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Astronomy & Physics Weekly News

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Top News

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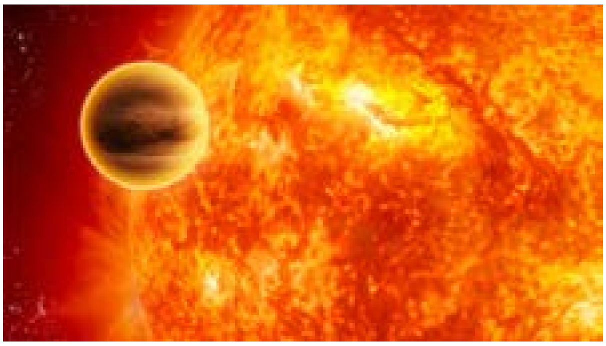
How NASA's Mission to 'Touch the Sun' May Reveal Clues About Alien Worlds



An artist's depiction of a so-called "hot Jupiter"-type planet orbiting a star of about the same size as our sun. Credit: NASA/JPL-Caltech

NASA's new mission to the sun may reveal clues about alien worlds, too.

Every day, we rely on the sun for warmth and light, but we need Earth's atmosphere to protect us from our star's harsh conditions — and because in the end our sun is just another star, the same could be true of life on other worlds, planetary scientists told Space.com.

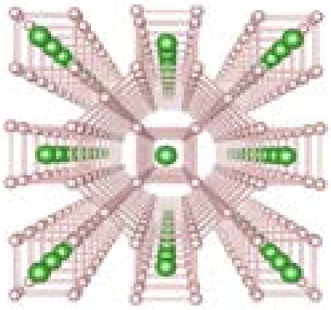
That means studying our sun up close could teach us about planets in distant solar systems as well. And a NASA mission may soon begin to do just that: This fall, the Parker Solar Probe, which launched in August, will start investigating how our star works. Exoplanet scientists are watching the mission to see what data it might offer them about exotic worlds.

"We can learn so much from our sun and particularly for other sun-like stars," Evgenya Shkolnik, an astrophysicist and planetary scientist at Arizona State University, told Space.com. In particular, she wants a better sense of the high-energy particles and photons, or particles of light, stars produce. "It's critically important to understand all these things for exoplanet hosts, for sure," she said.

We know about the dangers of those particles and photons from our own experiences here on Earth, where the planet's atmosphere buffers us from the worst side effects of living near the sun: Only with extreme sunbathing do we absorb enough ultraviolet radiation to damage the DNA inside our cells enough to potentially kill us with cancer, and only during the most extreme solar outbursts, called coronal mass ejections, do its highly charged particles overwhelm Earth's magnetic field and thus interfere with our technology.

If an exoplanet is less fortunate in its natural protections or in its star's temperament, those high-energy particles and photons could be the deciding factors in an exoplanet's habitability, said Ravi Kopparapu, a planetary scientist at NASA. Even if a planet develops an atmosphere, if it's bombarded by too many stellar particles, that barrage can destroy the atmosphere. "They can strip ...Read More...

A new hydrogen-rich compound may be a record-breaking superconductor



HELLA HYDROGEN The compound LaH_{10} is composed of 10 hydrogen atoms (pink) for each lanthanum atom (green). This hydrogen-rich material was predicted to exhibit superconductivity, evidence for which has now been found.

Superconductors are heating up, and a world record-holder may have just been dethroned.

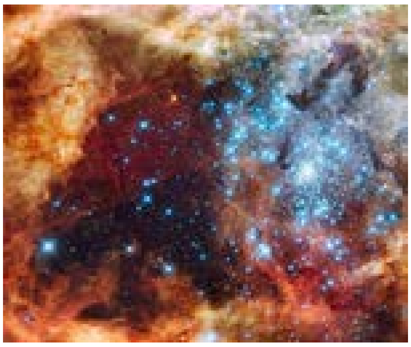
Two studies report evidence of superconductivity — the transmission of electricity without resistance — at temperatures higher than seen before. The effect appears in compounds of lanthanum and hydrogen squeezed to extremely high pressures.

All known superconductors must be chilled to function, which makes them difficult to use in real-world applications. If scientists found a superconductor that worked at room temperature, the material could be integrated into electronic devices and transmission wires, potentially saving vast amounts of energy currently lost to electrical resistance. So scientists are constantly on the lookout for higher-temperature superconductors. The current record-holder, hydrogen sulfide, which also must be compressed, works below 203 kelvins, or about −70° Celsius.

