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Astronomy & Physics Weekly News

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Top News

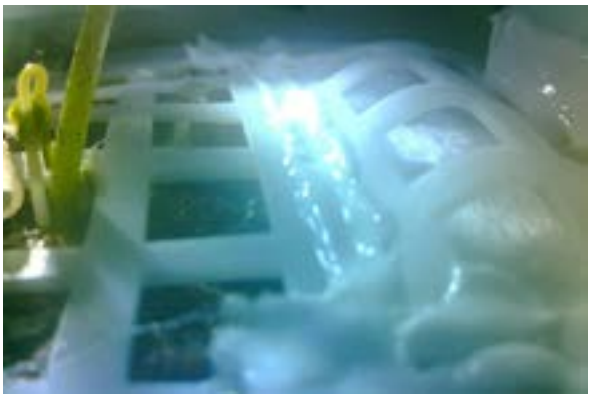
جامعة الشارقة
UNIVERSITY OF SHARJAH

IAU 100 Years: Under One Sky

IT Support Issam Jami

Design by Mohamed Bakir

Cottoning on: Chinese seed sprouts on moon



The sprout has emerged inside a canister since the Chang'e-4 lander set down on the moon's surface earlier this month

A small green shoot is growing on the moon in an out-of-this-world first after a cotton seed germinated on board a Chinese lunar lander, scientists said Tuesday.

The sprout has emerged from a lattice-like structure inside a canister since the Chang'e-4 lander set down earlier this month, according to a series of photos released by the Advanced Technology Research Institute at Chongqing University.

"This is the first time humans have done biological growth experiments on the lunar surface," said Xie Gengxin, who led the design of the experiment.

The Chang'e-4 probe—named after a Chinese moon goddess—made the world's first soft landing on the moon's "dark side" on January 3, a major step in China's ambitions to become a space superpower.

Scientists from Chongqing University —who designed the "mini lunar biosphere" experiment—sent an 18-centimetre (seven-inch) bucket-like container holding air, water and soil.

Inside are cotton, potato, and arabidopsis seeds—a plant of the mustard family—as well as fruit fly eggs and yeast.

Images sent back by the probe show a cotton sprout has grown well, but so far none of the other plants has taken, the university said.

Chang'e-4 is also equipped with instruments developed by scientists from Sweden, Germany and China to study the lunar environment, cosmic radiation and the interaction between solar wind and the moon's surface.

The lander released a rover, dubbed Yutu-2 (Jade Rabbit), that will perform experiments in the Von Karman Crater.

The agency said four more lunar missions are planned, confirming the launch of a probe by the end of the year to bring back samples from the moon.

China wants to establish a lunar research base one day, possibly using 3D printing technology ...Read More...

Researchers discover new evidence of superconductivity at near room temperature

Credit: CCO Public Domain

Researchers at the George Washington University have taken a major step toward reaching one of the most sought-after goals in physics: room temperature superconductivity.

Superconductivity is the lack of electrical resistance and is observed in many materials when they are cooled below a critical temperature. Until now, superconducting materials were thought to have to cool to very low temperatures (minus 180 degrees Celsius or minus 292 degrees Fahrenheit), which limited their application. Since electrical resistance makes a system inefficient, eliminating some of this resistance by utilizing room temperature superconductors would allow for more efficient generation and use of electricity, enhanced energy transmission around the world and more powerful computing systems.

"Superconductivity is perhaps one of the last great frontiers of scientific discovery that can transcend to everyday technological applications," Maddury Somayazulu, an associate research professor at the GW School of Engineering and Applied Science, said. "Room temperature superconductivity has been the proverbial 'holy grail' waiting to be found, and achieving it—albeit at 2 million atmospheres—is a paradigm-changing moment in the history of science."

The key to this discovery was creation of a metallic, hydrogen-rich compound at very high pressures: roughly 2 million atmospheres. The researchers used diamond anvil cells, devices used to create high pressures, to squeeze together miniscule samples of lanthanum and hydrogen. They then heated the samples and observed major changes in structure. This resulted in a new structure, LaH10, which the researchers previously predicted would be a superconductor at high temperatures.

