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# iF Space Sciences NEWS

Prof. Ilias Fernini

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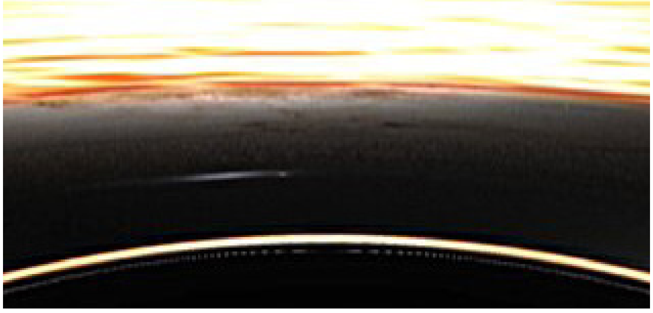
## New black hole visualization takes viewers beyond the brink



Credit: NASA's Goddard Space Flight Center/J. Schnittman and B. Powell

Ever wonder what happens when you fall into a black hole? Now, thanks to a new, immersive visualization produced on a NASA supercomputer, viewers can plunge into the event horizon, a black hole's point of no return.

"People often ask about this, and simulating these difficult-to-imagine processes helps me connect the mathematics of relativity to actual consequences in the real universe," said Jeremy Schnittman, an astrophysicist at NASA's Goddard Space Flight Center in Greenbelt, Maryland, who created the visualizations. "So I simulated two different scenarios, one where a camera—a stand-in for a daring astronaut—just misses the event horizon and slingshots back out, and one where it crosses the boundary, sealing its fate."

The visualizations are available in multiple forms. Explainer videos act as sightseeing guides, illuminating the bizarre effects of Einstein's general theory of relativity. Versions rendered as 360-degree videos let viewers look all around during the trip, while others play as flat all-sky maps.

To create the visualizations, Schnittman teamed up with fellow Goddard scientist Brian Powell and used the Discover supercomputer at the NASA Center for Climate Simulation. The project generated about 10 terabytes of data—equivalent to roughly half of the estimated text content in the Library of Congress—and took about 5 days running on just 0.3% of Discover's 129,000 processors. The same feat would take more than a decade on a typical laptop.

The destination is a supermassive black hole with 4.3 million times the mass of our sun, equivalent to the monster located at the center of our Milky Way galaxy.

"If you have the choice, you want to fall into a supermassive black hole," Schnittman explained. "Stellar-mass black holes, which contain up to about 30 solar masses, possess much smaller event horizons and stronger tidal forces, which can rip apart approaching objects before they get to the horizon."

This occurs because the gravitational pull on the end of an object nearer the black hole is much stronger than that on the other end. Infalling objects stretch out like noodles, a process astrophysicists call spaghettification.

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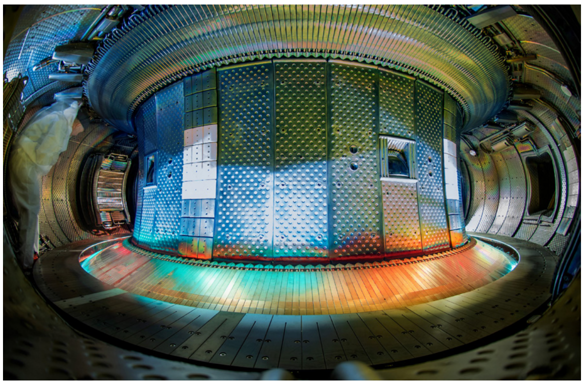
## Fusion record set for tungsten tokamak WEST



The interior of WEST, the tungsten (W) Environment in Steady-state Tokamak, where the fusion record was achieved. Credit: CEA-IRFM

Researchers at the U.S. Department of Energy's (DOE) Princeton Plasma Physics Laboratory (PPPL) measured a new record for a fusion device internally clad in tungsten, the element that could be the best fit for the commercial-scale machines required to make fusion a viable energy source for the world.

The device sustained a hot fusion plasma of approximately 50 million degrees Celsius for a record six minutes with 1.15 gigajoules of power injected, 15% more energy and twice the density than before. The plasma will need to be both hot and dense to generate reliable power for the grid.

The record was set in a fusion device known as WEST, the tungsten (W) Environment in Steady-state Tokamak, which is operated by the French Alternative Energies and Atomic Energy Commission (CEA). PPPL has long partnered with WEST, which is part of the International Atomic Energy Agency's group for the Coordination on International Challenges on Long duration OPeration (CICLOP).

This milestone represents an important step toward the CICLOP program's goals. The researchers will submit a paper for publication in the next few weeks.

"We need to deliver a new source of energy, and the source should be continuous and permanent," said Xavier Litaudon, CEA scientist and CICLOP chair. Litaudon said PPPL's work at WEST is an excellent example.

"These are beautiful results. We have reached a stationary regime despite being in a challenging environment due to this tungsten wall."

Remi Dumont, head of the Experimentation & Plasma Development Group of the CEA's Institute for Magnetic Fusion Research, was the scientific coordinator for the experiment, calling it "a spectacular result."

PPPL researchers used a novel approach to measure several properties of the plasma radiation. Their approach involved a specially adapted X-ray detector originally made by DECTRIS, an electronics manufacturer, and later embedded into the WEST tokamak, a machine that confines plasma—the ultra-hot fourth state of matter—in a donut-shaped vessel using magnetic fields.