The new evidence for superconductivity is based on a dramatic drop in the resistance of the lanthanum-hydrogen compounds when cooled below a certain temperature. One team of physicists found that their compound's resistance plummeted at a temperature of 260 kelvins (−13° C), the temperature of a very cold winter day. The purported superconductivity occurred when the material had been crushed with almost 2 million times the pressure of Earth's atmosphere by squeezing it between two diamonds. Some samples even showed signs of superconductivity at higher temperatures, up to 280 kelvins (about 7° C), physicist Russell Hemley of George Washington University in Washington, D.C., and colleagues report in a study posted online August 23 at arXiv.org. Hemley first reported signs of the compound's superconductivity in May in Madrid at a symposium on superconductivity and pressure.

Another group found evidence of superconductivity in a lanthanum-hydrogen compound under chillier, but still record-breaking, conditions. The researchers crushed lanthanum and hydrogen in a diamond press to about 1.5 million times Earth's atmospheric pressure. ...Read More...

Magnetic waves create chaos in star-forming clouds



Offner's research will shed light on the processes inside star-forming regions such as 30 Doradus, seen in this view from Hubble Space Telescope. Credit: NASA/ESA/F. Paresce/R. O'Connell/WFC3

New research by Stella Offner, assistant professor of astronomy at The University of Texas at Austin, finds that magnetic waves are an important factor driving the process of star formation within the enormous clouds that birth stars.

Her research sheds light on the processes that are responsible for setting the properties of stars, which in turn affects the formation of planets orbiting them, and, ultimately, life on those planets. The research is published in the current issue of the journal Nature Astronomy.

Offner used a supercomputer to make models of the multitude of processes happening inside a cloud where stars are forming, in an effort to sort out which processes lead to which effects.

"These clouds are violent places," Offner said.

"It's an extreme environment with all kinds of different physics happening at once," including gravity and turbulence as well as radiation and winds from forming stars (called stellar feedback). The fundamental question, Offner said, is: "Why are the motions in these clouds so violent?"

Some astronomers attribute the observed motions to gravitational collapse, while others attribute it to turbulence and stellar feedback. Offner wanted to test these theories and study how stars shape their birth environment, but it's virtually impossible to use telescope observations of these clouds to separate the influence of the various processes, she said.

"That's why we need computer models," Offner explained.

After comparing models of clouds with gravity, magnetic fields, and stars, Offner noticed extra motions.

Her models showed that stellar winds interacting with the cloud magnetic field generated energy and influenced gas at far greater distances across the cloud than previously thought: These local magnetic fields ...Read More...

Newfound Alien World May Bridge Rare Gap in Planet Types

A size comparison of the Earth, Wolf 503b and Neptune. The color blue for Wolf 503b is imaginary; nothing is yet known about the atmosphere or surface of the planet. Credit: Robert Simmon (Terre), NASA/JPL (Neptune)/NASA Goddard

A student who began her master's degree in May partnered with an international team of researchers to discover a special cosmic neighbor twice the size of Earth.

Graduate student Merrin Peterson and a team of Canadian, German and American scientists used data from NASA's Kepler telescope to study Wolf 503b, a planet located 145 light-years away in the patch of sky where the constellation Virgo is visible.

Peterson, a student at the Institute for Research on Exoplanets (iREx) at the University of Montreal, said in a Sept. 6 statement released by the university that the discovery of this world happened rather quickly. The find occurred after she and her adviser, Björn Benneke, ran a program in May 2018 to find "interesting exoplanet candidates" from a recent release of Kepler data, she said.

According to the statement, exoplanet Wolf 503b orbits an old "orange dwarf" star slightly dimmer than the sun, and goes around it quite closely and quickly – every six days. Wolf 503b is also fascinating because there's nothing in our solar system quite like it for comparison, according to university officials. Its size puts the exoplanet in a scientific sweet spot – Wolf 503b is in the zone where it might be a rocky "super-Earth," or gaseous like a "sub-Neptune."

Kepler has studied the radii of thousands of exoplanets strewn across the universe, but because of a yet-to-be-well-understood phenomenon that researchers call the Fulton gap, there aren't many exoplanets 1.5 to 2 times the size of Earth. This is what makes additional observations of Wolf 503b – with a radius 2.03 times that of Earth – brimming with discovery potential.

Typically, these Fulton-gap planets observed by Kepler are challenging to study. They orbit distant, dim stars, according to the statement, making it hard for researchers to figure out their density, measure the wavelengths of light coming from them or investigate their atmospheres. ...Read More...

Artificial intelligence helps track down mysterious cosmic radio bursts

Artificial intelligence helps track down mysterious cosmic radio bursts

Artificial intelligence is invading many fields, most recently astronomy and the search for intelligent life in the universe, or SETI.

