New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 28 Issue 8— September 2020

When Printed, this Newsletter costs VAS at least £1

Society News

The Observatory is still Closed and All Monthly Meetings are Cancelled Until Further Notice

We are still unable to hold meetings during the current Covid-19 virus pandemic.

The VAS Observatory is closed and all meetings are currently cancelled.

Latest News

Sorry, but we still can't open the observatory or restart meetings yet.

Tourist numbers visiting the Island have increased dramatically over the last few months, but we must not forget that **COVID-19 is still with us**. The safety of all members and visitors to our premises and meetings is our prime focus.

Members should be aware that your committee is meeting regularly and discussing the situation in depth. Our duty is to remain responsible during the pandemic and to only make steps forward when all agree to do so.

Stay safe and well.

Brian Curd
Observatory Director and NZ Editor

worldometer

Anyone who thing statistics are boring should take a look at this website:

https://www.worldometers.info/

There are all kinds of interesting data to look at but perhaps the most interesting at the moment is the *Corona Virus link* at the top of the page. It takes you to an overview page which contains a link to the *data by country.*

All the countries are listed along with their facts and figures which can be sorted by any of the table headings.

Both interesting and depressing at the same time!

VAS Website: wightastronomy.org

Submissions or letters to New Zenith are always welcome and should be sent to:

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Material for the next issue by the 6th of the month please.

Observatory Diary

The diary is currently empty!

VAS Website: wightastronomy.org

Contents this Month

2020 Monthly Meetings

Check *http://www.wightastronomy.org/meetings/* for the latest information

All Monthly Meetings are Cancelled Until Further Notice

Sorry but we are still unable to hold meetings during the current Covid-19 virus pandemic.

All meetings are currently cancelled and the VAS Observatory is closed. The government will let us know when the situation changes and, of course, we will contact members both here and via the website and social media when that situation changes.

I hope we can resume normal activities soon but we find ourselves affected by a very serious situation.

Stay safe and well and let's hope we're back to normal soon.

Please read the latest news on the front page.

Observatory Visits Booked

All Observatory Visits are Cancelled Until Further Notice

Please see the important information above this.

IMPORTANT

Could all VAS members please ensure they notify the Membership Secretary of any change of address.

To ensure our compliance with GDPR rules, we must maintain accurate membership records.

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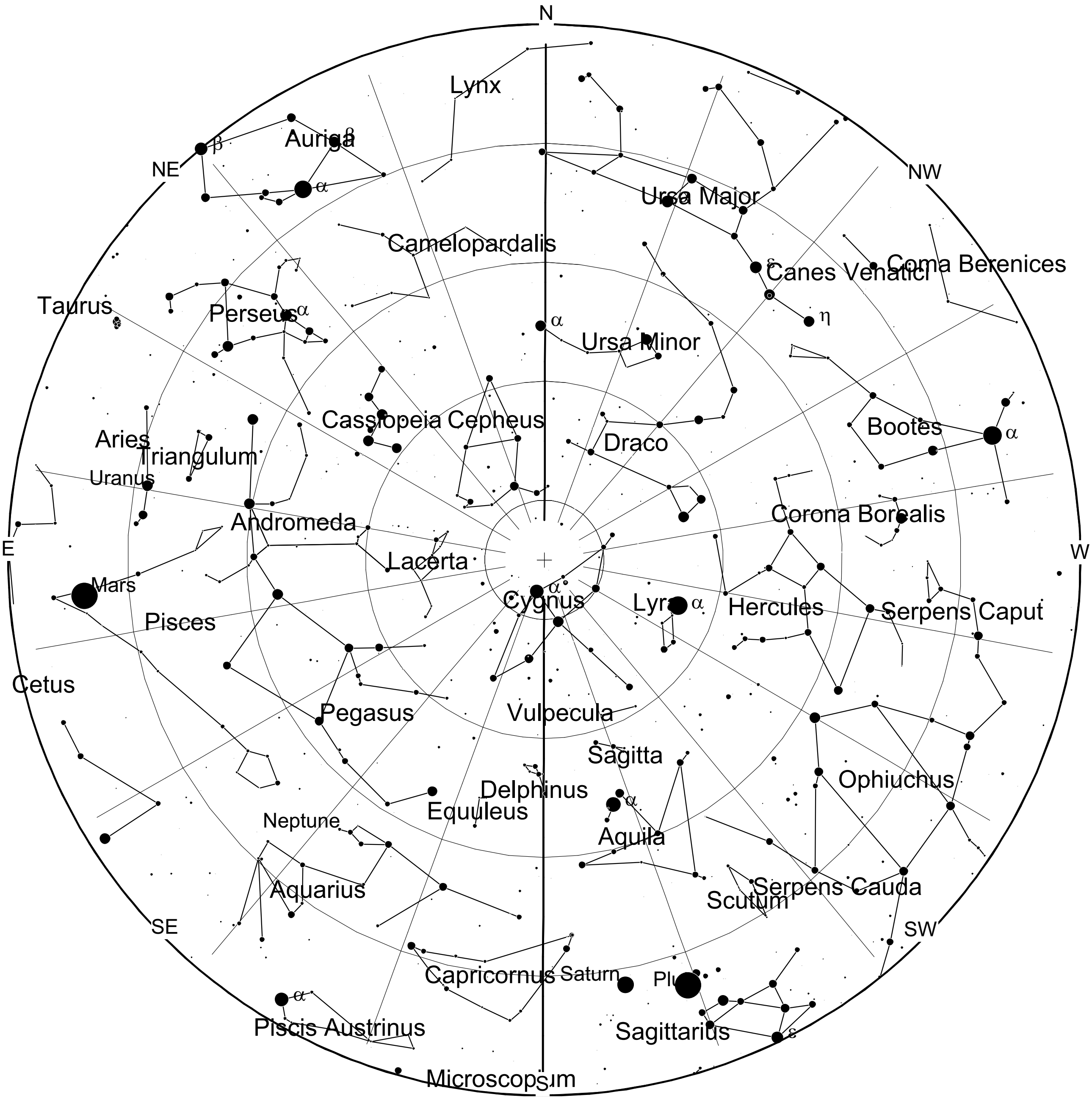
Important