While keeping the sample at high pressures, the team observed reproducible change in electrical properties. They measured significant drops in resistivity when the sample cooled below 260 K (minus 13 C, or 8 F) at 180-200 gigapascals of pressure, presenting evidence of superconductivity at near-room temperature. In subsequent experiments, the researchers saw the transition occurring at even higher temperatures, up to 280 K. Throughout the experiments, the researchers also used X-ray diffraction to observe the same phenomenon. This was done through a synchrotron beamline of the Advanced Photon Source at Argonne National Laboratory in ...Read More...

Weird Star System's Planet-Forming Disk Goes Vertical Like a Ferris Wheel

An artist's illustration of the star system HD 98800, which features a pair of stars orbited by a vertical planet-forming disk of material. Credit: Mark Garlick/University of Warwick

Planet-forming disks of material typically orbit around the equators of stars, but now scientists have discovered such rings can go dramatically awry and encircle the poles of stars instead. The new study suggests that worlds could exist with polar orbits around pairs of stars, potentially leading to seasons extraordinarily different than Earth's.

Stars are born within clouds of gas and dust. The gravitational pull of each star draws such material into spiraling orbits around it. Although clumps of this cloud start off moving in random directions at random speeds, as the cloud collapses, the clumps collide and merge. The result over time is a flattened disk called a protoplanetary disk that usually spins in the same direction as its star and surrounds the star's equator. The planets that emerge from such a disk also typically orbit around the star's equator, as is the case with the worlds of our solar system.

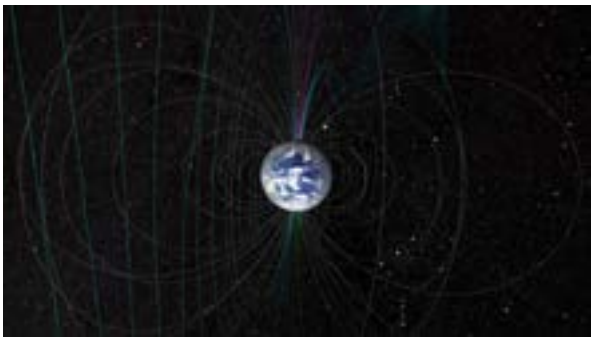
Prior work found that nearly all young stars are initially surrounded by protoplanetary disks. In the case of protoplanetary disks around single stars, at least a third go on to form planets, said lead study author Grant Kennedy, an astronomer at the University of Warwick in England.

However, computer simulations have previously suggested that after protoplanetary disks have formed, any extra material they collect can knock them off-kilter. This could explain why astronomers have detected exoplanets with relatively crooked orbits around stars.

Kennedy and his colleagues focused on so-called circumbinary planets, which orbit around binary stars. Scientists had suspected that planets around binary stars could become misaligned — instead of orbiting the stars in the same plane in which the stars orbit one another, these worlds could orbit around their poles instead.

Now, Kennedy and his colleagues have detected the first example of a misaligned circumbinary protoplanetary disk. "It's one of those examples that nature manages to be more creative than we expect," Kennedy ...Read More...

Earth's Magnetic Pole Is Wandering, Lurching Toward Siberia



The shape of Earth's magnetic field is the result of both the planet's north and south magnetic poles as well as the stream of particles coming from the sun. Credit: NASA's Scientific Visualization Studio

Earth's north magnetic pole is on the move, unpredictably lurching away from the Canadian Arctic and toward Siberia. It's wandered so much, that the current representation of the entire globe's magnetic field, just updated in 2015, is now out of date. And so, geologists have come up with a new model.

This updated model, called the World Magnetic Model, was supposed to be published Jan. 15, but it's now been delayed to Jan. 30, on account of the government shutdown.

Once it's made public, the new model will inform a wide array of navigation, including those directing airplanes and ships to people checking Google Maps on their smart devices.

The World Magnetic Model is one of a handful of models — another is called the International Geomagnetic Reference Field — that track so-called declination, or the difference between true, or geographic, north (that is, the North Pole) and magnetic north (the point where your compass needle points). Knowing that declination for points across the globe allows one to convert between a magnetic bearing and a true bearing, according to a report on the 2015 model. In that way, ships, aircraft, antennas, drilling equipment and other devices can be oriented.