Researchers at Breakthrough Listen, a SETI project led by the University of California, Berkeley, have now used machine learning to discover 72 new fast radio bursts from a mysterious source some 3 billion light years from Earth.

Fast radio bursts are bright pulses of radio emission mere milliseconds in duration, thought to originate from distant galaxies. The source of these emissions is still unclear, however. Theories range from highly magnetized neutron stars blasted by gas streams from a nearby supermassive black hole, to suggestions that the burst properties are consistent with signatures of technology developed by an advanced civilization.

"This work is exciting not just because it helps us understand the dynamic behavior of fast radio bursts in more detail, but also because of the promise it shows for using machine learning to detect signals missed by classical algorithms," said Andrew Siemion, director of the Berkeley SETI Research Center and principal investigator for Breakthrough Listen, the initiative to find signs of intelligent life in the universe.

Breakthrough Listen is also applying the successful machine-learning algorithm to find new kinds of signals that could be coming from extraterrestrial civilizations.

While most fast radio bursts are one-offs, the source here, FRB 121102, is unique in emitting repeated bursts. This behavior has drawn the attention of many astronomers hoping to pin down the cause and the extreme physics involved in fast radio bursts.

The AI algorithms dredged up the radio signals from data were recorded over a five-hour period on Aug. 26, 2017, by the Green Bank Telescope in West Virginia. An earlier analysis of the 400 terabytes of data employed standard computer algorithms to identify 21 bursts ..Read More...

Team of researchers challenge bold astronomical prediction

Credit: CC0 Public Domain

Calvin College professor of astronomy Larry Molnar made a bold announcement in 2017—he and his team had identified a binary star in the constellation Cygnus, the Swan, that was a strong candidate to merge and explode in the near future. Known by its Kepler mission number, KIC 9832227, the pair of stars is about 1800 light years from Earth and has an orbit so close that it takes just 11 hours to go around once. That first-of-its-kind prediction caught the attention of an international audience, creating excitement within the scientific community and among the general public.

Digging deeper

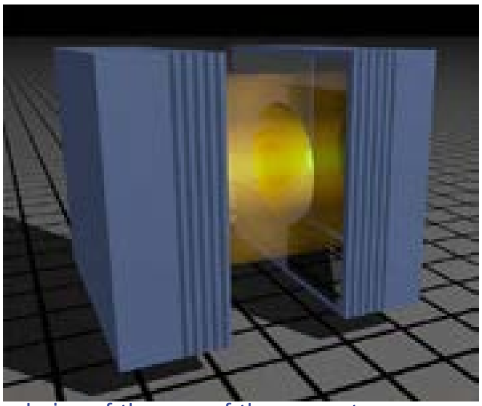
The interest led Molnar's peers to dig deeper into the discovery, in essence doing what Molnar says is "good science"—scrupulously testing his prediction.

Now, 18 months later, a team of researchers led by Quentin Socia, a graduate student at San Diego State University, has published a paper in The Astrophysical Journal Letters reevaluating Molnar's predicted merger, concluding it will not happen. And Molnar agrees with that assessment.

"Good science makes testable predictions," said Molnar. "There have been a few other papers that have tried to poke at our project, and we've been able to poke back—criticisms that just don't fly. But this one does fly, and I think they have a good point. This illustrates how science can be self-correcting."

Molnar's prediction was anchored by data. The binary orbit is oriented such that the stars take turns eclipsing each other from Earth's viewpoint. The prediction used measured times of minimum light (mid-eclipse) from all available sources. From 2013 to 2016, the Calvin Observatory was used to make an extensive series of measurements. Archival measurements from other observatories were found from every year from 2007 to 2013. This was rounded out with one very early measurement from 1999 from the Northern Sky Variability Survey (NSVS). Furthermore, since the prediction was made public ..Read More...

Just seven photons can act like billions



Artist's rendering of the core of the apparatus.

A system made of just a handful of particles acts just like larger systems, allowing scientists to study quantum behaviour more easily.

Most substances physicists study are made up of huge numbers of particles - so large that there is essentially no difference between the behavioural properties of a drop or a swimming pool's worth of pure water. Even a single drop can contain more than a quadrillion particles.

This makes understanding their collective behaviour relatively easy. For example, both the water in the drop and in the pool will freeze at 0C and boil at 100C.

Such 'phase transitions' (i.e. from liquid to solid or from liquid to gas) can appear abrupt in these large systems, because so many particles are involved that they all appear to act at once. But what about in far smaller systems? When there are only a handful of particles, do the same rules of phase transitions apply?

