

Welcome to the July 2023 issue

SCIENCE NEWS *Monthly* is produced by the Science Department, St Benedict's Catholic Secondary School, Bury St Edmunds, Suffolk, UK.

EDITOR'S NOTE: the frontpage article this month is provided by one of our keen Year 7 astronomers, **SOPHIA ISABELLA RIVERA** (7A). Sophia is clearly impressed by nature's spectacular light show – the Northern Lights. Sophia has obviously done some good research that has enabled her to write an excellent article for this month's Science News.

5 THINGS YOU SHOULD KNOW ABOUT THE NORTHERN LIGHTS

1. The Colours of The Northern Lights Are Determined By Gas

The different colours of the Northern Lights are caused by collisions between electrons entering the Earth's atmosphere and gaseous particles. The colours depend on which gas is involved and how high in the ionosphere the reaction takes place. Oxygen causes green lights at lower altitudes, and red lights at higher altitudes. Nitrogen particles causes blue or purplish-red lights.

2. The Sun Is What Ultimately Creates Northern Lights

As mentioned above, aurora activity is caused by electrons that enter the Earth's atmosphere, but where do these electrons come from? The Sun! That huge ball of fire and gas goes through an eleven-year cycle which is measured by the number of sunspots (magnetic storms on the sun's surface) which are visible from Earth. The more sunspots we see, the more solar flare energy is being released into space, eventually making its way to Earth into our atmosphere causing beautiful aurora activity.

3. The "Southern Lights" Are A Thing Too!

The Northern Lights also go by the name *aurora borealis*, a name coined by Galileo in 1619 after the Roman goddess of dawn, *Aurora*, and the Greek name for the north wind, *Boreas*. However, did you know there is also an *aurora australis*? Also known as the Southern Lights, it is the southern hemisphere's counterpart. They are visible from New Zealand, Argentina, and southern Chile.

4. You Can See The Northern Lights In Outer Space.

The Northern (and Southern) lights are visible from space. Astronauts on the International Space Station quite possibly have the best view of the incredible phenomenon.

5. We Aren't the Only Planet With Northern Lights.

Speaking of space. Earth isn't the only planet with aurora activity. Auroras have been observed on Jupiter, Saturn, Uranus, Neptune, Venus, and Mars, although Mercury has never had Auroras.

HUMAN WORLD - World's oldest human footprint identified in South Africa

Just over two decades ago, as the new millennium began, it seemed that tracks left by our ancient human ancestors dating back more than about 50,000 years were excessively rare. In 2023 the situation is very different. It appears that people were not looking hard enough or were not looking in the right places. Today the African tally for dated hominin *ichnosites* (a term that includes both tracks and other traces) older than 50,000 years stands at 14. We can conveniently divide these into an East African cluster (five sites) and a South African cluster from the Cape coast (nine sites). There are a further 10 sites elsewhere in the world including the UK and the Arabian Peninsula.

The traces left by our human ancestors as they moved about ancient landscapes are a useful way to complement and enhance our understanding of ancient hominins in Africa. In an article published in *Ichnos*, the international journal of trace fossils, researchers provided the ages of seven newly dated hominin ichnosites. They identified them in the past five years on South Africa's Cape south coast. These sites now form part of the "South African cluster" of nine sites. The sites ranged in age: the most recent dates back about 71,000 years. The oldest, which dates back **153,000 years**, is one of the more remarkable finds recorded in this study. It is the oldest footprint thus far attributed to our species, *Homo sapiens*.



The new dates corroborate the archaeological record, along with other evidence from the area and time period. This includes the development of sophisticated stone tools, art, jewellery and harvesting of shellfish. It confirms that the Cape south coast was an area in which early anatomically modern humans survived, evolved and thrived, before spreading out of Africa to other continents.

There are significant differences between the East African and South African tracksite clusters. The East African sites are much older. Laetoli, the oldest, is 3.66 million years old, and the youngest is 0.7 million years old. The tracks were <u>not</u> made by *Homo sapiens*, but by earlier species such as australopithecines, Homo heidelbergensis and Homo erectus. For the most part, the surfaces on which the East African tracks occur have had to be laboriously and meticulously excavated and exposed. The South African sites on the Cape coast, by contrast, are substantially younger. Scientists have attributed all of them to Homo sapiens. And the tracks tend to be fully exposed when they're discovered. They're in rocks known as aeolianites, which are the cemented versions of ancient dunes.

A key challenge when studying the paleo-record – trackways, fossils, or any other kind of ancient sediment – is determining how old the materials are. Without this, it is difficult to evaluate the wider significance of a find, or to interpret the climatic changes that create the geological record. In the case of the Cape south coast aeolianites, the dating method of choice is often **optically stimulated luminescence**. This method of dating shows how long ago a grain of sand was exposed to sunlight. In other words, it shows how long that section of sediment has been buried. Given how the tracks in this study were formed – impressions made on wet sand, followed by burial with new blowing sand – it's a good method as we can be reasonably confident that the dating "clock" started at about the same time the trackway was created.

https://theconversation.com/worlds-oldest-homo-sapiens-footprint-identified-on-south-africas-cape-south-coast-205310

PRE-HUMAN WORLD - How a 3.2-million-year-old human relative named Lucy walked

When the remains of an early human ancestor were found in Ethiopia in 1974, the discovery provided an unprecedented look at a species that lived millions of years before humans walked the Earth. The rare fossil, representing 40% of a skeleton belonging to a female *Australopithecus afarensis*, was named "Lucy," for the Beatles song "Lucy in the Sky with Diamonds."