The latest World Magnetic Model was designed to last until 2020, but magnetic north's rapid and unexpected surge toward Siberia was so great, that researchers had to amend the model early, Arnaud Chulliat, a geomagnetist at the University of Colorado Boulder and the National Oceanic and Atmospheric Administration's (NOAA's) National Centers for Environmental Information, told Nature.

News of the magnetic north's meanderings isn't exactly new. Researchers figured out in the 1800s that magnetic north tended to drift. Then, in the mid-1990s, it began moving faster, from just over 9 miles (15 kilometers) a year to about 34 miles (55 km) annually, ...Read More...

Rotating black holes as portals for hyperspace travel

Want to travel to another dimension? Choose your black hole wisely. Image via Vadim Sadovski/Shutterstock.com

One of the most cherished science fiction scenarios is using a black hole as a portal to another dimension or time or universe. That fantasy may be closer to reality than previously imagined.

Black holes are perhaps the most mysterious objects in the universe. They are the consequence of gravity crushing a dying star without limit, leading to the formation of a true singularity – which happens when an entire star gets compressed down to a single point yielding an object with infinite density. This dense and hot singularity punches a hole in the fabric of spacetime itself, possibly opening up an opportunity for hyperspace travel. That is, a short cut through spacetime allowing for travel over cosmic scale distances in a short period.

Researchers previously thought that any spacecraft attempting to use a black hole as a portal of this type would have to reckon with nature at its worst. The hot and dense singularity would cause the spacecraft to endure a sequence of increasingly uncomfortable tidal stretching and squeezing before being completely vaporized.

Flying through a black hole

My team at the University of Massachusetts Dartmouth and a colleague at Georgia Gwinnett College have shown that all black holes are not created equal. If the black hole like Sagittarius A*, located at the center of our own galaxy, is large and rotating, then the outlook for a spacecraft changes dramatically. That's because the singularity that a spacecraft would have to contend with is very gentle and could allow for a very peaceful passage.

The reason that this is possible is that the relevant singularity inside a rotating black hole is technically "weak," and thus does not damage objects that interact with it. At first, this fact may seem counterintuitive. But one can think of it as analogous to the common experience of quickly passing one's finger through a candle's near 2,000-degree flame, without getting burned.

My colleague Lior Burko and I have been investigating the physics of black holes for over two decades....Read More...

A cosmic flare called the 'Cow' may reveal a new way that stars die

An odd stellar flare called the "Cow" was observed by telescopes around the world, including the Australia Telescope Compact Array (shown) near Narrabri, Australia.

Astronomers may have discovered a new way that stars can die. A mysteriously brief and bright burst whimsically called the "Cow" reveals an entirely new type of stellar death.

The details of that stellar doom, however, remain hazy. Scientists are still debating whether the flare-up, spotted on June 16, 2018, was from an unusual type of star that was eaten by a black hole, or from an old, massive star exploding in a weird sort of supernova.

The Asteroid Terrestrial-impact Last Alert System telescope in Hawaii first detected the explosion, and gave the event the random name AT2018cow. "It was immediately dubbed, to avoid this mouthful of letters, the Cow," said astronomer Daniel Perley in a news conference January 10 at the American Astronomical Society meeting.

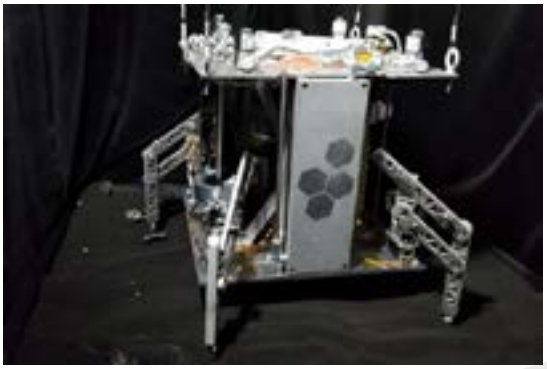
Right away, the Cow was weird. The first observations showed that it came from a star-forming dwarf galaxy about 200 million light-years away in the constellation Hercules. But the Cow was particularly bright for being so far away, suggesting it was about 10 times the luminosity of a typical supernova and 100 billion times the luminosity of the sun. It also appeared suddenly, going from invisible to peak brightness in just two days, far faster than most ordinary supernovas.