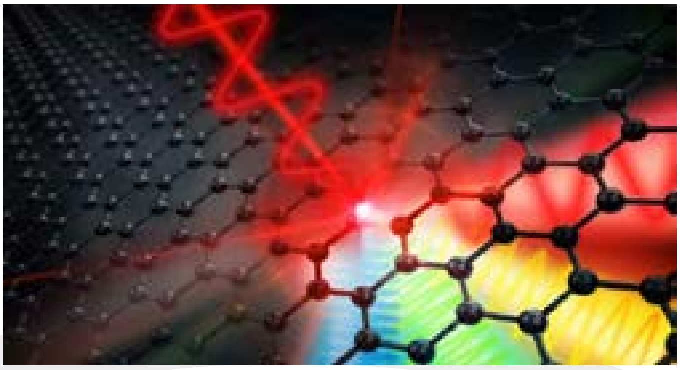
To answer these questions, a team of scientists from Imperial College London, the University of Oxford and Karlsruhe Institute of Technology, Germany, made a system of less than 10 photons, the fundamental particles of light. The results of their experiments, published in Nature Physics, show that phase transitions still occur in systems made up of as few as seven particles on average.

Studying quantum behaviour of particles is much easier with fewer particles, so the fact that phase transitions occur in these small systems means scientists are better able to study quantum properties such as coherence.

Lead author Dr Robert Nyman, from the Department of Physics at Imperial, said: "Now that it's confirmed that 'phase transition' is still a useful concept in such small systems, we can explore properties in ways that would not be possible in larger systems.

"In particular, we can study the quantum properties of matter and light - what happens at the smallest scale when phase transitions occur." ..Read More...

Here's how graphene could make future electronics superfast



SPECTRAL SPECTACLE New experiments show that graphene is especially good at translating incoming signals of one frequency (illustrated in red) into signals of higher frequencies (yellow, green and blue).

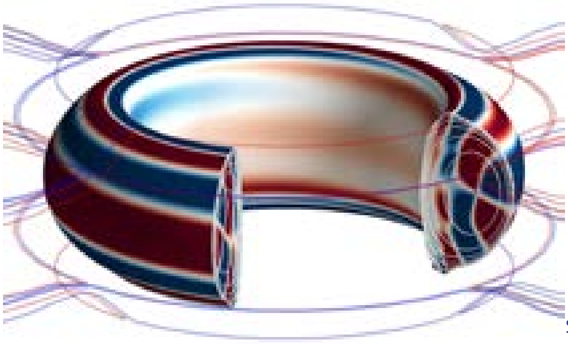
Graphene just added another badge to its supermaterial sash. New experiments show that this single layer of carbon atoms can transform electronic signals at gigahertz frequencies into higher-frequency terahertz signals — which can shuttle up to 1,000 times as much information per second.

Electromagnetic waves in the terahertz range are notoriously difficult to create, and conventional silicon-based electronics have trouble handling such high-frequency signals. But graphene-based devices could. These future electronics would work much faster than today's devices, researchers report online September 10 in Nature.

Physicist Dmitry Turchinovich of the University of Duisburg-Essen in Germany and colleagues tested graphene's terahertz-producing prowess by injecting a sheet of this atom-thick material with 300-gigahertz radiation. When these electromagnetic waves hit the graphene, electrons in the material rapidly heated and cooled off, releasing electromagnetic waves with frequencies up to seven times as high as the incoming radiation."This is yet another amazing result for graphene," says Orad Reshef, a physicist at the University of Ottawa not involved in the work. The 2-D material has been hailed as a supermaterial for its extraordinary abilities, such as conducting electric current with no resistance.

The graphene converted more than a thousandth, a ten-thousandth and a hundred-thousandth of the original 300-gigahertz signal into waves at 0.9, 1.5 and 2.1 terahertz, respectively. That conversion rate may seem small, but it's remarkably high for a lone layer of atoms, says Tsuneyuki Ozaki, a physicist at the National Institute of Scientific Research in Quebec City not involved in the work. Graphene-based computer components that can deal in terahertz "could be used, not in a normal Macintosh or PC, but perhaps in very advanced computers with high processing rates," Ozaki says. ...Read More...

Discovered: Optimal magnetic fields for suppressing instabilities in tokamaks



The s color-shaded regions on the smooth doughnut-shaped surface of the KSTAR plasma, together with the external 3D field coils in blue and red used to generate the distortion. Credit: Jong-Kyu Park, Princeton Plasma Physics Laboratory.

Fusion, the power that drives the sun and stars, produces massive amounts of energy. Scientists here on Earth seek to replicate this process, which merges light elements in the form of hot, charged plasma composed of free electrons and atomic nuclei, to create a virtually inexhaustible supply of power to generate electricity in what may be called a "star in a jar."

