“The Southern Cross”

The Hermanus Astronomy Centre Newsletter

JUNE 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.

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 May 21st**. **Dr Amoré Nel** spoke to us in person at Onrus Manor her subject was *“Black Auroras”*, an enigmatic title to most. As it happened, this was very topical following the excitement of the previous week with exceptional solar flares driving the Aurora Australis, so visible from the southern Cape. These auroras, both Borealis and Australis, are the result of an optical manifestation of the Earth’s and Sun’s magnetic fields involving solar particles and the Earth’s atmosphere.

Worth a revisit, the YouTube link:

https://www.youtube.com/watch?v=oCjm94BEKNs&t=2605s&ab_channel=DerekDuckitt

In our next Monthly meeting, planned for **Tuesday 18th**, **Dr David Buckley** will be presenting, in person at **Onrus Manor**, *“Things that go Bump in the Night: Observing Transients”*.

Abstract:
Join us for a thrilling exploration of the ever-changing night sky with Dr David Buckley as he delves into the fascinating world of astronomical transients—those mysterious and fleeting objects that briefly light up the cosmos. Over the past decade, advancements in ground and space-based survey facilities have revolutionized our understanding of these dynamic celestial events.

Dr David Buckley is currently a research associate in the Astronomy Department at the University of Cape Town.

My research interests are focused on accreting compact binaries, involving white dwarfs, neutron stars or black holes, which mainly involve optical observations, particularly with SALT. Some of this research also involves multi-wavelength observations (gamma ray, Xray & radio) through wider collaborations. I am Principal Investigator for the SALT follow-up programme on transients and am also one of the South African PI Affiliates for the Rubin Observatory Legacy Survey of Space and Time (LSST), focusing on transient detection and follow-up.

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 May 7th**, in episode 19 of "THE ENTIRE HISTORY OF THE UNIVERSE", we watched: ***"What is Beyond the Edge?"***, The YouTube video link:

https://www.youtube.com/watch?v=_IkaetPoBZM&list=PLROBLlvnR7BEF9b1NOvRf_zhboibmywJb&index=19&t=102s&pp=iAQB

and the YouTube discussion link:

xxx

The next Cosmology meeting, scheduled for **Tuesday June 4th**, is episode 20 of "THE ENTIRE HISTORY OF THE UNIVERSE": ***"Why does the Universe Look Like this?"*.**

Duckitt: derek.duckitt@gmail.com.

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.

Study Group

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

In our **May 28th** meeting, we watched videos and discussed ***"How Stonehenge was Built"*** and ***"The Building of the Inca Stone Walls".***

The video links:

Stonehenge: https://youtu.be/vqM6NpTf3HM

Inca stone Walls: https://www.youtube.com/watch?v=_KbSFphHCZY

The discussion link:

https://www.dropbox.com/s/i3qz3ubmc9gh5hh/2024-05-07%20HAC%20Cosmology%20%3D%20History%20of%20the%20Universe%20Episode%2019%20-%20What%20Is%20Beyond%20The%20Edge_.m4a?dl=0

The next Study Group is scheduled to meet on **June 25th**, the topic 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 **JUNE 2024**:

SUGGESTED EVENING OBSERVATION WINDOW
(Lunar observations notwithstanding)

Date	*Moon*		*Dusk end*
1st June	*Rises*	**01h51 (28%)**	**19h10**
to **9th June**	*Sets*	**20h25 (10%)**	**19h09**

Moonwatch – a few days either side of the **First Quarter** (Wednesday June 14th)

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

Also thanks to Sandy Herman - https://www.swpc.noaa.gov/products/aurora-30-minute-forecast

Meteors - None are forecast for June 2024.

Meteor enthusiasts please see the 2024 Sky Guide p. 86.

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

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

Future Trips

Please see the Outreach section below.