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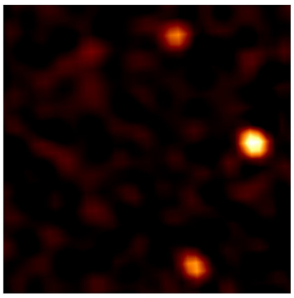
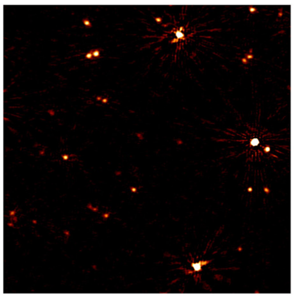
## Radio astronomers bypass disturbing Earth's atmosphere with new calibration technique





Old versus new. Left shows an image of a piece of sky observed with the hitherto best calibration technique. Right shows the same piece of sky with the new technique. More detail is visible, and what were once large, blurry patches now appear as single points. Credit: LOFAR/ Groeneveld et al.

An international team of researchers led by astronomers from Leiden University (Netherlands) has produced the first sharp radio maps of the universe at low frequencies. Thanks to a new calibration technique, they bypassed the disturbances of the Earth's ionosphere. They have used the new method to study plasmas from ancient black hole bursts. Potentially, the technique might be useful for finding exoplanets that orbit small stars. The researchers report their technique in the journal Nature Astronomy.

The technique allowed astronomers to take clear radio images of the universe at frequencies between 16 and 30 MHz for the first time. This was thought to be impossible, because the ionosphere, at about 80 kilometers above the Earth, interferes with observations at these frequencies. The researchers used the LOFAR telescope in Drenthe, the Netherlands. This is currently one of the best low-frequency radio telescopes in the world. To test their technique, they studied a number of galaxy clusters that had previously only been studied in detail at higher frequencies.

Thanks to the new images, it appears that the radio emission from these clusters is not evenly distributed across the entire cluster, but rather there is a spot pattern. "It's like putting on a pair of glasses for the first time and no longer seeing blurred," said research leader Christian Groeneveld of Leiden University.

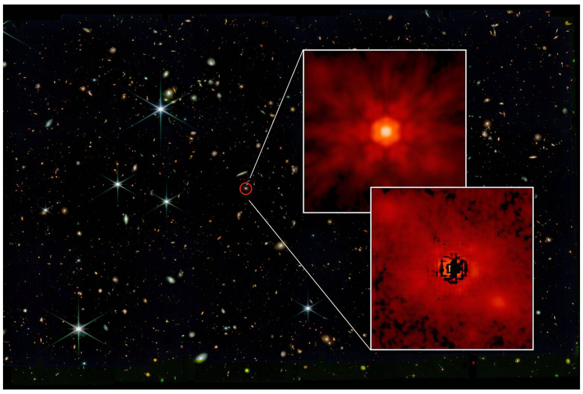
The motivation for the research was that at high frequencies, around 150 MHz, many improvements in calibration had already been made in recent years.

"We hoped that we could also extend this technique to lower frequencies, below 30 MHz," says the originator of the idea, Reinout van Weeren of Leiden University. "And we succeeded."

At the moment, the researchers are processing more data in order to map the entire northern sky at the lower frequencies.

According to the researchers, the new calibration technique makes it possible to study phenomena that were previously hidden. It might be used to detect exoplanets orbiting small stars. And, Groeneveld concludes, "There is, of course, a chance that we will eventually discover something unexpected." ...Read More...

## 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 centers 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.

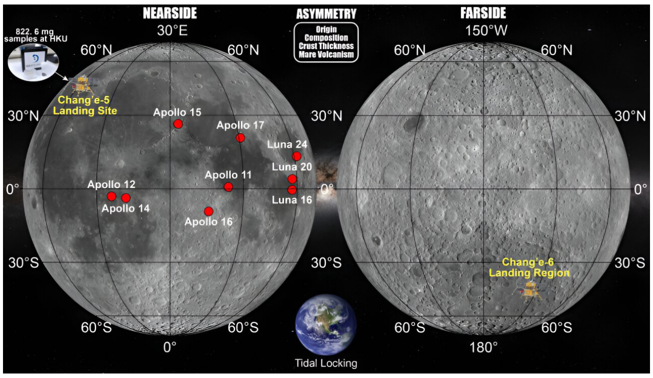
Because they are so bright, quasars outshine the rest of the galaxy in which they reside. But the MIT team was able for the first time to observe the much fainter light from stars in the host galaxies of three ancient quasars.

Based on this elusive stellar light, the researchers estimated the mass of each host galaxy, compared to the mass of its central supermassive black hole. They found that for these quasars, the central black holes were much more massive relative to their host galaxies, compared to their modern counterparts.

The findings, published today in The Astrophysical Journal, may shed light on how the earliest supermassive black holes became so massive despite having a relatively short amount of cosmic time in which to grow. In particular, those earliest monster black holes may have sprouted from more massive "seeds" than more modern black holes did.

"After the universe came into existence, there were seed black holes that then consumed material and grew in a very short time," says study author Minghao Yue, a postdoc in MIT's Kavli Institute for Astrophysics and Space Research. "One of the big questions is to understand how those monster black holes could grow so big, so fast." ...Read More...