A long-time puzzle in the effort to capture the power of fusion on Earth is how to lessen or eliminate a common instability that occurs in the plasma called edge localized modes (ELMs). Just as the sun releases enormous bursts of energy in the form of solar flares, so flare-like bursts of ELMs can slam into the walls of doughnut-shaped tokamaks that house fusion reactions, potentially damaging the walls of the reactor.

Ripples control new bursts

To control these bursts, scientists disturb the plasma with small magnetic ripples called resonant magnetic perturbations (RMPs) that distort the smooth, doughnut shape of the plasma—releasing excess pressure that lessens or prevents ELMs from occurring. The hard part is producing just the right amount of this 3-D distortion to eliminate the ELMs without triggering other instabilities and releasing too much energy that, in the worst case, can lead to a major disruption that terminates the plasma.

Making the task exceptionally difficult is the fact that a virtually limitless number of magnetic distortions can be applied to the plasma, causing finding precisely the right kind of distortion to be an extraordinary challenge. But no longer.

Physicist Jong-Kyu Park of the U.S. Department of Energy's (DOE) Princeton Plasma Physics Laboratory (PPPL), working with a team of collaborators from the United States and the National Fusion Research Institute (NFRI) in Korea, have successfully predicted the entire set of beneficial 3-D distortions for controlling ELMs ...Read More...

Scientists discover a 'tuneable' novel quantum state of matter

When the Princeton researchers turn an external magnetic field in different directions (indicated with arrows), they change the orientation of the linear electron flow above the kagome (six-fold) magnet, as seen in these electron wave interference patterns on the surface of a topological quantum kagome magnet. Each pattern is created in the lab of Princeton Professor Zahid Hasan by a particular direction of the external magnetic field applied on the sample. Credit: M. Z. Hasan, Jia-Xin Yin, Songtian Sonia Zhang, Princeton University

Quantum particles can be difficult to characterize, and almost impossible to control if they strongly interact with each other—until now.

An international team of researchers led by Princeton physicist Zahid Hasan has discovered a quantum state of matter that can be "tuned" at will—and it's 10 times more tuneable than existing theories can explain. This level of manipulability opens enormous possibilities for next-generation nanotechnologies and quantum computing.

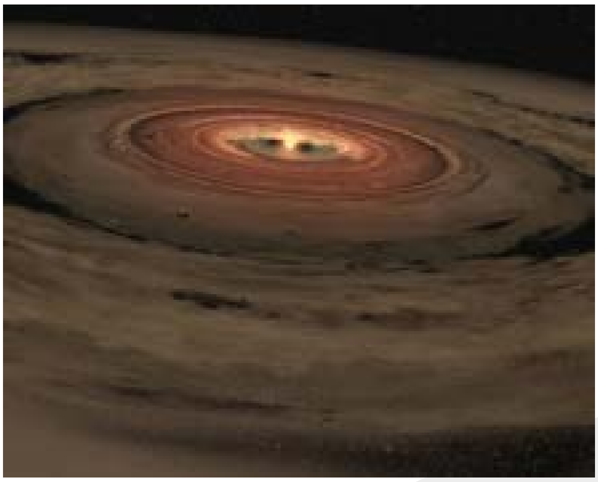
"We found a new control knob for the quantum topological world," said Hasan, the Eugene Higgins Professor of Physics. "We expect this is tip of the iceberg. There will be a new subfield of materials or physics grown out of this. ... This would be a fantastic playground for nanoscale engineering."

Hasan and his colleagues, whose research appears in the current issue of Nature, are calling their discovery a "novel" quantum state of matter because it is not explained by existing theories of material properties.

Hasan's interest in operating beyond the edges of known physics is what attracted Jiaxin Yin, a postdoctoral research associate and one of three co-first-authors on the paper, to his lab. Other researchers had encouraged him to tackle one of the defined questions in modern physics, Yin said.

"But when I talked to Professor Hasan, he told me something very interesting," Yin said. "He's searching for new phases of matter. The question is undefined. What we need to do is search for the question rather than the answer." The classical phases of matter—solids, liquids and gases—arise from interactions between atoms ...Read More...

Water in small dust grains can explain large amounts of water on Earth



Artist impression of a very young star surrounded by a disk of gas and dust. Scientists suspect that rocky planets such as the Earth are formed from these materials. Credit: NASA/JPL-Caltech

Water trapped in dust grains from which the Earth formed can explain the current large amount of water on Earth.

This is suggested by scientists from the Netherlands, Germany and the United Kingdom, based on calculations and simulations. The research will appear in two articles in the journal Astronomy & Astrophysics.