"This combination of being very fast and very luminous is very unusual," said Perley, of Liverpool John Moores University in England. "Many of us got very excited."

Over the following months, a slew of telescopes rushed to follow up on the Cow in wavelengths of light spanning the electromagnetic spectrum, from long radio waves to short gamma rays. "The Cow has become one of the most intensely observed cosmic events in history," said astronomer Anna Ho of Caltech at the meeting.

Those follow-up observations revealed that the Cow was surrounded by dense material moving at a tenth of the speed of light. The burst of light also lasted for several months, growing gradually dimmer across a ...Read More...

Steam-powered spaceship could cruise the cosmos indefinitely without running out of gas



By using steam rather than fuel, the World Is Not Enough (WINE) spacecraft prototype can theoretically explore "forever," as long as water and sufficiently low gravity is presentUniversity of Central Florida

Come one, come all and behold the future of space travel: steam power!

No, seriously; half a century after the world's first manned space mission, it seems that interplanetary travel has finally entered the steam age. Scientists at the University of Central Florida have teamed up with Honeybee Robotics, a private space and mining tech company based in California, to develop a small, steam-powered spacecraft capable of sucking its fuel right out of the asteroids, planets and moons it's exploring.

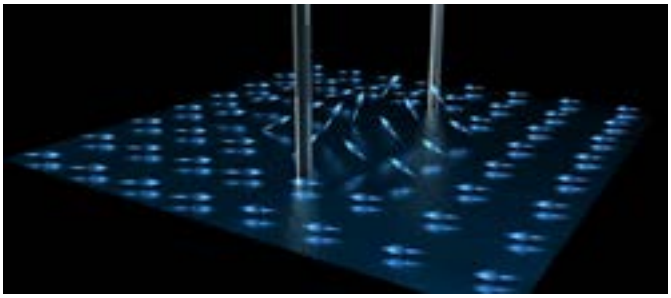
By continuously turning extraterrestrial water into steam, this microwave-sized lander could, theoretically, power itself on an indefinite number of planet-hopping missions across the galaxy – so long as it always lands somewhere with H20 for the taking.

"We could potentially use this technology to hop on the moon, Ceres, Europa, Titan, Pluto, the poles of Mercury, asteroids – anywhere there is water and sufficiently low gravity," Phil Metzger, a UCF space scientist and one of the chief minds behind the steampunk starship, said in a statement. Metzger added that such a self-sufficient spacecraft could explore the cosmos "forever."

Metzger and his colleagues call the lander WINE (short for "World Is Not Enough"), and a prototype of the craft recently completed its first test mission on a simulated asteroid surface in California. Using a compact drilling apparatus, the lander successfully mined the fake comet for water, converted that H20 into rocket propellant and launched itself into the air using a set of steam-powered thrusters.

While the phrase "steam-powered spaceship" might initially evoke images of a rusty, gear-laden, fog-belching bucket of bolts, the technology behind WINE is far more complex than it sounds. ...Read More...

New quantum structures in super-chilled helium may mirror early days of universe



Representation of the spin vectors of the liquid helium as they form half quantum vortices. Credit: Ella Maru Studios

For the first time, researchers have documented the long-predicted occurrence of 'walls bound by strings' in superfluid helium-3. The existence of such an object, originally foreseen by cosmology theorists, may help explaining how the universe cooled down after the Big Bang. With the newfound ability to recreate these structures in the lab, earth-based scientists finally have a way to study some of the possible scenarios that might have taken place in the early universe more closely.

The findings, to be published 16th January in Nature Communications, came after two successive symmetry-breaking phase transitions at Aalto University's Low Temperature Laboratory.

Helium stays a liquid at atmospheric pressure even when chilled down to absolute zero, at which all other materials freeze solid. Not only does helium remain fluid at cryogenic temperatures, but it becomes a superfluid at a sufficiently low temperature. A superfluid material has essentially zero viscosity, which means it should flow forever without losing energy.

When confined to a nano-structured volume, researchers can use superfluid phases of the isotope helium-3 to study effects like half-quantum vortices—whirlpools in the superfluid where the amount of helium flowing is strictly controlled by the rules of quantum physics.