Sorry, but the Observatory is still closed to all members and visitors until further notice

September 2020 Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 September 2020

Jupiter is the fifth planet from the Sun and the largest in the Solar System. It is a gas giant with a mass one-thousandth that of the Sun, but two-and-a-half times that of all the other planets in the Solar System combined. Jupiter is one of the brightest objects visible to the naked eye in the night sky, and has been known to ancient civilizations since before recorded history. It is named after the Roman god Jupiter. When viewed from Earth, Jupiter can be bright enough for its reflected light to cast visible shadows, and is on average the third-brightest natural object in the night sky after the Moon and Venus.

Jupiter is primarily composed of hydrogen with a quarter of its mass being helium, though helium comprises only about a tenth of the number of molecules. It may also have a rocky core of heavier elements, but like the other giant planets, Jupiter lacks a well-defined solid surface.

September 2020 Night Sky

Autumnal Equinox

Autumn Equinox occurs at 02:30 on September 22nd. At his time the Sun crosses the equator on its journey to the south and day and night are of equal length. From now on, northern hemisphere nights are longer than the days.

Moon Phases

New 17th	First Qtr 24th	Full 2nd	Last Qtr 10th
●	◐	○	◑

Planets

Mercury

From our northern latitude Mercury makes a very poor showing in the sunset sky this month. At sunset, although it is well separated from the Sun, it is very close to the horizon and sets very shortly after the Sun.

Venus

The brilliant Morning Star can be found low in the hours before sunrise. It is steadily moving closer to the Sun rising slightly later each day. On the 14th the Beehive cluster, M44 is flanked by both Venus and the crescent moon making a challenging photo opportunity given the brightness contrast between these objects.

Mars

Mars is very close to opposition, which is in early Oct, it is now almost at its biggest and brightest. Make the most of the coming few weeks, Mars will not be as good again for another two years. It rises just after sunset and is well up in the south at midnight. If seeing conditions are good a telescope will surface markings like Sirtis Major and Olympus Mons, the largest volcano in the solar system.

Jupiter

In the early evening Jupiter can be found low in the south. It is brighter than anything in that part of the sky and can be easily seen against the twilight sky.

Saturn

Saturn is as it has been all this year following along few degrees behind Jupiter in the southern sky. It is bright and easily seen, but nowhere near as bright as Jupiter.

Uranus

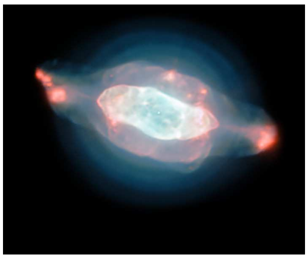
Uranus is in a part of the sky that is relatively devoid of bright guide stars. Find it a degree southwest of the sixth magnitude star 29 Arietis which is about 5° north of Mu Ceti a fourth mag star. Finder chart in Aug New Zenith.

Neptune

The best time for observing Neptune this month is between 10PM and 2AM when the planet is well clear of the horizon. It can be found about 2° east of the fourth magnitude star Phi Aquarii, and 0.5° south east of the fifth magnitude 96 Aqarii. Finder chart in the July New Zenith.

Deep Sky

NGC7009 The Saturn Nebula
RA 21h 5m Dec -11° 20' mag 8.3



Credit: ESO/J. Walsh - http://www.eso.org/ public/images/eso1731a/

Originally discovered by William Herschel in 1782 and named by Lord Rosse who saw its elongated shape for the first time. This tiny nebula is one of the few that can show some hint of colour, usually reported as light green. The high brightness allows the use of fairly high magnification and being so small this is needed if the Saturn shape is to be seen.

M15 Globular Cluster
RA 21h 30m Dec 12° 10' mag 7.5

This impressive globular is quite bright and very easily found in binoculars. Follow the line from Baham to Enif, about 4° beyond the horse's nose to find this rather large fuzzy looking star. Through a telescope it reveals its self as a bright core surrounded by a halo of much fainter stars. As with all globulars the view becomes more impressive with increasing aperture. This is one of only a few globular clusters to contain a planetary nebula, it is however about 14^{th} magnitude and for visual beyond all but those with the largest telescopes and best eyes.