For a long time scientists have struggled with an explanation for the large amount of water on Earth. A first scenario states that the water is delivered by comets and asteroids that hit the Earth. According to a second scenario, the Earth was born 'wet' and the water was already present on ten-kilometer-big boulders from which the Earth was built up. However, the amount of water that these large boulders can contain is limited.

Now, an international team of scientists has devised and calculated a variant of the boulder-with-water scenario. The team shows that in the region where the Earth once originated, small to millimeter-sized dust grains can hold enough water. The water-rich dust grains then clump together to form pebbles and eventually kilometer-sized boulders. These boulders can then contain large amounts of water and they will eventually proceed to form Earth.

The new calculations also show that the small dust grains can collect enough water in 'only' a million years to explain the amount of water on Earth. A million years fits easily in the time it takes to form the larger boulders.

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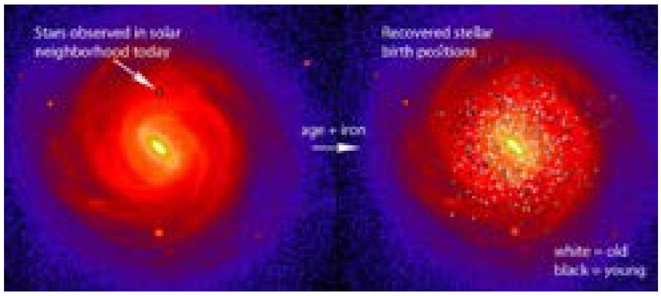
Uncovering the birthplaces of stars in the Milky Way



Left: A sample of about 600 stars situated very close to the Sun was used (approximate volume shown by arrow). Right: Using precise stellar age and iron content measurements, the stellar birth places could be recovered. Older stars were found to arrive preferentially from the inner parts of the disk (lighter coloured dots), while younger ones (darker coluored dots) were born closer to their current distance from the Galactic centre. The background image shows a simulation of a galaxy similar to the Milky Way for perspective. Credit: I. Minchev (AIP)

An international team of scientists led by Ivan Minchev of the Leibniz Institute for Astrophysics Potsdam (AIP) has found a way to recover the birth places of stars in our Galaxy. This is one of the major goals in the field of Galactic Archaeology, whose aim is to reconstruct the formation history of the Milky Way.

Stars in galactic discs have long been known to wander away from their birth sites owing to a phenomenon known as "radial migration." This movement across the Galaxy severely hampers inferences of the Milky Way formation history. Radial migration is influenced by a number of parameters: for example, the size and speed of the Galactic bar, the number and shape of spiral arms in the Galactic disc, and the frequency of smaller galaxies colliding with the Milky Way during the past 10 billion years and their respective masses.

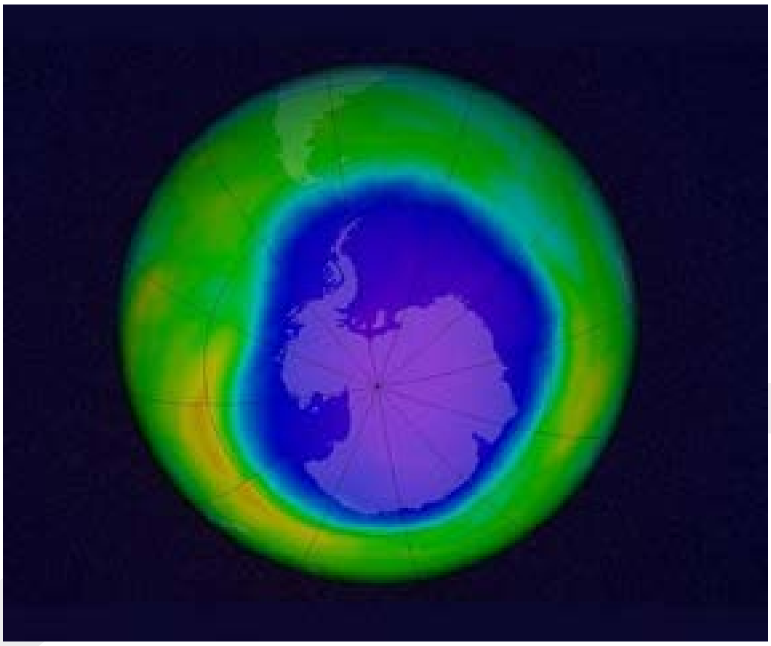
To circumvent these obstacles, the scientists devised a way of recovering the Galactic migration history using the ages and chemical composition of stars as "Archaeological artifacts." They used the well-established fact that star formation in the Galactic disc progresses gradually outwards, following that stars born at a given position at a particular time have a distinct chemical-abundance pattern. Therefore, if the age and chemical composition (its iron content, for example) of a star can be measured very precisely, it becomes possible to directly infer its birth position in the Galactic disc without additional modeling assumptions.