# Geologists reveal mysterious and diverse volcanism in lunar Apollo Basin, Chang'e-6 landing site




The Chang'e-6 mission is the world's first lunar farside sample-return mission. Credit: Dr. Yuqi Qian

The far side of the moon is a mysterious place that is never visible from the Earth. The most remarkable feature of the moon is its asymmetry between the lunar near side and far side in composition, crust thickness, and mare volcanism. Scientists have not yet reached a consensus on the origin of the lunar asymmetry due to the lack of far side samples, which is one of the most significant remaining questions of lunar science.

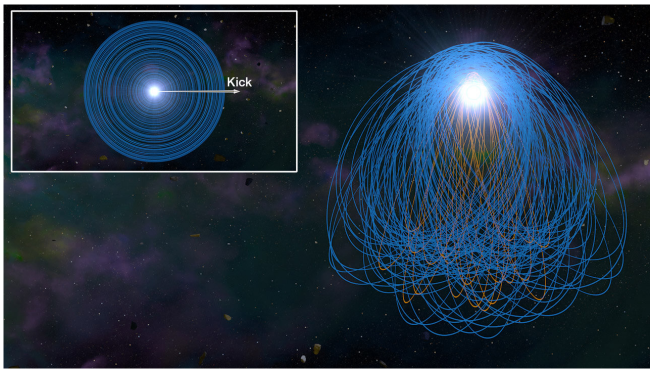
The Chang'e-6 mission, launched on May 3, 2024, and currently heading to the moon, is the world's first lunar far side sample-return mission. It aims to return ~2 kg lunar soils to the Earth from the southern mare plain of the Apollo basin within the South Pole-Aitken basin, the largest known impact feature in the solar system. These samples contain enormous scientific potential that can be used to solve the lunar dichotomy conundrum and even reshape our knowledge of our closest neighbor.

As shown in a recent paper published in Earth and Planetary Science Letters, Dr. Yuqi Qian, Professors Joseph Michalski and Guochun Zhao from the Department of Earth Sciences at The University of Hong Kong (HKU) and their international collaborators have comprehensively studied the volcanism of the Apollo basin and its surroundings, which revealed the mysterious and diverse volcanism of the Chang'e-6 landing site with significant implications for the Chang'e-6 sample analysis and the origin of the lunar dichotomy.

The study has found that the Apollo basin has extensive volcanic activities lasting from the Nectarian (~4.05 billion years ago) to the Eratosthenian Period (~1.79 billion years ago). Volcanic activity in the region was significantly influenced by crustal thickness. Dikes in intermediate-thickness crust tend to stall beneath the crater floor, spreading laterally to form a sill and floor-fractured crater.

Dikes below the crust thinned by the Apollo basin event reached directly to the surface and erupted to form widespread lava flows, and dikes in thick crust stall before being able to reach the surface and form basaltic dike intrusions. "This fundamental finding indicates that the crustal thickness discrepancy between near side and far side may be the primary cause of lunar asymmetrical volcanism," said Dr. Qian. "This can be tested by the returned Chang'e-6 samples." ...Read More...

# Hungry, hungry white dwarfs: Solving the puzzle of stellar metal pollution




Planetesimal orbits around a white dwarf. Initially, every planetesimal has a circular, prograde orbit. The kick forms an eccentric debris disk which with prograde (blue) and retrograde orbits (orange). Credit: Steven Burrows/Madigan Group/JILA

Dead stars known as white dwarfs, have a mass like the sun while being similar in size to Earth. They are common in our galaxy, as 97% of stars will eventually become white dwarfs. As stars reach the end of their lives, their cores collapse into the dense ball of a white dwarf, making our galaxy seem like an ethereal graveyard. Despite their prevalence, the chemical makeup of these stellar remnants has been a conundrum for astronomers for years. The presence of heavy metal elements—like silicon, magnesium, and calcium—on the surface of many of these compact objects is a perplexing discovery that defies our expectations of stellar behavior.

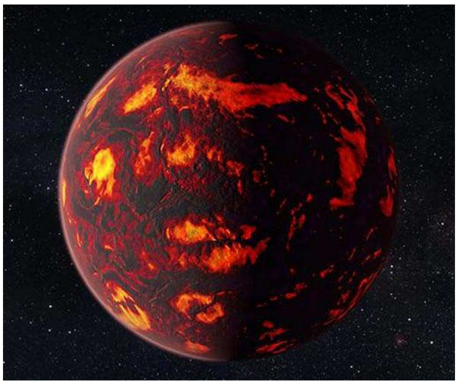
"We know that if these heavy metals are present on the surface of the white dwarf, the white dwarf is dense enough that these heavy metals should very quickly sink toward the core," explains JILA graduate student Tatsuya Akiba. "So, you shouldn't see any metals on the surface of a white dwarf unless the white dwarf is actively eating something."

While white dwarfs can consume various nearby objects, such as comets or asteroids (known as planetesimals), the intricacies of this process have yet to be fully explored. However, this behavior could hold the key to unraveling the mystery of a white dwarf's metal composition, potentially leading to exciting revelations about white dwarf dynamics.