Outreach and Maintenance

HERMANUS SCIENCE AND TECHNOLOGY CLUB: The following Excursions are *provisionally* planned:

Palmiet Hydro-electric Power Station – June 13th,

Caledon (Middelvlei) **Wind Turbine** facility - **July 10th, 17th or 24th,**

Iziko Planetarium as guests of the IAU GA on **10th August.**

HAC members are welcome to join these visits but please inform me on petermh@hermanus.co.za of your intentions. The above dates are provisional and confirmations will be advised as appropriate.

Pierre reports that maintenance plans for GPAED and the Solar System Model have been put on hold owing to 'Flu-induced non-action.

ASTRONOMY NEWS: MAY 2024

(Compiled By Pieter Kotzé)

Webb telescope details weather patterns on distant exoplanet

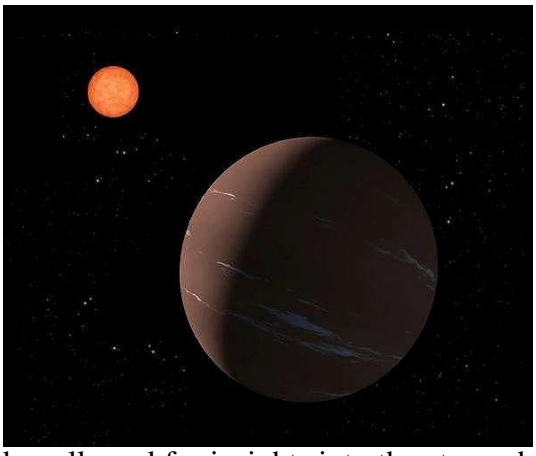


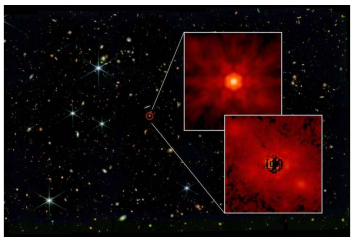
Illustration only

Using the Mid-Infrared Instrument (MIRI) aboard NASA's Webb Telescope, scientists have conducted a detailed examination of the weather on WASP-43 b, a hot gas-giant exoplanet 280 light-years from Earth. The planet, similar in size to Jupiter but in a much closer orbit to its star, has revealed a range of atmospheric phenomena including high-speed equatorial winds and stark temperature differences between its day and night sides. A collaborative international research team utilized the James Webb Space Telescope's capabilities to gather precise brightness measurements and apply advanced 3D climate modelling. This has allowed for insights into the atmospheric conditions of WASP-43 b, which orbits its host star at only 3.3 million kilometres away, experiencing temperatures and environmental dynamics vastly different from those in our solar system
.https://www.spacedaily.com/reports/Webb_telescope_details_weather_patterns_on_distant_exoplanet_999.html

Manganese discovery on Mars suggests ancient Earth-like conditions

Researchers using the ChemCam instrument on NASA's Curiosity rover have found significant amounts of manganese in the sedimentary rocks of Mars's Gale Crater. This discovery suggests that these minerals were deposited by ancient bodies of water such as rivers, deltas or lakes, according to findings published in the Journal of Geophysical Research: Planets. "It is difficult for manganese oxide to form on the surface of Mars, so we didn't expect to find it in such high concentrations in a shoreline deposit" said Patrick Gasda, of Los Alamos National Laboratory's Space Science and Applications group and lead author on the study. "On Earth, these types of deposits happen all the time because of the high oxygen in our atmosphere produced by photosynthetic life and from microbes that help catalyze those manganese oxidation reactions.
https://www.spacedaily.com/reports/Manganese_discovery_on_Mars_suggests_ancient_Earth_like_conditions_999.html

Astronomers observe elusive stellar light surrounding ancient quasars



A James Webb Telescope image shows the J0148 quasar circled in red. Two insets show, on top, the central black hole, and on bottom, the stellar emission from the host galaxy. Credit: Courtesy of Minghao Yue, Anna-Christina Eilers; NASA.