Now, researchers are using the skeleton to figure out how this ancient human relative moved 3.2 million years ago. The findings of the study were published in the journal *Royal Society Open Science*. Lucy was shorter than the average human, reaching about 3.3 feet (1 metre) in height, had an ape-like face and a brain about one-third the size of a human brain. Analysis of Lucy's fossil over the past 20 years has suggested that she and others of her species walked upright. But lead study author Dr. Ashleigh L.A. Wiseman, a research associate at the University of Cambridge in the United Kingdom, wanted to take things a step further and recreate a component of Lucy that didn't fossilize: her muscles.



Wiseman and her colleagues developed a method called **polygonal muscle modelling**. Wiseman

applied it to Lucy to understand the shape and size of her muscles and how she used them to move, concluding that she did truly walk upright.

HEALTH - New superbug-killing antibiotic discovered using AI

AI (Artificial Intelligence) is receiving a bad press at the moment, but it is not all doom and gloom. As has been reported in earlier issues of the *News*, the use of AI could revolutionise the way we prepare new and more powerful drugs, especially antibiotics.

Antibiotics kill bacteria. However, there has been a lack of new drugs for decades and bacteria are becoming harder to treat, as they evolve resistance to the ones we have. More than a million people a year are estimated to die from infections that resist treatment with antibiotics. The researchers focused on one of the most problematic species of bacteria - *Acinetobacter baumannii*, which can infect wounds and cause pneumonia. You may not have heard of it, but it is one of the three superbugs the World Health Organization has identified as a "critical" threat. It is often able to shrug off multiple antibiotics and is a problem in hospitals and care homes, where it can survive on surfaces and medical equipment.



To find a new antibiotic, the researchers first had to train the AI. They took thousands of drugs where the precise chemical structure was known, and manually tested them on *Acinetobacter baumannii* to see which could slow it down or kill it. This information was fed into the AI so it could learn the chemical features of drugs that could attack the problematic bacterium.

The AI was then unleashed on a list of 6,680 compounds whose effectiveness was unknown. The results - published in Nature Chemical Biology - showed it took the AI an hour and a half to produce a shortlist. The researchers tested 240 in the laboratory, and found nine potential antibiotics. One of them was the incredibly potent antibiotic **abaucin**. Laboratory experiments showed it could treat infected wounds in mice and was able to kill *A. baumannii* samples from patients. The next step is to perfect the drug in the laboratory and then perform clinical trials.

https://www.bbc.co.uk/news/health-65709834

ENERGY - Engineers harvest abundant clean energy from thin air

A team of engineers has recently shown that nearly any material can be turned into a device that continuously harvests electricity from humidity in the air. Researchers describe the **'generic Air-gen effect'**– nearly any material can be engineered with nanopores to harvest, cost effective, scalable, interruption-free electricity. The secret lies in being able to pepper the material with nanopores less than 100 nanometres in diameter.

"The air contains an enormous amount of electricity," says Jun Yao, assistant professor of electrical and computer engineering in the College of Engineering at UMass Amherst, and the paper's senior author. "Think of a cloud, which is nothing more than a mass of water droplets.

Each of those droplets contains a charge, and when conditions are right, the cloud can produce a lightning bolt - but we don't know how to reliably capture electricity from lightning. What we've done is to create a human-built, small-scale cloud that produces electricity for us predictably and continuously so that we can harvest it."

The heart of the human-made cloud depends on what Yao and his colleagues call the "generic Air-gen effect," and it builds on work that Yao and co-author Derek Lovley, Distinguished Professor of Microbiology at UMass Amherst, had previously completed in 2020 showing that electricity could be continuously harvested from the air using a specialized material made of protein nanowires grown from the bacterium *Geobacter sulfurreducens*.

"What we realized after making the Geobacter discovery," says Yao, "is that the ability to generate electricity from the air – what we then called the 'Air-gen effect' – turns out to be generic: literally any kind of material can harvest electricity from air, as long as it has a certain property." That property? It needs to have holes smaller than 100 nanometres (nm), or less than a thousandth of the width of a human hair.

Yao and his colleagues realized that they could design an electricity harvester based around this number. This harvester would be made from a thin layer of material filled with nanopores smaller than 100 nm that would let water molecules pass from the upper to the lower part of the material. In doing so they would create an imbalance in electrical charge, like that in a cloud, which would effectually create a battery – one that runs as long as there is any humidity in the air.