The team used a sample of about 600 solar-neighborhood stars observed with the high-resolution spectrograph HARPS mounted on the 3.6 m telescope of ESO's La Silla Observatory in Chile. Thanks to the very precise age and iron abundance measurements, it was found that these stars were born all across the Galactic disc, with older ones coming more from the central parts.

Researches can now use this method for calculation of birth places even for stars not in the ...Read More...

Special Read:

Protection for the ozone layer: sugar molecules bind harmful CFCs



File Illustration

Researchers at Johannes Gutenberg University Mainz (JGU) and Aschaffenburg University of Applied Sciences have managed to make a breakthrough when it comes to dealing with the extremely ozone-depleting chlorofluorocarbon Freon 11. Their findings could make a major contribution to protecting the endangered ozone layer.

Freon 11 is a chlorofluorocarbon (CFC). These substances were previously used, among other things, as coolants in refrigerators and as foaming agents for polyurethane foams. In the 1970s scientists realized that CFCs were damaging the protective ozone layer in the upper atmosphere and were also responsible for the appearance of the ozone hole. In addition, Freon 11 is 4,750 times more potent than carbon dioxide as a greenhouse gas, additionally contributing to global warming.

Although the Montreal Protocol banned the production and trade of this CFC in the late 1980s, it is still released today when refrigerators are recycled and is even traded on the black market. The ozone-depleting substance has also recently been the subject of repeated scientific and media attention.

A study published in the journal Nature reported an alarming recurrence and a sharp increase in the global release of Freon 11, which the authors were able to attribute to extensive illegal production and use of this substance in Chinese polyurethane foam factories.

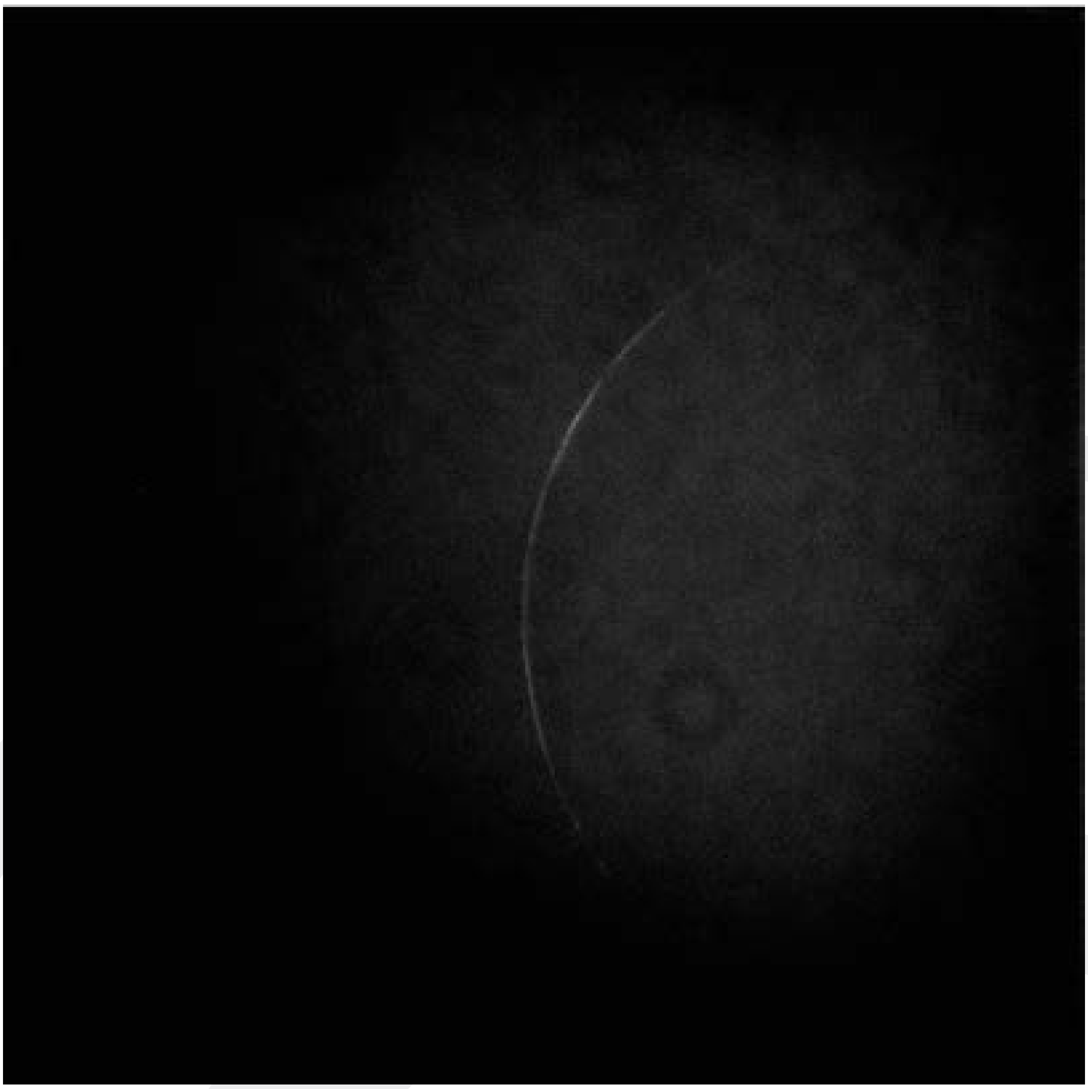
Being able to effectively adsorb and detect Freon 11 at an early stage, it would seem, is thus more important than ever. "If we can learn to safely handle this environmentally harmful substance, it would be not only of great scientific interest but also, and above all, a matter of worldwide benefit," emphasized Professor Siegfried Waldvogel of JGU, corresponding author of the study.