Collinder 399 The Coat Hanger Cluster
RA 19h 26m Dec 20°12' mag 3.6

The universe really does have a sense of humour; this is a coat hanger, floating above the starry background out there in the Milky Way. It can be seen with the naked eye as a brighter knot in the Milky Way just on the Vulpecula side of the border with Sagitta. Any optical aid shows the coat hanger with it's rather over sized hook. A telescope may be too much for this cluster unless the magnification can be kept very low. If a telescope is available try to spot NGC6802, this rather small magnitude 8.8 cluster would make the seventh and most eastward star in the bar of the hanger.

Peter Burgess

Fifty New Planets Confirmed in Machine Learning First

Fifty potential planets have had their existence confirmed by a new machine learning algorithm developed by University of Warwick scientists.

For the first time, astronomers have used a process based on machine learning, a form of artificial intelligence, to analyse a sample of potential planets and determine which ones are real and which are 'fakes', or false positives, calculating the probability of each candidate to be a true planet.

Their results are reported in a new study published in the Monthly Notices of the Royal Astronomical Society, where they also perform the first large scale comparison of such planet validation techniques. Their conclusions make the case for using multiple validation techniques, including their machine learning algorithm, when statistically confirming future exoplanet discoveries.

Many exoplanet surveys search through huge amounts of data from telescopes for the signs of planets passing between the telescope and their star, known as transiting. This results in a telltale dip in light from the star that the telescope detects, but it could also be caused by a binary star system, interference from an object in the background, or even slight errors in the camera. These false positives can be sifted out in a planetary validation process.

Researchers from Warwick's Departments of Physics and Computer Science, as well as The Alan Turing Institute, built a machine learning based algorithm that can separate out real planets from fake ones in the large samples of thousands of candidates found by telescope missions such as NASA's Kepler and TESS.

It was trained to recognise real planets using two large samples of confirmed planets and false positives from the now retired Kepler mission. The researchers then used the algorithm on a dataset of still unconfirmed planetary candidates from Kepler, resulting in fifty new confirmed planets and the first to be validated by machine learning. Previous machine learning techniques have ranked candidates, but never determined the probability that a candidate was a true planet by themselves, a required step for planet validation.

Those fifty planets range from worlds as large as Neptune to smaller than Earth, with orbits as long as 200 days to as little as a single day. By confirming that these fifty planets are real, astronomers can now prioritise these for further observations with dedicated telescopes.

Dr David Armstrong, from the University of Warwick Department of Physics, said: “The algorithm we have developed lets us take fifty candidates across the threshold for planet validation, upgrading them to real planets. We hope to apply this technique to large samples of candidates from current and future missions like TESS and PLATO.

“In terms of planet validation, no-one has used a machine learning technique before. Machine learning has been used for ranking planetary candidates but never in a probabilistic framework, which is what you need to truly validate a planet. Rather than saying which candidates are more likely to be planets, we can now say what the precise statistical likelihood is. Where there is less than a 1% chance of a candidate being a false positive, it is considered a validated planet.”

Dr Theo Damoulas from the University of Warwick Department of Computer Science, and Deputy Director, Data Centric Engineering and Turing Fellow at The Alan Turing Institute, said: “Probabilistic approaches to statistical machine learning are especially suited for an exciting problem like this in astrophysics that requires incorporation of prior knowledge -- from experts like Dr Armstrong -- and quantification of uncertainty in predictions. A prime example when the additional computational complexity of probabilistic methods pays off significantly.”

Once built and trained the algorithm is faster than existing techniques and can be completely automated, making it ideal for analysing the potentially thousands of planetary candidates observed in current surveys like TESS. The researchers argue that it should be one of the tools to be collectively used to validate planets in future.

Dr Armstrong adds: “Almost 30% of the known planets to date have been validated using just one method, and that's not ideal. Developing new methods for validation is desirable for that reason alone. But machine learning also lets us do it very quickly and prioritise candidates much faster.

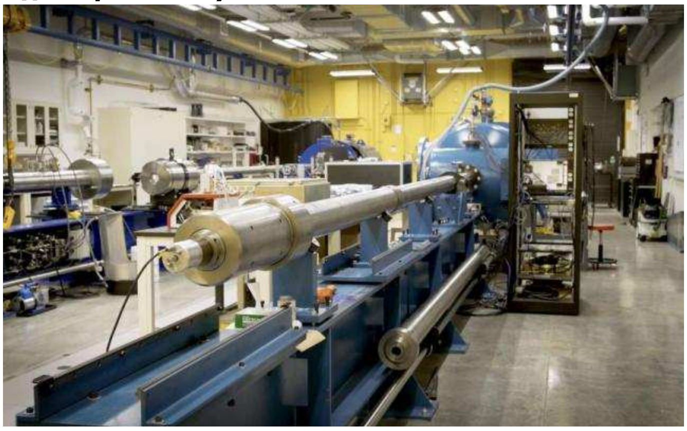
“We still have to spend time training the algorithm, but once that is done it becomes much easier to apply it to future candidates. You can also incorporate new discoveries to progressively improve it.

“A survey like TESS is predicted to have tens of thousands of planetary candidates and it is ideal to be able to analyse them all consistently. Fast, automated systems like this that can take us all the way to validated planets in fewer steps let us do that efficiently.”