In results reported in a new paper in The Astrophysical Journal Letters, Akiba, along with JILA Fellow and University of Colorado Boulder Astrophysical and Planetary Sciences professor Ann-Marie Madigan and undergraduate student Selah McIntyre, believe they have found a reason why these stellar zombies eat their nearby planetesimals. Using computer simulations, the researchers simulated the white dwarf receiving a "natal kick" during its formation (which has been observed) caused by asymmetric mass loss, altering its motion and the dynamics of any surrounding material.

In 80% of their test runs, the researchers observed that, from the kick, the orbits of comets and asteroids within a range of 30 to 240 AU of the white dwarf (corresponding to the sun–Neptune distance and beyond) became elongated and aligned. Furthermore, around 40% of subsequently eaten planetesimals come from counter-rotating (retrograde) orbits. ...Read More...

## Evidence of atmosphere discovered on rocky exoplanet 55 Cancri e



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A collaborative study involving multiple research institutions including NASA's Jet Propulsion Laboratory and the University of New Mexico, recently published in Nature, reveals that the exoplanet 55 Cancri e may possess an atmosphere-a surprising discovery given its harsh conditions.

The exoplanet, situated just 41 light years away, orbits its sun-like star at a close proximity that results in extreme temperatures. Its unique orbit, completing a full cycle in less than a day, ensures one side of the planet is always exposed to daylight while the other remains in constant night.

"The discovery of an atmosphere on 55 Cancri e is the clearest piece of information we have obtained so far," said UNM Assistant Professor Diana Dragomir, who has been closely studying the exoplanet since her doctoral thesis.

The presence of the atmosphere is attributed to volcanic activity on the planet, which likely contributes to maintaining a secondary atmosphere through continuous emissions of volcanic gases. This recent insight into 55 Cancri e's atmosphere was enabled by the James Webb Space Telescope, which provided the high-resolution images necessary for this level of analysis.

The research suggests the atmosphere could be composed of vaporized rock and gases such as carbon monoxide and dioxide. "This study is one of the first of its kind to utilize Webb telescope data for exoplanet atmosphere analysis," noted Michael Bess, a recent graduate who collaborated on the project.

While the planet is too hostile for life as we know it, the discovery advances our understanding of planetary formation and atmosphere retention under extreme conditions.

Further investigations are required to confirm these findings and to explore other characteristics of 55 Cancri e, potentially unlocking more secrets of this intriguing exoplanet. "The ability to study such distant rocky planets in detail is a testament to the advances in our astronomical technologies," Dragomir added.

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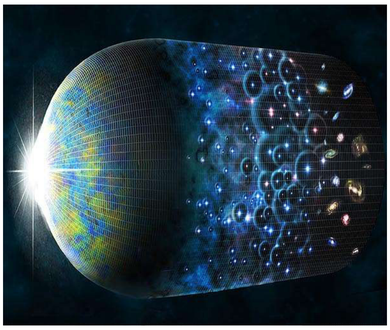
## HKU scientists develop new method to detect universe's earliest stars



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Astrophysicists from The University of Hong Kong have unveiled a new technique to detect the universe's first stars, known as Population III stars. These stars, primarily composed of hydrogen and helium, differ significantly from modern stars like our Sun and those forming today. Despite their massive size and high temperature, Population III stars were ephemeral and critical in the synthesis of heavier elements and the formation of subsequent star generations.

Until now, direct detection of these ancient stars has been elusive due to their faintness and vast distance from Earth. The new method involves observing the remnants of Population III stars that have been disrupted by massive black holes' tidal forces. This process results in tidal disruption events (TDEs), during which the black hole consumes the stellar debris, emitting exceptionally bright flares detectable from Earth.

Professor Jane Lixin Dai, the project's principal investigator, explained, "As the energetic photons travel from a very faraway distance, the timescale of the flare will be stretched due to the expansion of the Universe. These TDE flares will rise and decay over a very long period of time, which sets them apart from the TDEs of solar-type stars in the nearby Universe." Further insights were provided by Dr. Rudrani Kar Chowdhury, stating, "Interestingly, not only are the timescales of the flares are stretched, so is their wavelength. The optical and ultraviolet light emitted by the TDE will be transferred to infrared emissions when reaching the Earth."

This discovery is timely as NASA's James Webb Space Telescope (JWST) and the forthcoming Nancy Grace Roman Space Telescope are well-equipped to observe these infrared emissions. Professor Priya Natarajan highlighted the Roman telescope's capabilities, noting its potential to significantly advance our understanding of the early universe through the detection of Pop III TDE flares. Janet Chang, a PhD student involved in the research, anticipates the detection of numerous such events annually with the proper observational strategies.

This breakthrough sets the stage for significant discoveries about the universe's first stars and the mysteries surrounding its origins.

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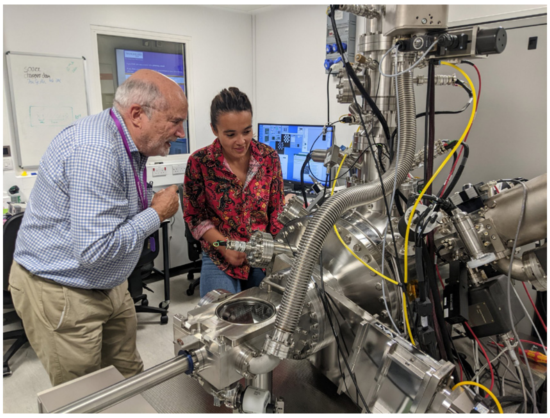
## New super-pure silicon chip opens path to powerful quantum computers



Co-authors (left) Prof David Jamieson (University of Melbourne) and (right) Dr. Maddison Coke (University of Manchester) inspect the P-NAME focused ion beam system at the University of Manchester used for the silicon enrichment project. Credit: University of Melbourne / University of Manchester

Researchers at the Universities of Melbourne and Manchester have invented a breakthrough technique for manufacturing highly purified silicon that brings powerful quantum computers a big step closer. The new technique to engineer ultra-pure silicon makes it the perfect material to make quantum computers at scale and with high accuracy, the researchers say.