MIT astronomers have observed the elusive starlight surrounding some of the earliest quasars in the universe. The distant signals, which trace back more than 13 billion years to the universe's infancy, are revealing clues to how the very first black holes and galaxies evolved. Quasars are the blazing centres of active galaxies, which host an insatiable supermassive black hole at their core. Most galaxies host a central black hole that may occasionally feast on gas and stellar debris, generating a brief burst of light in the form of a glowing ring as material swirls in toward the black hole. Quasars, by contrast, can consume enormous amounts of matter over much longer stretches of time, generating an extremely bright and long-lasting ring—so bright, in fact, that quasars are among the most luminous objects in the universe.

https://phys.org/news/2024-05-astronomers-elusive-stellar-ancient-quasars.html

Enceladus Spills Its Guts through Strike-Slip Motion

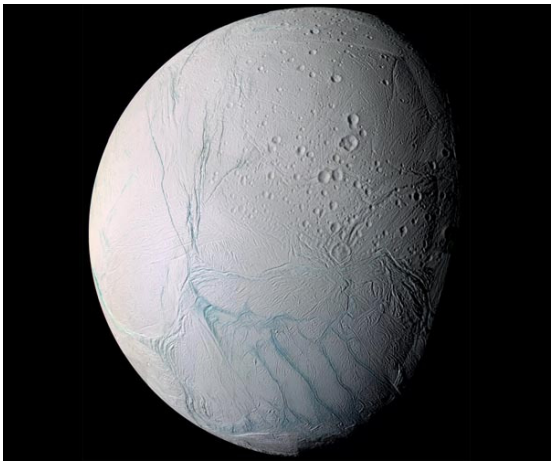


illustration only

Over the course of its elliptical orbit, the moon Enceladus is squeezed unevenly by Saturn's gravitational pull and deforms from a spherical shape into a football shape and back again. This cyclic stress causes a phenomenon called "tidal heating" within Enceladus and dissipates enough energy to maintain what is believed to be a global ocean underneath the moon's icy crust. At Enceladus's south pole, a large number of jets spray icy particles out from a set of jagged, 150-kilometre-long faults, known as the tiger-stripe faults, and this ejected material coalesces above the moon's surface to form a plume. Samples of this plume material analyzed by NASA's Cassini mission suggests that the chemical conditions believed to be necessary for life may exist in the ocean deep beneath Enceladus's surface. Now, new research led by graduate student Alexander Berne (MS '22), working with Mark Simons, the John W. and Herberta M. Miles Professor of Geophysics and director of the Brinson Exploration Hub at Caltech, uses a detailed geophysical model to characterize the motion of these tiger-stripe faults and provides new insights into the geophysical processes controlling jet activity. Understanding these and other factors-such as the extent to which the jet material represents the subsurface ocean, how long jets have been active, the topography of its ice shell, and so on, is crucial for getting a detailed picture of the moon's potential habitability over time.

https://www.spacedaily.com/reports/Enceladus_Spills_Its_Guts_through_Strike_Slip_Motion_999.html

Two Stars in a Binary System are Very Different. It's Because There Used to be Three

A beautiful nebula in the southern hemisphere with a binary star at its centre seems to break our standard models of stellar evolution. But new data from the European Southern Observatory (ESO) suggests that there may once have been three stars and that one was destroyed in a catastrophic collision.

About 3 800 light years away, in the Southern constellation of Norma, you can find an object called the Dragon's Egg Nebula (catalogue number NGC 6164). In the heart of this nebula lies a double star known as HD 148937. The pair are bright enough to be seen through binoculars and small telescopes but are far enough away that they only appear as a single star. Both of the stars that make up the pair are hot young blue giants, but the nebula surrounding them is quite unusual, which is why astronomers have been studying them for a long time.