From: https://www.sciencedaily.com/releases/2020/08/200825110610.htm

Understanding Matter at Atom-Crushing Densities

Newly formed center to study principles that affect planetary bodies



The Shock Compression Lab at UC Davis uses high-velocity cannon to simulate the pressures of planet formation. The lab's director, Professor Sarah T. Stewart, is co-principal investigator for the new NSF-funded Center for Matter at Atomic Pressures which will probe the physics and astrophysical implications of matter under pressures so high that the structure of individual atoms is disrupted. Credit: UC Davis photo

University of California, Davis, will be part of a new National Science Foundation Physics Frontier Center focusing on understanding the physics and astrophysical implications of matter under pressures so high that the structure of individual atoms is disrupted.

The Center for Matter at Atomic Pressures, or CMAP, will be funded with $12.96 million from the NSF. It will be hosted at the University of Rochester in collaboration with researchers at UC Davis; MIT; Princeton; the University of California, Berkeley; the University of Buffalo; and Lawrence Livermore National Laboratory.

The Physics Frontiers Centers are university-based centers funded by the NSF to enable transformational advances in the most promising research areas.

“This collaboration is focused on developing a new area of physics focused on the properties of matter under extreme pressures” said Sarah T. Stewart, professor of earth and planetary sciences at UC Davis and co-principal investigator on the project. “Most of the work is motivated by the diversity of the interiors of planets, to understand their formation and evolution.”

Stewart studies how planets formed and received a MacArthur Foundation grant in 2018 for her research on how celestial collisions give birth to planets.

Impetus for the project is twofold:

First is a recent shift in how scientists think about extreme states of matter. It was previously believed, for example, that materials subjected to very high pressure, atomic scale pressure, would transition to simple densely packed metals. Now recent results suggest such extreme matter is complex and may have novel properties. Aluminum, for example, may transform from a simple metal to a transparent insulator, and hydrogen from a gas into a superconducting superfluid.

Second is that thousands of planets, some of which may be platforms for life, have been discovered outside our solar system. To understand the nature of these massive bodies we need to understand their deep interior states, which are under the crushing forces of gravity.

CMAP will lead discoveries at the confluence of these two movements in science. The center will combine powerful lasers, pulsed-power, and X-ray beam technology with first-principles theory and astrophysical interpretation concentrating on four main areas of fundamental research:

How hydrogen and helium behave at extraordinary densities in the so-called “gas giant” planets, including Jupiter and Saturn in our own solar system, which could advance knowledge of how the solar system evolved.

How other elements react at high densities, to understand the nature of terrestrial and water worlds in the universe, and how materials might be manipulated in laboratories on Earth to “harness revolutionary properties.”

The pathways of energy transport that enable the dramatic change in properties of material at high densities. This could shed light on topics ranging from the structure and evolution of planets and stars to refining inertial confinement fusion.

The direct astrophysical implications of extreme matter properties -- linking laboratory exploration of matter at atomic pressure with state-of-the-art models of astrophysical objects to better understand astronomical observations.

“The Physics Frontiers Centers program supports creative and interdisciplinary work at the frontiers of physics,” says Jean Cottam Allen, the NSF program officer overseeing the centers. “Researchers at the Center for Matter at Atomic Pressures are investigating a new frontier of matter at extreme pressures.”

From: https://www.eurekalert.org/pub_releases/2020-08/uoc--uma081020.php

Classifying Galaxies With Artificial Intelligence

Astronomers have applied artificial intelligence (AI) to ultra-wide field-of-view images of the distant Universe captured by the Subaru Telescope, and have achieved a very high accuracy for finding and classifying spiral galaxies in those images. This technique, in combination with citizen science, is expected to yield further discoveries in the future.

A research group, consisting of astronomers mainly from the National Astronomical Observatory of Japan (NAOJ), applied a deep-learning technique, a type of AI, to classify galaxies in a large dataset of images obtained with the Subaru Telescope. Thanks to its high sensitivity, as many as 560,000 galaxies have been detected in the images. It would be extremely difficult to visually process this large number of galaxies one by one with human eyes for morphological classification. The AI enabled the team to perform the processing without human intervention.

Automated processing techniques for extraction and judgment of features with deep-learning algorithms have been rapidly developed since 2012. Now they usually surpass humans in terms of accuracy and are used for autonomous vehicles, security cameras, and many other applications. Dr. Ken-ichi Tadaki, a Project Assistant Professor at NAOJ, came up with the idea that if AI can classify images of cats and dogs, it should be able to distinguish "galaxies with spiral patterns" from "galaxies without spiral patterns." Indeed, using training data prepared by humans, the AI successfully classified the galaxy morphologies with an accuracy of 97.5%. Then applying the trained AI to the full data set, it identified spirals in about 80,000 galaxies.

Now that this technique has been proven effective, it can be extended to classify galaxies into more detailed classes, by training the AI on the basis of a substantial number of galaxies classified by humans. NAOJ is now running a citizen-science project "Galaxy Cruise," where citizens examine galaxy images taken with the Subaru Telescope to search for features suggesting that the galaxy is colliding or merging with another galaxy.

Video and Links: https://phys.org/news/2020-08-galaxies-artificial-intelligence.html

Scientists Spot Space Junk With Lasers in Broad Daylight

Our ability to efficiently detect space debris has taken an important leap forward, thanks to a new technique in which lasers can spot these potentially dangerous objects during daylight hours.