Project co-supervisor Professor David Jamieson, from the University of Melbourne, said the innovation, published in Communications Materials, uses qubits of phosphorous atoms implanted into crystals of pure stable silicon and could overcome a critical barrier to quantum computing by extending the duration of notoriously fragile quantum coherence.

"Fragile quantum coherence means computing errors build up rapidly. With robust coherence provided by our new technique, quantum computers could solve in hours or minutes some problems that would take conventional or 'classical' computers—even supercomputers—centuries," Professor Jamieson said.

Quantum bits or qubits—the building blocks of quantum computers—are susceptible to tiny changes in their environment, including temperature fluctuations. Even when operated in tranquil refrigerators near absolute zero (minus 273 degrees Celsius), current quantum computers can maintain error-free coherence for only a tiny fraction of a second. University of Manchester co-supervisor Professor Richard Curry said ultra-pure silicon allowed construction of high-performance qubit devices—a critical component required to pave the way towards scalable quantum computers.

"What we've been able to do is effectively create a critical 'brick' needed to construct a silicon-based quantum computer. It's a crucial step to making a technology that has the potential to be transformative for humankind," Professor Curry said.

Lead author Ravi Acharya, a joint University of Manchester/University of Melbourne Cookson Scholar, said the great advantage of silicon chip quantum computing was it used the same essential techniques that make the chips used in today's computers.

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## Advanced experimental setup expands the hunt for hidden dark matter particles

Final assembly of germanium radiation detectors for the Majorana Demonstrator in 2015. These detectors produced a low-background, "quiet" data set that researchers used to search for signs of dark matter and other physics beyond the Standard Model. Credit: Matthew Kapust, Sanford Underground Research Facility.

Scientific evidence for dark matter comes from observing how it influences the motion of stars and galaxies. Scientists believe that dark matter may consist of particles. To search for these particles and their billiard ball-like collisions, researchers have used some of the largest, most sensitive experiments ever built.

However, these experiments have yet to see signals of dark matter. Scientists predict that dark matter particles would be very weakly interacting. This means detectors on Earth should be able to sense a "wind" in dark matter particles as the Earth moves through dark matter and collides with a small number of the particles.

Another possibility is that when a rare collision happens, the dark matter may be totally absorbed, generating a tiny jolt of energy. The Majorana Demonstrator is a radiation detector that is very sensitive to this type of interaction. The experiment is deep underground and shielded from ambient radiation such as cosmic rays, and its detectors are extremely sensitive to small jolts of energy.

These features allowed scientists to perform a search five to 10 times more sensitive than similar detectors. The researchers did not detect the expected signal from dark matter. This allows scientists to update the limits on the possible mass of dark matter in several different models. These results are likely to remain the best limits for some time using this particular detector technology.

Understanding the nature and origin of dark matter would completely revolutionize scientists' understanding of the universe. Many theoretical models of dark matter predict that its signals can be detected using low-background radiation detectors.

By looking for specific types of dark matter and finding no signal, scientists operating the Majorana Demonstrator experiment have significantly narrowed the characteristics of potential dark matter particles. Although their study published in the journal Physical Review Letters did not directly detect dark matter, it used an approach that can help guide future experiments.

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## Physicist achieve milestone in quantum simulation with circular Rydberg qubits

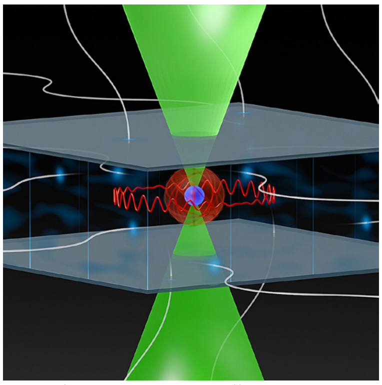


Illustration of a circular strontium Rydberg atom trapped in optical tweezers. Credit: Aaron Götzelmann, University of Stuttgart

A team of researchers from the 5th Institute of Physics at the University of Stuttgart is making important progress in the field of quantum simulation and quantum computing based on Rydberg atoms by overcoming a fundamental limitation: the limited lifetime of Rydberg atoms. Circular Rydberg states are showing enormous potential for overcoming this limitation.

The paper is published in the journal Physical Review X.

In the world of quantum computing and quantum simulation technology, there is a fundamental challenge when using neutral atoms: The lifetime of Rydberg atoms, which are the building blocks for quantum computing, is limited. But there is a promising solution: circular Rydberg states.

For the first time, the research team has succeeded in generating and capturing circular Rydberg atoms of an alkaline-earth metal in an array of optical tweezers.