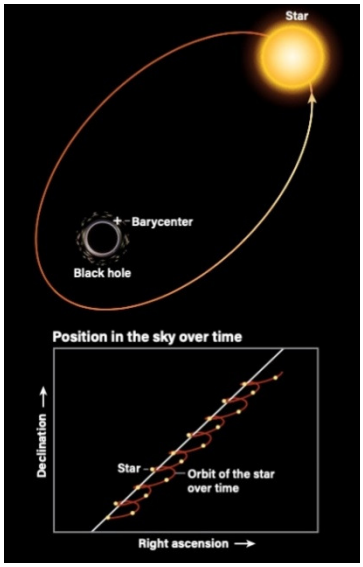
Fighting Dragons of Ara (NGC 6188 and 6164)
© Michael Sidonio

The stars themselves have their own mysteries. The larger of the two has a strong magnetic field. Magnetic fields in stars like our Sun are formed when the thick central shell of super-heated plasma circulates. Much of the heat from the Sun's core is transferred to the surface by convection: hot plasma near the core bubbles up towards the surface where it cools and then sinks back down. Plasma is electrically charged and all that charge moving generates a magnetic field in what scientists call a dynamo effect.

But truly massive stars, like those in HD 148937, are so big that heat can simply radiate out from the core. There is such a large distance from the core to the surface that the temperature gradient is very gradual. There is nowhere inside the star with a high enough temperature differential to start convection, so there is no flow of material to generate a magnetic field. Nevertheless, the star has a magnetic field, which leads to the next oddity: magnetic stars experience a braking effect, causing their spin to gradually slow. So, this star, with its strong magnetic field which it should not have, spins rapidly, which the magnetic field should have prevented.

https://www.universetoday.com/166737/two-stars-in-a-binary-system-are-very-different-its-because-there-used-to-be-three/

Astronomers uncover 'sleeping giant' black hole Gaia BH3, the largest ever found in the Milky Way



A star in a binary system with an invisible black hole exhibits an apparent wobble in space if observed long enough. Gaia measures this wobble by continuously scanning in two directions simultaneously, to measure each star's position with an accuracy of about 20 micro arcseconds. Credit: Astronomy: Roen Kell

The dormant black hole, which doesn't appear to be shredding its companion star to pieces, is 1,926 light-years from Earth. Pasquale Panuzzo of the French National Center for Scientific Research (CNRS) was among a team of astronomers routinely processing data from Gaia, the European star-mapping observatory, when a peculiar but recurrent wobble of an old, otherwise unremarkable giant star caught his eye.

It appeared a consistent gravitational tug from a hitherto unknown companion was disrupting the star's motion. Sure enough, follow-up observations from ground-based observatories confirmed the star was swaying thanks to a remarkably massive yet previously undetected black hole. Now known to weigh roughly 33 times our Sun, the cosmic behemoth is the heaviest stellar black hole yet found in the Milky Way.

https://www.astronomy.com/science/astronomers-uncover-sleeping-giant-black-hole-gaia-bh3-the-largest-ever-found-in-the-milky-way/

