermassive black holes dictate galactic chemistry

An illustration shows the distribution of chemicals around a black hole with hydrogen cyanide isotopes (yellow) restricted to the central region, cyanide radicals (red) at the center and extending out in jets, and carbon monoxide isotopes)blue) steering clear of the central region.(Image credit: ALMA (ESO/NAOJ/NRAO), NASA/ESA Hubble Space Telescope, T. Nakajima et al.)

New research has revealed how supermassive black holes that lurk at the hearts of large galaxies influence the distribution of chemicals throughout their entire galactic homes.

Scientists have long understood that supermassive black holes have a massive influence on the galaxies around them. In particular, as these black holes feed from matter surrounding them, they form electromagnetic radiation emissions that are bright enough to outshine the combined light of every star in their home galaxy. This active feeding process also causes jets of matter to blast outwards from the black hole at near the speed of light.

https://www.space.com/squid-galaxy-supermassive-black-hole-galactic-chemistry

Exoplanet with a large iron core adds to puzzle of how planets form

Researchers at the University of Turin and at the Thuringer Landessternwarte have confirmed that the extrasolar planet GJ 367 b has an ultra-high density. The research team also found two more planets that orbit the same star.

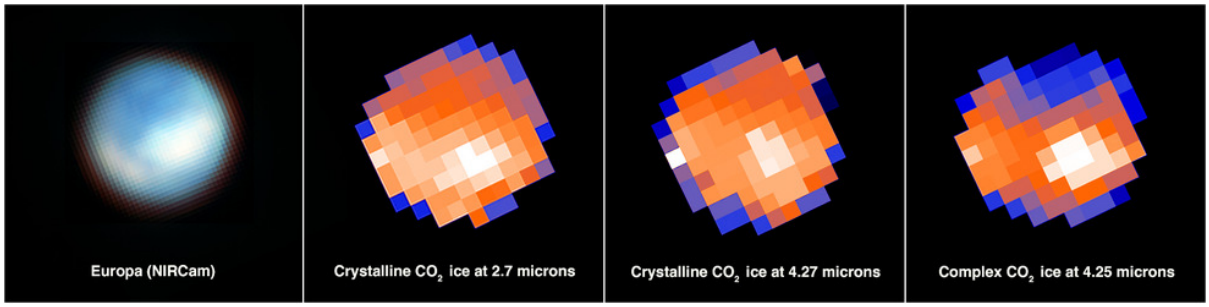
Elisa Goffo, Ph.D. student at the Physics Department of the University of Turin (Italy) and at the Thuringer Landessternwarte (Germany), together with an international research team, has made a unique discovery about the planet GJ 367 b that raises interesting questions about how planets are born. She is the lead author of the article Company for the ultra-high density, ultra-short period sub-Earth GJ 367 b: discovery of two additional low-mass planets at 11.5 and 34 days published in "The Astrophysical Journal Letters".

Elisa Goffo is part of the international KESPRINT collaboration, which confirmed that the ultra-short period exoplanet GJ 367 b, whose orbital period is only 7.7 hours, is also ultra-dense. The density of a planet can be determined from its mass and radius. GJ 367 b is ultra-dense because the researchers found its density to be 10.2 grams per cubic centimeter. That is almost twice the density of Earth, suggesting that this extrasolar planet consists almost entirely of iron.

https://www.spacedaily.com/reports/Exoplanet_with_a_large_iron_core_adds_to_puzzle_of_how_planets_form_999.html

NASA's Webb Finds Carbon Source on Surface of Jupiter's Moon Europa

Jupiter's moon Europa is one of a handful of worlds in our solar system that could potentially harbor conditions suitable for life. Previous research has shown that beneath its water-ice crust lies a salty ocean of liquid water with a rocky seafloor. However, planetary scientists had not confirmed if that ocean contained the chemicals needed for life, particularly carbon.Astronomers using data from NASA's James Webb Space Telescope have identified carbon dioxide in a specific region on the icy surface of Europa. Analysis indicates that this carbon likely originated in the subsurface ocean and was not delivered by meteorites or other external sources. Moreover, it was deposited on a geologically recent timescale. This discovery has important implications for the potential habitability of Europa's ocean.



This graphic shows a map of Europa's surface with NIRCam (Near Infrared Camera) on NASA's James Webb Space Telescope in the first panel and compositional maps derived from Webb's NIRSpec/IFU (Near Infrared Spectrograph's Integral Field Unit) data in the following three panels. In the compositional maps, the white pixels correspond to carbon dioxide in the large-scale region of disrupted chaos terrain known as Tara Regio (center and right), with additional concentrations within portions of the chaos region Powys Regio (left). The second and third panels show evidence of crystalline carbon dioxide, while the fourth panel indicates a complexed and amorphous form of carbon dioxide.

Credits: Science Credit: Geronimo Villanueva (NASA/GSFC), Samantha Trumbo (Cornell Univ.), NASA, ESA, CSA. Image Processing Credit: Geronimo Villanueva (NASA/GSFC), Alyssa Pagan (STScI)

"On Earth, life likes chemical diversity – the more diversity, the better. We're carbon-based life. Understanding the chemistry of Europa's ocean will help us determine whether it's hostile to life as we know it, or if it might be a good place for life," said Geronimo Villanueva of NASA's Goddard Space Flight Center in Greenbelt, Maryland, lead author of one of two independent papers describing the findings."We now think that we have observational evidence that the carbon we see on Europa's surface came from the ocean. That's not a trivial thing. Carbon is a biologically essential element," added Samantha Trumbo of Cornell University in Ithaca, New York, lead author of the second paper analyzing these data.NASA plans

to launch its Europa Clipper spacecraft, which will perform dozens of close flybys of Europa to further investigate whether it could have conditions suitable for life, in October 2024.Webb finds that on Europa's surface, carbon dioxide is most abundant in a region called Tara Regio – a geologically young area of generally resurfaced terrain known as "chaos terrain." The surface ice has been disrupted, and there likely has been an exchange of material between the subsurface ocean and the icy surface.

https://www.nasa.gov/feature/goddard/2023/nasa-s-webb-finds-carbon-source-on-surface-of-jupiter-s-moon-europa

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Johan Retief	(Membership)	028 315 1132