Researchers from the Institute for Space Research at the Austrian Academy of Sciences have developed a technique in which lasers can measure the position of space debris during daylight conditions.

Prior to this, lasers could only detect space junk during twilight, as ground stations enter into darkness and objects near the horizon remain illuminated by the Sun's rays. This severely minimizes the amount of time available to search for and characterize these orbiting objects, which can threaten crucial satellites.

"We are used to the idea that you can only see stars at night, and this has similarly been true for observing debris with telescopes, except with a much smaller time window to observe low-orbit objects," explained Tim Flohrer, Head of ESA's Space Debris Office, in an ESA press release. "Using this new technique, it will become possible to track previously 'invisible' objects that had been lurking in the blue skies, which means we can work all day with laser ranging to support collision avoidance."

It's vital that we document as much space junk as possible to mitigate collisions in space. An estimated 34,000 objects larger than 10 cm are currently in orbit around Earth, along with millions of tinier objects. Even objects measuring a few millimeters across can pose a threat to satellites and spacecraft, as speeds in low Earth orbit can reach 10 km/s.

Radar can track objects bigger than 10cm but not well enough to manage space traffic, according to an Institute for Space Research press release. Lasers, on the other hand, can track similarly sized objects much more precisely, to an accuracy close to 1m.

The new technique differs from conventional methods in that it can track objects during daylight hours, which it does using a combination of telescopes, light deflectors, and filters that track light at specific wavelengths. So even when the sky is bright and blue, scientists can increase a target's contrast, making previously invisible objects visible. Keys to this method include additional telescopes and the ability to visualize space debris against the blue sky background in real-time.

More at: https://gizmodo.com/scientists-spot-space-junk-with-lasers-in-broad-dayligh-1844623499

Spacecraft may be Powered by Lattice Confinement Fusion

NASA researchers demonstrate the ability to fuse atoms inside room-temperature metals

Deuterons have been forced into the atomic lattice structures of these samples of erbium used in NASA's fusion experiments. Credit NASA

Nuclear fusion is hard to do. It requires extremely high densities and pressures to force the nuclei of elements like hydrogen and helium to overcome their natural inclination to repel each other. On Earth, fusion experiments typically require large, expensive equipment to pull off.

Researchers at NASA's Glenn Research Center have now demonstrated a method of inducing nuclear fusion without building a massive stellarator or tokamak. In fact, all they needed was a bit of metal, some hydrogen, and an electron accelerator. The team believes that their method, called lattice confinement fusion, could be a potential new power source for deep space missions.

"Lattice confinement" refers to the lattice structure formed by the atoms making up a piece of solid metal. The NASA group used samples of erbium and titanium for their experiments. Under high pressure, a sample was "loaded" with deuterium gas, an isotope of hydrogen with one proton and one neutron. The metal confines the deuterium nuclei, called deuterons, until it's time for fusion.

"During the loading process, the metal lattice starts breaking apart in order to hold the deuterium gas," says Theresa Benyo, an analytical physicist and nuclear diagnostics lead on the project. "The result is more like a powder." At that point, the metal is ready for the next step: overcoming the mutual electrostatic repulsion between the positively-charged deuteron nuclei, the so-called Coulomb barrier.

To overcome that barrier requires a sequence of particle collisions. First, an electron accelerator speeds up and slams electrons into a nearby target made of tungsten. The collision between beam and target creates high-energy photons, just like in a conventional X-ray machine. The photons are focused and directed into the deuteron-loaded erbium or titanium sample. When a photon hits a deuteron within the metal, it splits it apart into an energetic proton and neutron. Then the neutron collides with another deuteron, accelerating it.

At the end of this process of collisions and interactions, you're left with a deuteron that's moving with enough energy to overcome the Coulomb barrier and fuse with another deuteron in the lattice.

Key to this process is an effect called electron screening, or the shielding effect. Even with very energetic deuterons hurtling around, the Coulomb barrier can still be enough to prevent fusion. But the lattice helps again. "The electrons in the metal lattice form a screen around the stationary deuteron," says Benyo. The electrons' negative charge shields the energetic deuteron from the repulsive effects of the target deuteron's positive charge until the nuclei are very close, maximizing the amount of energy that can be used to fuse.

Aside from deuteron-deuteron fusion, the NASA group found evidence of what are known as Oppenheimer-Phillips stripping reactions. Sometimes, rather than fusing with another deuteron, the energetic deuteron would collide with one of lattice's metal atoms, either creating an isotope or converting the atom to a new element. The team found that both fusion and stripping reactions produced useable energy.

"What we did was not cold fusion," says Lawrence Forsley, a senior lead experimental physicist for the project. Cold fusion, the idea that fusion can occur at relatively low energies in room-temperature materials, is viewed with skepticism by the vast majority of physicists. Forsley stresses this is hot fusion, but "We've come up with a new way of driving it."

"Lattice confinement fusion initially has lower temperatures and pressures" than something like a tokamak, says Benyo. But "where the actual deuteron-deuteron fusion takes place is in these very hot, energetic locations." Benyo says that when she would handle samples after an experiment, they were very warm. That warmth is partially from the fusion, but the energetic photons initiating the process also contribute heat.