A new process for the synthesis of rare nuclei in the universe

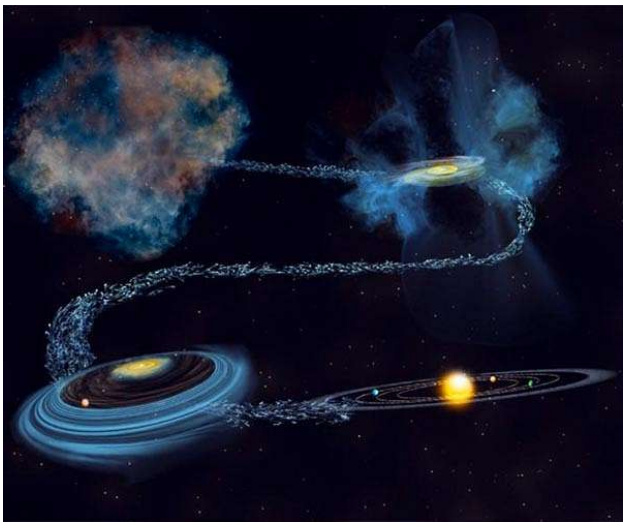


illustration only

A new nucleosynthesis process, called the r-Process, has been proposed by scientists from GSI and the Max Planck Institute for Astrophysics. This r-Process occurs when neutron-rich material is exposed to a high flux of neutrinos. The theoretical proposal, recently published in "Physical Review Letters," may solve the long-standing issue of the production of certain rare isotopes found in the solar system, known as p-nuclei. Fusion processes in massive stars produce nuclei up to iron and nickel. Beyond these elements, most heavy stable nuclei, such as lead and gold, are produced via slow or rapid neutron capture processes. However, explaining the large abundances of 92,94Mo, 96,98Ru and 92Nb in the early solar system has been challenging. The r-Process allows for the simultaneous production of these nuclei through a series of capture reactions catalyzed by neutrinos. Initially, in astrophysical explosions, neutron-rich outflows consist of neutrons and nuclei around iron and nickel. As the temperature decreases, heavier nuclei form from lighter ones through neutron

captures and weak interaction processes. Unlike the rapid neutron capture process, the r-Process involves neutrino absorption reactions instead of beta-decays.
https://www.spacedaily.com/reports/A_new_process_for_the_synthesis_of_rare_nuclei_in_the_universe_999.html

NASA's asteroid Bennu samples have rocks unlike any meteorite ever found

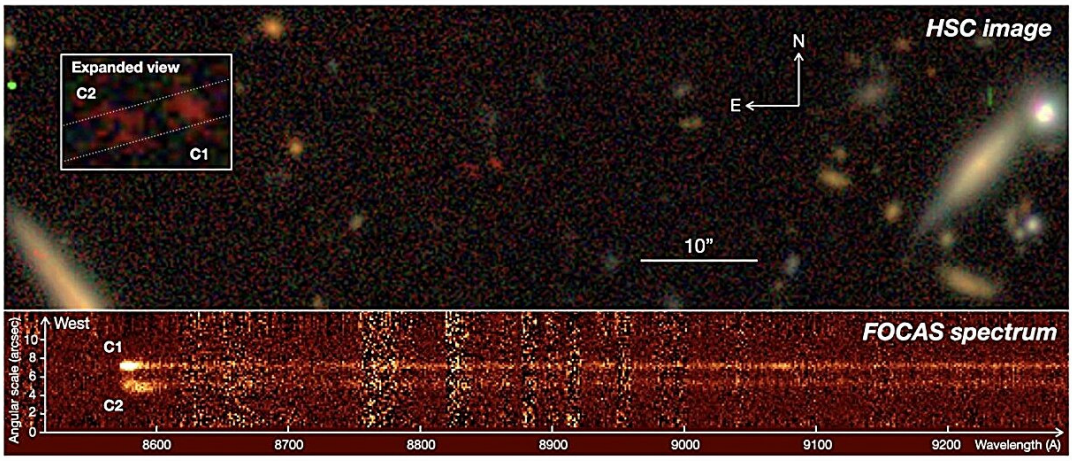
Early results from NASA's OSIRIS-REx mission to Bennu have uncovered exotic versions of chondrules — rocks commonly found in meteorites.

A view of eight sample trays containing the final material from asteroid Bennu. Credit: NASA/Erika Blumenfeld & Joseph Aebersold.

In 1877, when English geologist Henry Clifton Sorby first examined samples of meteorites under a microscope, he saw small, spherical rocks and described them as "drops of fiery rain." Now known as chondrules, from the ancient Greek *chondros*, meaning "grain", they are present in nearly all meteorites and, hence, are thought to be a major part of the building blocks of planets. Yet, the processes that formed them remain enigmatic today. Today, planetary scientists can study not only rocks that have fallen from the sky — they have begun to look for chondrules in materials directly sampled from asteroids to learn more. Most recently, researchers have started analyzing materials returned from asteroid 101955 Bennu and presented their initial findings at the Lunar and Planetary Science Conference in The Woodlands, Texas, earlier this year. So far, researchers have not found anything in Bennu samples that looks exactly like chondrules seen in meteorites. But they have found an array of rocks that resemble chondrules to varying degrees, suggesting that asteroids are more diverse than meteorites might suggest.