Sustainable and environmentally-friendly method of binding Freon 11
In their paper in the journal Global Challenges, the scientists from Mainz and Aschaffenburg describe a method of effectively binding both airborne and liquid phase Freon 11 using modified cyclic sugar molecules, i.e., a substance called methyl-substituted a-cyclodextrin.

This would prevent the release of the environmentally harmful foaming agent into the atmosphere, where it additionally impairs the stratosphere's ability to protect against UV radiation. The process of Freon 11 binding is reversible and the adsorbent medium can be fully regenerated under controlled conditions.

The recovered material can also be reused. This makes the process a sustainable and environmentally-friendly method of binding this extremely ozone-depleting substance, a method that can be readily employed when old refrigerators are scrapped, for example. ..Read More...

Crescent of Muharram 1440 AH



Crescent of Muharram 1440 AH - Sep. 10, 2018
(SCASS Observ. 17" Telescope - Time: 18:45)

This Week's Sky at a Glance - Sep. 15-21, 2018

Sep 17	Mo	03:15	First Quarter
		20:46	Moon-Saturn: 2.3° S
Sep 18	Tu	13:35	Moon South Dec.: 20.9° S
Sep 20	Th	04:54	Moon Apogee: 404900 km
		13:30	Moon Descending Node

UAE Space Agency Visit to SCASS - Sep. (12, 2018)

The Sharjah Center for Astronomy and Space Sciences had the visit of Eng. Mubarak Al-Ahbabi and Eng. Ahmed Al Darei from the UAE Space Agency on Wednesday, Sep. 12, 2018. This is part of a monthly discussion on the current projects sponsored by the agency. Dr. Ilias Fernini, the Deputy General Director for the Research Laboratories and Observatory along with SCASS research assistants have welcomed the team. An up-to-date status of the project funded by the UAESA "UAE Meteor Monitoring Network (UAEMMN)" has been presented along with discussion with research assistants and students on the different stages of the network. This network consists of three towers located at Sharjah, Abu-Dhabi, and the Liwa NCMS station in the Liwa region. The Sharjah tower is fully operational since Aug. 28. The second tower and third tower will be fully operational by Oct. 15, 2018.

Up to date, the Sharjah tower was able to detect more than 20 bright meteors. There is an ongoing simulation of the possible falling locations of these meteors even with just one tower working. As a background information, the network is being built to detect space-debris (man-made i.e., falling debris of a satellite, and also meteors). The three towers are located in such a way to cover the whole UAE sky. There is a plan to have more towers to increase the accuracy of the network to better focus the falling sites of the meteorites.

Among the researchers who attended the meeting: Mohamed Bassem Abdelmonem Abdelsalam; Yusra Mohamed Elkalyoubi; Takwa Mohamed Dawdi; Anas Omar Mohamad Adwan; Aisha Abdulla Alowais; Mariam Abdisalam Ahmed; Douae Nouichi; Safa Naseem; Khawla Alaa Ibrahim Kadry Hassan; Akhmad Hassan Ahmad Mohammad Ahmad; Shahab Mohammad Zarafshan; Masa Basel Mohƒ??d Alnaser; Maryam Essa A Sharif; Mohammed Fadil Talafha; Mohammad Baker Rihan; Sara Abdulmoein Chaar; Ridwan Mohammed Fernini; Noora Mohamad Alameri; Tarifa Mohammed Al Kaabi; Salma Subhi