Benyo says that the ultimate goal is still to be able to power a deep-space mission with lattice confinement fusion. Power, space, and weight are all at a premium on a spacecraft, and this method of fusion offers a potentially reliable source for craft operating in places where solar panels may not be useable, for example. And of course, what works in space could be used on Earth.

More at: https://spectrum.ieee.org/

A Gallery of Magnetic Fields

This composite image of the Serpens South Cluster shows the magnetic fields, as observed by SOFIA, as streamlines over an image from the Spitzer Space Telescope. The strong, dense flow of gas in the dark filament at lower left has dragged the magnetic field lines so that they run along the length of the filament.
NASA / SOFIA / T. Pillai / J. Kauffmann; NASA / JPL-Caltech / L. Allen

Invisible magnetic fields play a role in everything from star formation to galaxy evolution to black hole phenomena. But astronomers still debate what that role is.

The HAWC+ instrument, a far-infrared imager and polarimeter aboard the Stratospheric Observatory for Infrared Astronomy (SOFIA), is helping portray magnetism's role in a beautiful way. Flying above much of Earth's atmosphere aboard a modified Boeing 747, HAWC+ has measured the polarization of far-infrared radiation, gauging how well the light waves are aligned with each other.

Usually, light waves are not aligned with each other at all. But dust grains line up in the space between stars due to interstellar magnetic fields, so the infrared radiation dust emits is polarized. HAWC+ thus enables astronomers to infer the alignment and strength of the magnetic field.

In the August 20th Nature Astronomy, Thushara Pillai (Boston University and Max Planck Institute for Radio Astronomy, Germany) and colleagues used HAWC+ to measure the magnetic fields in a stellar nursery known as Serpens South. Denser filaments permeate such clouds, channelling gas into young star clusters.

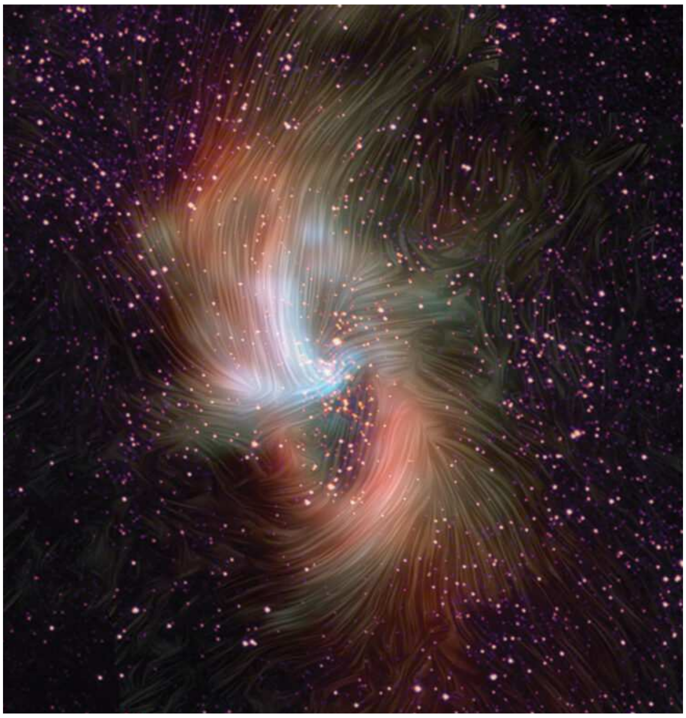
Magnetic fields also permeate star-forming clouds — but what they do there remains unclear, as the field strength is 10,000 times weaker than Earth's magnetic field and therefore difficult to measure.

Previous measurements using the Planck satellite have shown that the magnetic field tends to run parallel to lower-density filaments and perpendicular to higher-density filaments, suggesting that magnetism might moderate star formation by counteracting the pull of gravity.

However, the new HAWC+ measurements taken by Pillai's team indicate that along the densest, darkest filaments in Serpens South, the magnetic fields once again run parallel. "In some dense filaments the magnetic field succumbs to the flow of matter and is pulled into alignment with the filament," Pillai explains. In these regions, the weakly magnetized gas is feeding the growth of young stellar clusters like a conveyor belt.

This is only the latest result to come out of HAWC+. A selection of other composite images below visualize the magnetic field lines in the star-forming Orion Nebula, the Cigar Galaxy (M82), and in the region around our galaxy's supermassive black hole.

The SOFIA 106-inch telescope and instruments image infrared light from on high, flying aboard a modified Boeing 747SP jetliner. Unfortunately, operations have been suspended due to the ongoing COVID-19 pandemic; however, the SOFIA science center remains active and astronomers continue to work with the data that SOFIA has already collected.



https://skyandtelescope.org/astronomy-news/gallery-magnetic-fields/

The Most Sensitive Instrument in the Search for Life Beyond Earth

The question of whether life exists beyond the Earth is one of humanity's most fundamental questions. Future NASA missions, for example, aim to examine the ice moons of Jupiter and Saturn, which may potentially shelter life in the liquid oceans underneath the thick layer of ice, on the ground. Proving traces of life beyond the Earth is extremely challenging, however. Highly sensitive instruments which take measurements on the ground with the greatest possible degree of autonomy and with high precision -- millions of kilometers from the Earth and thus without direct support from humankind -- are required.