https://www.astronomy.com/science/nasas-asteroid-bennu-samples-have-rocks-unlike-any-meteorite-ever-found/

Astronomers discover merging twin quasars

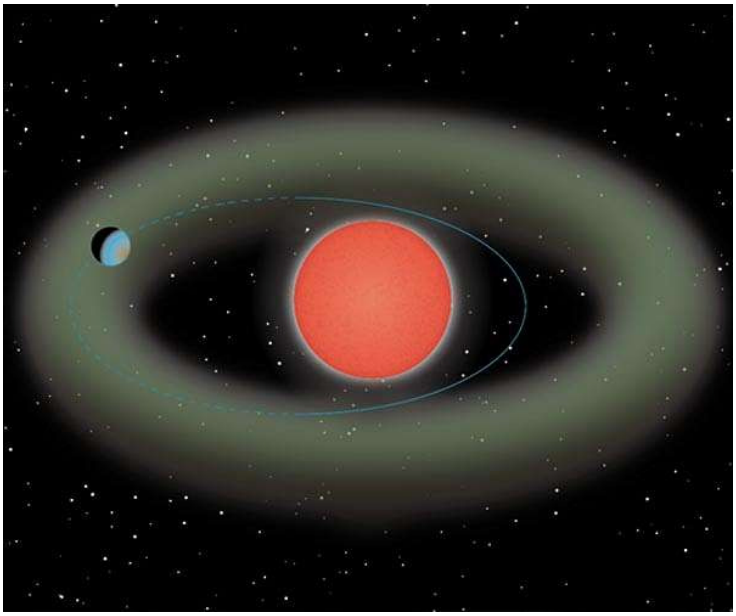


Top: three-color (HSC r, i, and z-band) composite image around C1 and C2, the two reddest sources at the centre. The inset shows an expanded view of C1 and C2. Bottom: two-dimensional FOCAS spectrum of C1 (upper trace of light) and C2 (lower trace), created by stacking all available data. Credit: Astrophysical Journal Letters (2024). DOI: 10.3847/2041-8213/ad35c7

Using the Subaru Telescope in Hawaii, astronomers have detected a pair of merging quasars at a high redshift, as part of the Hyper Suprime Cam (HSC) Subaru Strategic Program (SPP) survey. The serendipitous discovery is reported in the latest issue of the *Astrophysical Journal Letters*. Quasars, or quasi-stellar objects (QSOs), are active galactic nuclei (AGN) of very high luminosity, emitting electromagnetic radiation observable in radio, infrared, visible, ultraviolet and X-ray wavelengths. They are among the brightest and most distant objects in the known universe and serve as fundamental tools for numerous studies in astrophysics as well as cosmology. Recently, a team of astronomers led by Yoshiki Matsuoka of the Ehime University in Japan has analyzed the deep multi-band imaging data collected by HSC-SPP. Combing through the data, they serendipitously detected two

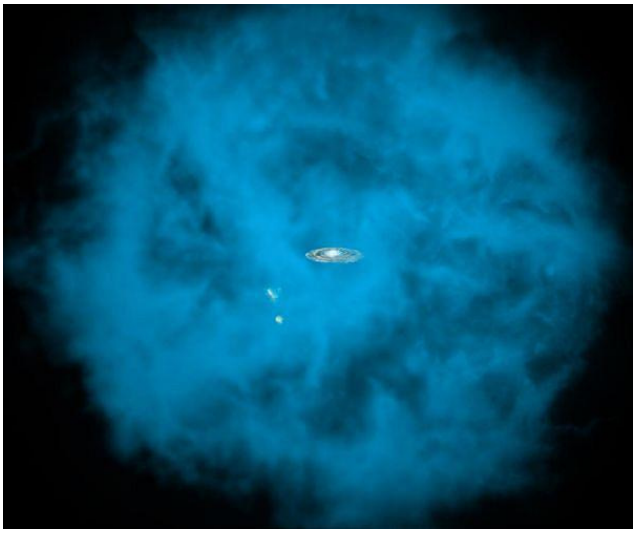
merging quasars, which received designations HSC J121503.42−014858.7 (C1) and HSC J121503.55−014859.3 (C2). According to the study, the two quasars are separated by approximately 39,000 light years and are likely in physical association with each other. The observations detected extended Lyman-alpha emission bridging C1 and C2, as well as various extended structures in other emission lines. https://phys.org/news/2024-05-astronomers-merging-twin-quasars.html