"This is exciting because they are particularly stable and can extend the lifetime of a quantum bit enormously. They therefore have great potential for the development of more powerful quantum simulators," says Dr. Florian Meinert, Head of the Junior Research Group at the 5th Institute of Physics, who is in charge of the project.

**The significance of circular Rydberg atoms**

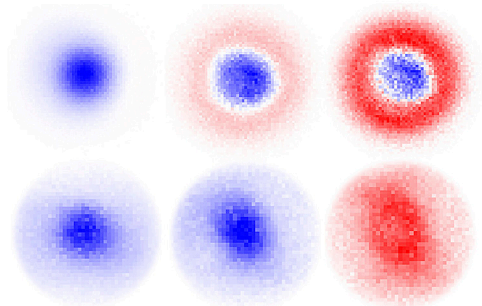
A circular Rydberg atom is a particular type of Rydberg atom in which the excited electron follows a circular path around the atomic nucleus. Compared to other Rydberg states, these atoms have an increased stability and a longer lifetime. This makes them attractive candidates for use as qubits.

Circular Rydberg states have been known for decades and were the key to Nobel Prize-winning experiments on the quantum nature of light-matter interaction. Recently, the potential of these states for quantum computing has been increasingly discussed again.

**Strontium, an alkaline-earth metal**

Strontium, an alkaline-earth metal with two optically active electrons, was chosen to create the Rydberg atom since it offers unique possibilities. Once prepared in the circular Rydberg state, the second electron orbiting the atomic nucleus can be used for quantum operations that are already known from research on ion quantum computers. ...Read More...

## Scientists demonstrate the potential of electron spin to transmit quantum information



Magnon wave packet propagation in an antiferromagnet is revealed in these snapshots obtained using pairs of laser pulses. Credit: Joseph Orenstein/Berkeley Lab

The spin of the electron is nature's perfect quantum bit, capable of extending the range of information storage beyond "one" or "zero." Exploiting the electron's spin degree of freedom (possible spin states) is a central goal of quantum information science.

Recent progress by Lawrence Berkeley National Laboratory (Berkeley Lab) researchers Joseph Orenstein, Yue Sun, Jie Yao, and Fanghao Meng has shown the potential of magnon wave packets—collective excitations of electron spin—to transport quantum information over substantial distances in a class of materials known as antiferromagnets.

Their work upends conventional understanding about how such excitations propagate in antiferromagnets. The coming age of quantum technologies—computers, sensors, and other devices—depends on transmitting quantum information with fidelity over distance.

With their discovery, reported in a paper published in Nature Physics, Orenstein and coworkers hope to have moved a step closer to these goals. Their research is part of broader efforts at Berkeley Lab to advance quantum information by working across the quantum research ecosystem, from theory to application, to fabricate and test quantum-based devices and develop software and algorithms.

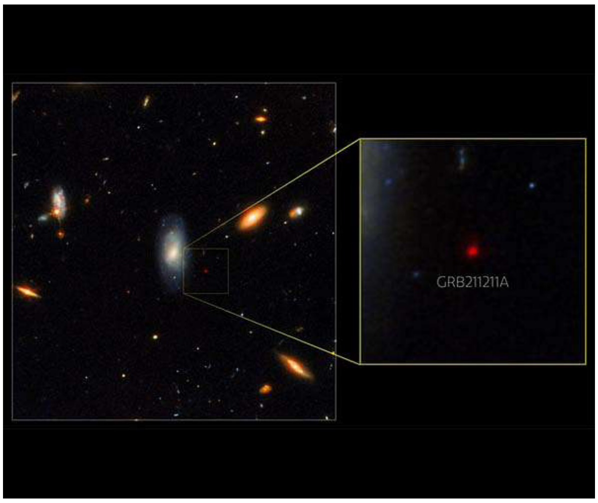
Electron spins are responsible for magnetism in materials and can be thought of as tiny bar magnets. When neighboring spins are oriented in alternating directions, the result is antiferromagnetic order, and the arrangement produces no net magnetization.

To understand how magnon wave packets move through an antiferromagnetic material, Orenstein's group used pairs of laser pulses to perturb the antiferromagnetic order in one place while probing at another place, yielding snapshots of their propagation. These images revealed that magnon wave packets propagate in all directions, like ripples on a pond from a dropped pebble.

The Berkeley Lab team also showed that magnon wave packets in the antiferromagnet CrSBr (chromium sulfide bromide) propagate faster and over longer distances than the existing models would predict. The models assume that each electron spin couples only to its neighbors. ...Read More...

## Special Read:

# Novel Methodology Reveals Early X-ray Emissions of Gamma-Ray Bursts Across Cosmic Distances

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Scientists at ICRA and ICRANet have developed an innovative approach that significantly enhances the observation of early X-ray emissions from gamma-ray bursts (GRBs), utilizing the cosmological time dilation effect. This method allows for the detection of events occurring at the very edge of the observable universe, around 500 million years post-big bang, providing a new lens through which to study the early universe.

GRBs, known for their intense luminosities which can rival the collective output of all stars in the observable universe within seconds, have been a focal point for astronomers. However, the technical limitations of the XRT instrument on the Neil Gehrels Swift Observatory satellite have historically restricted timely observations of these bursts' early X-ray emissions, typically within about 40 seconds of detection.