An international group of researchers under the leadership of Andreas Riedo and Niels Ligterink at the University of Bern have now developed ORIGIN, a mass spectrometer which can detect and identify the smallest amounts of such traces of life. They describe the instrument in a recently published article in the specialist journal Nature Scientific Reports. Niels Ligterink from the Center for Space and Habitability (CSH) is the lead author of the international study, and co-author Andreas Riedo from the Physics Institute at the University of Bern developed the instrument in the laboratories of the space research and planetary sciences division of the Physics Institute. Various international space agencies, particularly NASA, have already expressed interest in testing ORIGIN for future missions.

New Instrument Required

Since the first Mars mission “Viking” in the 1970s, humanity has been searching for traces of life on Mars using highly specialized instruments which are installed on landing platforms and rovers. In its early years, Mars was Earth-like, had a dense atmosphere and even liquid water. However, as Niels Ligterink explains, Mars lost its protective atmosphere over the course of time: “As a result of this, the surface of Mars is subjected to high solar and cosmic radiation which makes life on the surface impossible.” NASA's “Curiosity” rover is currently examining Mars in detail but with no concrete indications of traces of life to date.

Since the discovery by the Cassini and Galileo missions of the global oceans beneath kilometers of ice layers on Jupiter's moon Europa and Saturn's moon Enceladus, these two bodies have increasingly become the focus of the search for extraterrestrial life for researchers. According to current knowledge, the oceans have all of the properties which are not only needed for the occurrence of life, but also which provide environments in which life can exist in the long term. NASA therefore plans to land a mission on Jupiter's moon Europa around 2030 and take measurements on the ground. The goal: Identification of life. Co-author Prof. Dr. Peter Wurz from the Physics Institute at the University of Bern says: “Concepts which were specially developed for Mars cannot be simply applied to other bodies in our solar system because they are very different. New instruments with higher sensitivity and simpler and more robust analysis systems must be designed and used.”

Unprecedented Measurement Sensitivity for Proof of Life in Space

ORIGIN is one such new instrument which outperforms previous space instruments many terms over in terms of its measurement sensitivity. Various international space agencies have expressed great interest in the instrument for future missions. Andreas Riedo says: “NASA has invited us to participate and test our instrument in the Arctic. The Arctic is the optimal test environment in the context of the EUROPA LANDER mission, which should start in 2025, which will allow us to demonstrate the performance of ORIGIN.”

Amino acids are key components of life as we know it on Earth. Contemporaneous proof of certain amino acids on extraterrestrial surfaces, such as those of Europa, allow conclusions to be drawn about possible life. The measurement principle developed by the Bern-based researchers is simple. Niels Ligterink explains: “Laser pulses are directed at the surface to be examined. In the process, small amounts of material are detached, the chemical composition of which is analyzed by ORIGIN in a second step.” Andreas Riedo adds: “The compelling aspect of our technology is that no complicated sample preparation techniques, which could potentially affect the result, are required. This was one of the biggest problems on Mars until now,” says Riedo. The amino acids which have been analyzed with ORIGIN to date have a specific chemical fingerprint which allows them to be directly identified. Niels Ligterink: “To be honest, we didn't expect that our first measurements would already be able to identify amino acids.”

The discovery of traces of past or present life on bodies in our solar system beyond the Earth is of great importance for a better understanding of the existence of life in the universe and its genesis. Andreas Riedo says: “Our new measurement technology is a real improvement on the instruments currently used on space missions. If we are taken along on a future mission, we may be able to answer one of humanity's most fundamental questions with ORIGIN: Is there life in space?”

From: https://www.sciencedaily.com/releases/2020/08/200819120720.htm

Arecibo Observatory Data Help Lead to Discovery of Cosmic 'Heartbeat'

The unexpected findings were a result of data collected for more than a decade at the NSF facility, which is managed by the University of Central Florida, and from data from NASA's Fermi Large Area Space Telescope.

An international team of researchers using data from Arecibo Observatory and the Fermi Space Telescope have discovered what they call a “gamma-ray heartbeat” coming from a cosmic gas cloud.

The cloud is in the constellation Aquilla and “beats” in rhythm with a black hole 100 light years away in a microquasar system known as SS 433. The results were published today in the journal Nature Astronomy.

“This result challenges obvious interpretations and is unexpected from previously published theoretical models,” says Jian Li, a Humboldt Fellow with the Deutsches Elektronen-Synchrotron in Zeuthen, Germany, and study co-author. “It provides us with a chance to unveil the particle transport from SS 433 and to probe the structure of the magnetic field in its vicinity.”

In the SS 433 system, a black hole orbits a giant star, 30 times the mass of Earth's sun. The black hole sucks matter from the giant star while orbiting it, forming a swirling accretion disc that drains into the black hole, like water into a bathtub drain.

Some of the matter doesn't fall into the hole though, but rather jets out in high speed spirals from the disc's center in both directions, top and bottom, like pegs on a wheel.

The researchers made the discovery by analyzing more than a decade of data from NASA's Fermi Large Area Space Telescope and from Galactic ALFA HI survey data collected with the Arecibo Observatory's 1,000-foot-wide radio telescope. The observatory was recently damaged and is currently offline, but scientists continue to have access to data previously collected. Engineers are assessing what caused a cable to break and plans for repairs.