"We initially thought that the half-quantum vortices would disappear when we lowered the temperature. It turns out that they [half-quantum vortices] actually survive as the helium-3 sample is cooled below half a millikelvin—instead a nontopological wall appears," says Jere Mäkinen, lead author of the study and doctoral student at Aalto University.

While not physical walls, which would block flow, the nontopological walls alter the magnetic properties of helium. The researchers were able to detect the changes using nuclear magnetic resonance.

In the first few microseconds after the Big Bang, some cosmologists believe the entire universe experienced symmetry-breaking phase transitions, like ...Read More...

Scientists discover new ways to twist and shift light

Credit: CC0 Public Domain

The results from the National Physical Laboratory's (NPL) latest research in photonics could open doors to new quantum technologies and telecoms systems.

Researchers from the National Physical Laboratory (NPL) have revealed unusual qualities in light that could lead the way to entirely new electronic devices and applications. Light is used extensively in electronics for telecommunications and computing. Optical fibres are just one common example of how light is used to facilitate telephone calls and internet connections across the globe.

As outlined today in Physical Review Letters, NPL researchers investigated how light can be controlled in an optical ring resonator, a tiny device that can store extremely high light intensities. Just as certain 'whispers' can travel around a whispering gallery and be heard the other side, in an optical ring resonator wavelengths of light resonate around the device.

The first-of-its-kind study uses optical ring resonators to identify the interplay of two types of spontaneous symmetry breaking. By analysing how the time between pulses of light varied and how the light is polarised, the team has been able reveal new ways to manipulate light.

For instance, usually light will obey what is known as 'time reversal symmetry', meaning that if time is reversed, light should travel back to its origin. However, as this research shows, at high light intensities this symmetry is broken within optical ring resonators.

Francois Copie, scientist on the project explains: "When seeding the ring resonator with short pulses, the circulating pulses within the resonator will either arrive before or after the seed pulse but never at the same time."

As a potential application, this could be used to combine and rearrange optical pulses e.g. in telecommunication networks.

The research also showed that light can spontaneously change its polarisation in ring resonators. This is as if a guitar string was initially plucked in the vertical direction but suddenly starts to vibrate either in a clockwise or an anticlockwise circular motion. ...Read More...

CERN lays out vision for next-generation particle collider

Aerial View of the CERN. Credit: CERN

Scientists behind the world's largest atom smasher have laid out their multibillion-euro vision to build an even bigger one, in hopes of unlocking even more secrets of matter and the universe in the coming decades.

Officials at CERN, the European Organization for Nuclear Research, presented Tuesday their study for a "Future Circular Collider" inside a 100-kilometer (62-mile) circumference tunnel that could start operating in 2040.

It would sit next to the current 27-kilometer (17-mile) circumference Large Hadron Collider near Geneva, which is perhaps best known for helping confirm the subatomic Higgs boson in 2012.

Officials hope for a decision by CERN's 22 member states within the next few years about the project that would debut with an electron-positron collider at an estimated cost of 9 billion euros ($10.25 billion).

A second phase would involve a superconducting proton machine in the same tunnel, at a cost of about 15 billion euros more. That machine could start operation in the late 2050s.

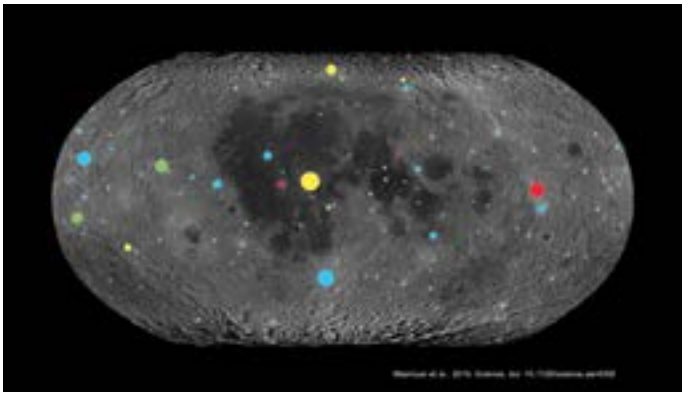
The concept paper, five years in the making, aimed to explore prospects of "tantalizingly more powerful particle colliders that can inaugurate the post-LHC era in high-energy physics," CERN said on its website.