The research team tackled this challenge by analyzing data from the Swift GRB catalog, which includes 368 GRBs with measured distances spanning from 2005 to the end of 2023. Through their analysis, the team was able to identify early X-ray emissions in over 220 GRB events by exploiting the time dilation effects present at high cosmological redshifts. These findings provide crucial insights into the dynamics of the cosmos at its nascent stages.

"Our results not only extend our capabilities in observing the universe but also challenge our theoretical understanding of these monumental cosmic events," said Prof. Remo Ruffini, Director of ICRANet. "By observing GRBs at such high redshifts, we effectively see these events in slow motion, which dramatically increases our window of observation relative to their cosmological timeline."

In detailing their methodology, the team highlighted the cases of GRB 090423, GRB 090429B, and GRB 220101A, observed at redshifts of 8.233, approximately 9.4, and 4.61, respectively. These particular observations verified the collapse of the carbon-oxygen core and the formation of new neutron stars, which are thought to trigger the GRB under the binary-driven hypernova model. Additionally, the team observed the spin-up and subsequent slowdown of the neutron stars, potentially punctuated by brief gravitational wave emissions marking a transition in the star's rotation.

Moreover, the analysis of the redshift distribution within these GRB samples supports the hypothesis that certain types of hypernovae may evolve into binary neutron star systems, which later serve as progenitors for short GRBs. This correlation provides a novel perspective on the lifecycle of neutron stars and their role in the cosmos.

The findings, detailed in the team's publication in The Astrophysical Journal, promise to not only refine existing models of GRBs but also assist in planning future missions. Upcoming missions like THESEUS and HERMES, equipped with wide field-of-view X-ray instruments, are poised to take advantage of this methodology, providing immediate observations of GRB emissions without the delays that currently hamper our understanding.

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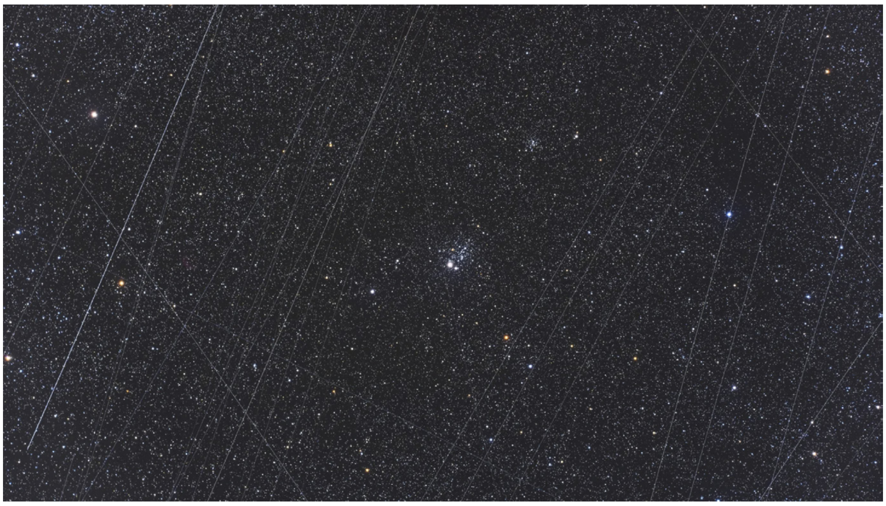
# Special Read:

## Blinded by the light: How bad are satellite megaconstellations for astronomy?



This is NGC 457, the ET or Owl Cluster in Cassiopeia, in a stack of images showing the total number of satellite trails recorded over the 36 minutes of total exposure time on a night in mid-October. By coincidence, the trails frame the main subject, but the number of satellites now above us make it nearly impossible to take a long-exposure image, certainly at the start or end of a night, without recording at least one satellite trail, if not more, per image. (Image credit: Alan Dyer/VW Pics/Universal Images Group via Getty Images)

“We are just beginning to appreciate how bad the disruption can be for land-based and space-based telescopes, and as more and more satellite overflights occur, the problems will only intensify.”

Over the past few years, our planet has become increasingly encircled by Starlink, OneWeb and other “megaconstellation” satellites. Yes, the emergence of those megaconstellations offers great benefits for humanity. But in a wait-a-minute pause, there are also substantial costs, including a growing imposition on astronomy. That’s the view of David Koplow, the Scott K. Ginsburg Professor of Law at Georgetown University Law Center in Washington, D.C.

“We are just beginning to appreciate how bad the disruption can be for land-based and space-based telescopes, and as more and more satellite overflights occur, the problems will only intensify,” Koplow told Inside Outer Space.

**Legal rights**

Koplow’s concerns have been voiced in several scholarly works, the titles of which underscore his qualms, such as: “Large Constellations of Small Satellites: The Good, the Bad, the Ugly and the Illegal,” as well as “Blinded by the Light: Resolving the Conflict Between Satellite Megaconstellations and Astronomy.”

“The world has mostly been assuming that the relevant international law basically allows the satellite companies to do whatever they want in space, while forcing the observatories to adapt as well as they can,” Koplow said. But in reality, the legal regime is not so one-sided, according to Koplow: “Astronomers also have legal rights to free use of space, and they need not stand by idly while their profession is damaged.”

**‘Hair on fire’ emergency?**

Koplow pointed out that, in 2019, the world of optical and radio astronomy changed abruptly and massively when the first big batch of SpaceX’s Starlink satellites launched to low Earth orbit.