The researchers found that the precession, or wobble, of the black hole's jets matched with a gamma-ray signal emitted from a gas cloud. The researchers have labeled the position in the gas cloud Fermi J1913+0515. The position was revealed using Arecibo Observatory's telescope, and Fermi provided data about the SS 433 system.

“The consistent periods indicate the gas cloud's emission is powered by the micro quasar,” Li says.

The Arecibo Telescope

Scientists still do not fully know how the jets overcome the black hole's pull and are emitted from the disc, and the current study presents a new question - How does the black hole power the gas cloud's heartbeat?

The study's researchers say further observations and theoretical work are needed, but one suggestion is that the cloud's gamma-ray emissions are caused by the injection of the nuclei of hydrogen atoms, known as fast protons, that are produced at the end of the jets, or near the black hole.

“SS 433 continues to amaze observers at all frequencies and theoreticians alike,” Li says. “And it is certain to provide a testbed for our ideas on cosmic-ray production and propagation near microquasars for years to come.”

*The **Fermi Large Area Space Telescope***

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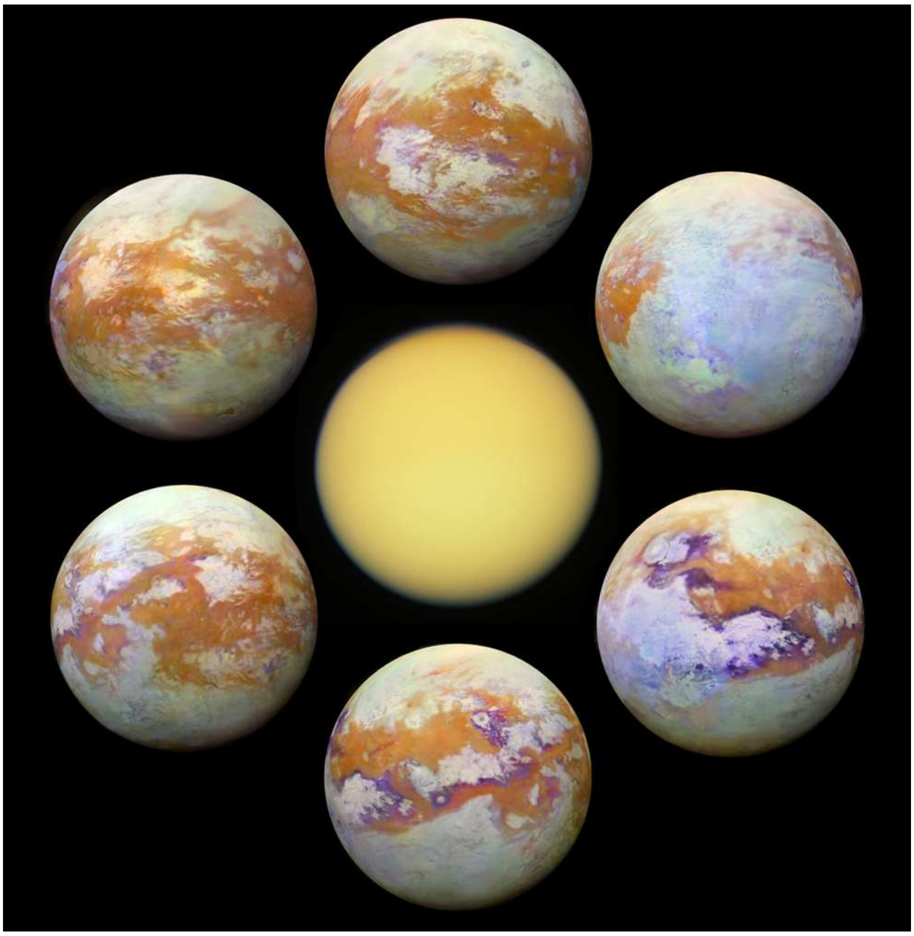

Astronomy Picture of the Day 20 August 2020

Shrouded in a thick atmosphere, Saturn's largest moon Titan really is hard to see. Small particles suspended in the upper atmosphere cause an almost impenetrable haze, strongly scattering light at visible wavelengths and hiding Titan's surface features from prying eyes. But Titan's surface is better imaged at infrared wavelengths where scattering is weaker and atmospheric absorption is reduced. Arrayed around this visible light image (center) of Titan are some of the clearest global infrared views of the tantalizing moon so far. In false color, the six panels present a consistent processing of 13 years of infrared image data from the Visual and Infrared Mapping Spectrometer (VIMS) on board the Cassini spacecraft. They offer a stunning comparison with Cassini's visible light view.

https://apod.nasa.gov/apod/ap200820.html

At The Observatory

For your own safety, please bring a torch.
Make sure you close and lock the car park gate if you are the last to leave.

Articles Needed

NZ needs letters, articles, reviews or pictures related to astronomy. Contact details on page 1.

"Energy is liberated matter, matter is energy waiting to happen"
Bill Bryson

"Maybe this world is another planet's hell"
Aldous Huxley

"If all of mathematics disappeared, physics would be set back by exactly one week"
Richard Feynman

"There are only two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle"
Albert Einstein

"In theory, there is no difference between theory and practice. But, in practice, there is"
Jan van de Snepscheut

"The more success the quantum theory has, the sillier it looks"
Albert Einstein