Ultimately, the FCC would include a superconducting proton accelerator ring with energy of up to 100 tera electron volts, compared with a maximum 17 TeV in the current collider.

CERN Director-General Fabiola Gianotti called the report "a remarkable achievement" that could help boost understanding of fundamental physics and advance technologies.

CERN said it was not possible to say exactly what benefits the new collider would bring to the world, but pointed out that the discovery of the electron in 1897 led to the electronics industry that now contributes $3 trillion annually to the world economy. ...Read More...

Scientists find increase in asteroid impacts on ancient Earth by studying the Moon



SwRI was part of a team that used Lunar Reconnaissance Orbiter data to study the moon's craters, scaled by size and color-coded by age here, to understand the impact history of the Earth. The lunar surface is dominated by blue craters younger than 290 million years old, which is consistent with those on Earth, indicating that bombardments on both bodies has increased since that time. Credit: NASA/LRO/USGS/University of Toronto

An international team of scientists is challenging our understanding of a part of Earth's history by looking at the Moon, the most complete and accessible chronicle of the asteroid collisions that carved our solar system.

In a study published today in Science, the team shows the number of asteroid impacts on the Moon and Earth increased by two to three times starting around 290 million years ago.

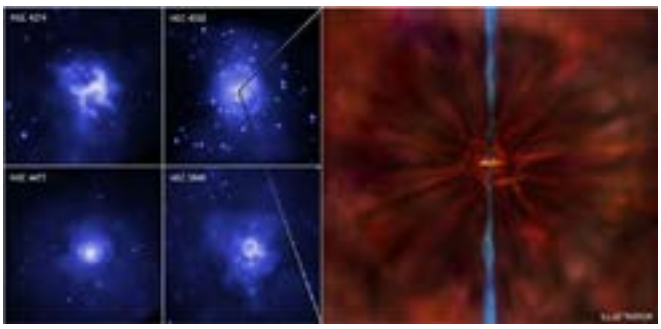
"Our research provides evidence for a dramatic change in the rate of asteroid impacts on both Earth and the Moon that occurred around the end of the Paleozoic era," said lead author Sara Mazrouei, who recently earned her Ph.D. in the Department of Earth Sciences in the Faculty of Arts & Science at the University of Toronto (U of T). "The implication is that since that time we have been in a period of relatively high rate of asteroid impacts that is 2.6 times higher than it was prior to 290 million years ago."

It had been previously assumed that most of Earth's older craters produced by asteroid impacts have been erased by erosion and other geologic processes. But the new research shows otherwise.

"The relative rarity of large craters on Earth older than 290 million years and younger than 650 million years is not because we lost the craters, but because the impact rate during that time was lower than it is now," said Rebecca Ghent, an associate professor in U of T's Department of Earth Sciences and one of the paper's co-authors. "We expect this to be of interest to anyone interested in the impact history of both Earth and the Moon, and the role that it might have played in the history of life on Earth."

Scientists have for decades tried to understand the rate that asteroids hit Earth by using radiometric dating of the rocks around them to determine their ages. But because it was believed erosion caused some craters to disappear, it was difficult to find an accurate impact rate ...Read More...

Researchers discover black hole in our galaxy spinning rapidly around itself



The Chandra images show pairs of huge bubbles, or cavities, in the hot gaseous atmospheres of the galaxies, created in each case by jets produced by a central supermassive black hole. Credit: X-ray: NASA/CXC Illustration: CXC/M. Weiss.

A University of Southampton-led project has shown a black hole spinning near its maximum possible rate around its axis.

The study, funded by the Royal Society and published in the Astrophysical Journal, comprised an international team of astronomers led by the University and sheds more light on the characteristics of black holes and the environment surrounding them.

Using observations from state-of-the-art technology, the team of researchers found evidence that a stellar-mass black hole in our galaxy (known as 4U 1630-472) is rotating rapidly (at a speed of 92-95 per cent of the theoretically-allowed rotational speed) around its axis while sucking in falling material. It is subject to gravitational stresses and temperatures so high that it begins to shine brightly in X-rays, which were seen by astronomers using telescopes.

According to Einstein's General Theory of Relativity (GR), if a black hole is rotating rapidly, then it will modify the space and time around it in a way which is different than that for a black hole which is not rotating.