Earth-sized planet discovered orbiting ultra-cool red dwarf star



An international team of astronomers has detected a new Earth-sized planet orbiting an ultra-cool red dwarf star, located 55 light years away.The planet, named SPECULOOS-3 b, is the second of its kind discovered around this type of star. It completes an orbit of the star in about 17 hours. The star is more than twice as cold as our sun and significantly less massive and luminous.SPECULOOS-3 b is likely tidally locked, meaning the same side always faces the star, similar to the relationship between the moon and Earth. The discovery, published on May 15, 2024, in Nature Astronomy, was made by the SPECULOOS project, led by the University of Liege, in collaboration with the Universities of Birmingham, Cambridge, Bern and the Massachusetts Institute of Technology. SPECULOOS (Search for Planets EClipsingULtra-cOOl Stars) uses a network of robotic telescopes worldwide to search for exoplanets orbiting ultra-cool dwarf stars.
https://www.spacedaily.com/reports/Earth_sized_planet_discovered_orbiting_ultra_cool_red_dwarf_star_999.html

MIT researchers discover the universe's oldest stars in our own galactic backyard



MIT researchers, including several undergraduate students, have discovered three of the oldest stars in the universe, and they happen to live in our own galactic neighbourhood. The team spotted the stars in the Milky Way's "halo" - the cloud of stars that envelopes the entire main galactic disk. Based on the team's analysis, the three stars formed between 12 and 13 billion years ago, the time when the very first galaxies were taking shape. The researchers have coined the stars "SASS," for Small Accreted Stellar System stars, as they believe each star once belonged to its own small, primitive galaxy that was later absorbed by the larger but still growing Milky Way. Today, the three stars are all that are left of their respective galaxies. They circle the outskirts of the Milky Way, where the team suspects there may be more such ancient stellar survivors.
https://www.spacedaily.com/reports/MIT_researchers_discover_the_universes_oldest_stars_in_our_own_galactic_backyard_999.html

Researchers succeed for first time in accurately dating a 7 000-year-old prehistoric settlement using cosmic rays

The pile field at the site of Dispilio. Almost 800 piles, mostly made of juniper and oak wood, were sampled and dendrochronologically measured. This data forms the basis for the high-precision dating of this site. Dispilio is the first archaeological site to be dated to a precise year using the Miyake event of 5259 BC. Credit: Dispilio Excavation Archive

Researchers at the University of Bern have for the first time been able to pin down a prehistoric settlement of early farmers in northern Greece dating back more than 7 000 years to the year.

For this, they combined annual growth ring measurements on wooden building elements with the sudden spike of cosmogenic radiocarbon in 5259 BC. This provides a reliable chronological reference point for many other archaeological sites in Southeast Europe.

Dating finds plays a key role in archaeology. It is always essential to find out how old a tomb, settlement or single object is. Determining the age of finds from prehistoric times has only been possible for a few decades.

A team led by the Institute of Archaeological Sciences at the University of Bern has now succeeded in precisely dating timber from the archaeological site of Dispilio in northern Greece, where dating to the year had previously not been possible, to different building activities between 5328 and 5140 BC. The researchers made use of high-energy particles from space which can be reliably dated to 5259 BC. Their research has been published in the journal *Nature Communications*.

https://phys.org/news/2024-05-succeed-accurately-dating-year-prehistoric.html

COMMITTEE MEMBERS

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