“Jolted by the sudden brightness of those spacecraft, and alarmed by the prospect of their legions of successors, observatories scrambled to respond,” Koplow observed.

They did so by studying and documenting the true dimensions of the problem, beginning to invent or conceptualize mitigation measures, and entering into discussions with SpaceX and other companies.

“Some astronomers see this as a true ‘hair on fire’ emergency, heralding irretrievable losses to space science; others present a more sanguine face, depicting this as yet another challenge to be surmounted in surveying a decreasingly pristine sky,” Koplow remarked.
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# Farewell to Mrs. Maryam Al-Ansari
# May 09, 2024

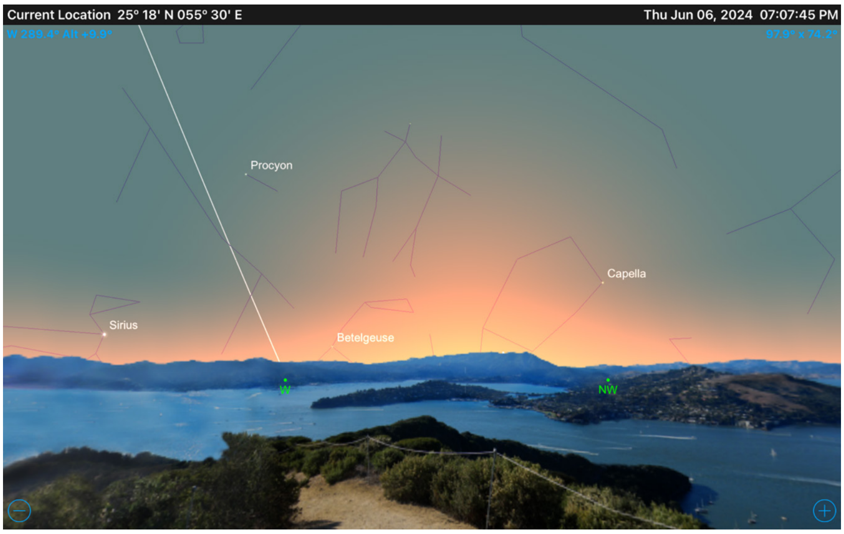
With heavy hearts and profound gratitude, the Space Sciences Department bid farewell to Mrs. Maryam Al-Ansari, a beacon of excellence and innovation in our CubeSat Laboratory at the Sharjah Academy for Astronomy, Space Sciences, and Technology. As Mrs. Maryam embarks on a new chapter in her professional life, leaving behind a legacy etched in the stars, we reflect on her invaluable contributions and unwavering dedication. Her exemplary skills as an engineer have been instrumental in propelling the CubeSat Lab to new heights, culminating in the resounding success of the Sharjah-Sat-1 mission.

Mrs. Maryam's tireless commitment, coupled with her boundless enthusiasm and open-hearted spirit, has not only inspired her colleagues but also enriched the fabric of our departmental community. Her departure leaves a palpable void, as her presence was not merely felt in the laboratory but also in the warmth of her camaraderie and the depth of her expertise. Though we bid farewell with a tinge of sadness, we do so knowing that Mrs. Maryam's brilliance will continue to illuminate whichever path she chooses to tread. We extend our heartfelt wishes for her continued success and fulfillment in her new endeavor, confident that she will excel as she always has. Farewell, Mrs. Maryam Al-Ansari, and may your destiny guide you towards ever-greater achievements and boundless horizons.

# Observing Dhu’l Hijjah 1445 AH Crescent
# June 06, 2024

Here is below some basic astronomical Information about the observations of the crescent of Dhu’l Qiddah 1445 AH for the city of Sharjah:

| | June 06, 2024<br>Sun/Moon data | June 07, 2024<br>Sun/Moon Data |
|---|---|---|
| **New Moon** | 4:37 pm | -- |
| **Sunset (Azimuth)** | 7:07 pm (296$^0$) | 7:07 pm (296$^0$) |
| **Moonset (Azimuth)** | 7:17 pm (301$^0$) | 8:20 pm (302$^0$) |
| **Moon's Altitude** | 1.4$^0$ | 13.2$^0$ |
| **Moon's Illumination (%)** | 0.17+ | 1.68+ |
| **Lag Time (Minutes)** | 10 | 73 |
| **Age (Hrs, Min)** | 2h 30min | 26h 30min |




An impossible setting for the crescent to be observed on June 06 with the naked eye or the telescope because of the low elevation and young age. The simulation shows the extremely low location of the Moon. **We should expect Dhu’l Hijjah 1445 AH’s first day to be Saturday, June 08, 2024.**

## This Week’s Sky at a Glance - May 11-17, 2024

| | | | |
|---|---|---|---|
| **May 11** | Sa | 11:4 | Moon North Dec.: 28.5° N |
| **May 13** | Mo | 02:17 | Moon-Pollux: 1.7° N |
| **May 13** | Mo | 14:45 | Uranus Conjunction |
| **May 14** | Tu | 02:47 | Moon-Beehive: 3.7° S |
| **May 15** | We | 15:48 | First Quarter |
| **May 15** | We | 22:43 | Moon-Regulus: 3.9° S |
| **May 17** | FR | 23:00 | Moon Apogee: 404600 km |

**Note - Some astronomical events listed above do happen during daylight, so they are not observable.**