Such modifications from high spin rates leave an impression on the shape of the radiation from the material rotating very close to the black hole before disappearing. Therefore, if the change in shape of the emitting spectra can be determined somehow, then the GR can be used to measure the black hole spin.

The findings from this study are significant as previously high spin rates of approximately five black holes have been quantified accurately.

Dr. Mayukh Pahari, from the University of Southampton and lead author, said: "Detecting signatures that allow us to measure spin is extremely difficult. The signature is embedded in the spectral information which is very specific to the rate at which matter falls into the black hole. The spectra, however, are often very ...Read More...

Special Read:

When You Look Up, How Far Back in Time Do You See?

Distant stars above the ruins of Sherborne Old Castle in the UK. Credit: Rich Grundy/Flickr, CC BY-NC

Our senses are stuck in the past. There's a flash of lightning, and then seconds pass until we hear the rumble of distant thunder. We hear the past.

We are seeing into the past too.

While sound travels about a kilometre every three seconds, light travels 300,000 kilometres every second. When we see a flash of lighting three kilometres away, we are seeing something that happened a hundredth of a millisecond ago. That's not exactly the distant past.

But as we look further afield, we can peer further back. We can see seconds, minutes, hours and years into the past with our own eyes. Looking through a telescope, we can look even further into the past.

A second back in time

If you really want to look back in time, you need to look up.

The Moon is our nearest celestial neighbour - a world with valleys, mountains and craters.

It's also about 380,000km away, so it takes 1.3 seconds for light to travel from the Moon to us. We see the Moon not as it is, but as it was 1.3 seconds ago.

The Moon doesn't change much from instant to instant, but this 1.3-second delay is perceptible when mission control talks to astronauts on the Moon. Radio waves travel at the speed of light, so a message from mission control takes 1.3 seconds to get to the Moon, and even the quickest of replies takes another 1.3 seconds to come back.

Minutes and hours

It's not hard to look beyond the Moon and further back in time. The Sun is about 150 million km away, so we see it as it was about 8 minutes ago.

Even our nearest planetary neighbours, Venus and Mars, are tens of millions of kilometres away, so we see them as they were minutes ago. When Mars is very close to Earth, we are seeing it as it was about three minutes ago, but at other times light takes more than 20 minutes to travel from Mars to Earth.

This presents some problems if you're on Earth controlling a Rover on Mars. If you're driving the Rover at 1km per hour then the lag, due to the finite speed of light, means the rover could be 200 metres ahead of where you see it, and it could travel another 200 metres after you command it to hit the brakes.

Not surprisingly, Martian Rovers aren't breaking any speed records, travelling at 5cm per second (0.18kph or 0.11mph), and on-board computers help with driving, to prevent rover wrecks. Not surprisingly, Martian Rovers aren't breaking any speed records, travelling at 5cm per second (0.18kph or 0.11mph), with rovers following carefully programmed sequences and using on-board computers to avoid hazards and prevent punctures. ..Read More...

This Week's Sky at a Glance - Jan. 19-25, 2019

Jan. 20	Su	03:20	Moon North Dec.: 21.5° N
Jan. 21	Mo	02:48	Moon Ascending Node
		09:12	Total Lunar Eclipse (Not Visible)
		09:16	Full Moon
		19:32	Moon-Beehive: 0.6° N
		23:58	Moon Perigee: 357300 km
Jan. 22	Tu	19:10	Venus-Jupiter: 2.4° N
Jan. 23	We	05:41	Moon-Regulus: 2.5° S

2nd UAE Meteor Monitoring Network Tower is Up and Running

A team from SCASS (Ilias Fernini, Issam Abu-Jami, Ridwan Fernini, and Mohamed Talafha) spent a week (Jan. 12-16) in Yahar North (Al-Ain, UAE) to build the second UAE Meteor Monitoring Network tower as part of the UAEMMN project sponsored by the UAE Space Agency. The first and third tower have already been built in Sharjah and Liwa, respectively. With the second tower operating, the system of three towers is ready to catch any space debris (natural, i.e., meteors, or man-made falling space satellites) over the UAE sky. The SCASS team was also joined by Anas Adwan, Shahab Mohammad Zarafshan, and Sahith Reddy Madara to help in building the Yahar tower.