SCIENCE FICTION (that may become fact!) - Humans might hibernate during space travel

Imagine a crew boarding their spaceship. Once on board, they each approach a bed, crawl in, close the lid and fall asleep. Their bodies are frozen for a trip to a planet several light-years from Earth. A few years later they wake up, still the same age and perfectly fit and healthy. This ability to put life on pause while asleep is called **"suspended animation."** But it is still in the realm of science fiction....or is it?

Nothing like this is yet possible in the real world, at least for us humans. But some animals and birds have their own forms of suspended animation: They **hibernate**. This might hold some lessons for how to put astronauts



of the future into hibernation for long space flights. Hibernation may look like a deep form of sleep, but it's not sleep. As an animal hibernates, it chills its body and slows its heart rate and breathing. Metabolism also slows. To do this, an animal must turn on and off certain genes when they hibernate. Those genes do things like controlling whether an animal burns sugars or fats for fuel. Other genes are involved in keeping muscles strong.

Humans have many of these same genes. We don't use them to hibernate, but turning some of these genes on or off might allow humans to do something similar to hibernation. Some animals' body temperatures drop below freezing when they hibernate, squirrels for example. Humans may not survive that chill. Since a person probably wouldn't survive their body temperature dropping below freezing, it is thought that people might be able to hibernate like bears.

Black bears cut their metabolism by 75 percent when they hibernate, but their bodies stay somewhat warm. Normal body temperature for a black bear is 37.7° Celsius to 38.3° C (100° Fahrenheit to 101° F). During hibernation, their body temperature stays above 31° C (88° F). Hibernating humans might therefore have to lower their body temperature by only a few degrees.

If people are like bears, hibernation may help keep bones and muscles strong. That is important in space. Bones and muscles tend to break down in low gravity. Hibernation could cut the amount of food, water and oxygen that crews need. And it could save people from the inevitable boredom of long trips in space,

https://www.snexplores.org/article/humans-hibernate-space-travel-cryobiology-suspended-animation

AMAZING CROCODILE – Female crocodile found to have made herself pregnant!

The first case of a crocodile who made herself pregnant has been identified at a zoo in Costa Rica. She produced a foetus that was 99.9% genetically identical to herself. The phenomenon of so-called "virgin birth" has been found in species of birds, fish and other reptiles, but never before in crocodiles. The scientists say the trait might be inherited from an evolutionary ancestor, so dinosaurs might also have been capable of self-reproduction. The research has been published in the Royal Society journal, *Biology Letters*.

The egg was laid by an 18-year-old female American crocodile in Parque Reptilania in January 2018. The foetus inside was fully formed but stillborn and so did not hatch. The crocodile who laid the egg was obtained when she was two years old and



was kept apart from other crocodiles for its entire life. Because of this, the park's scientific team contacted Belfast-born Dr Warren Booth, now working at Virginia Tech in the US. He has been studying virgin births, known scientifically as **parthenogenesis**, for 11 years. Dr Booth analysed the foetus and found that it was more than 99.9 % genetically identical to its mother - confirming that it had no father.

He told BBC News that he wasn't surprised by the discovery. "We see it in in sharks, birds, snakes and lizards and it is remarkably common and widespread". He speculated that the reason that parthenogenesis has not been seen in crocodiles is because people have not been looking for instances of them. "There was a big increase in reports of parthenogenesis when people started keeping pet snakes. But your average reptile keeper doesn't keep a crocodile," he said.

One theory is that it happens in species capable of parthenogenesis when numbers dwindle, and they are on the verge of extinction. And Dr Booth told BBC news that this may have happened to some species of dinosaurs when their numbers dwindled due to environmental changes. "The fact that the mechanism of parthenogenesis is the same in so many different species suggests that it is a very ancient trait that has been inherited throughout the ages. So this supports the idea that dinosaurs could also reproduce this way."

https://www.bbc.co.uk/news/science-environment-65834167

SPACE EXPLORATION - Fairy tale inspiration could help rovers explore risky places

In the classic fairy tale, Hansel and Gretel dropped bread crumbs while walking through a forest to avoid losing their way. Rovers may one day use a similar trick to traverse other planets without losing their data. Typically, if a rover loses contact with Earth for good, all the data it has gathered is lost. To avoid this, researchers suggest using a multi-rover system.





In that setup, a small rover would piggyback on a larger "mother rover." The small rover would then hop off the mother rover to explore any uncertain territory. Such places might include caves or lava tubes. The small rover would drop sensors like bread crumbs behind it as it drove. And those sensors could wirelessly pass any collected data back to the mother rover.

The breadcrumb strategy could also be useful here on Earth. Imagine a natural disaster, such as an earthquake. A sensor-dropping rover could be sent into rubble that's too dangerous for people to navigate. Even if the rover gets broken, its trail of sensors could still return its observations to search-and-rescue teams.

https://www.snexplores.org/article/rover-mars-moon-bread-crumbs-hansel-gretel-technology

SPACE MATHEMATICS - Here's how we could decode an alien message using maths

One of the most famous messages ever beamed to space was a string of 1,679 bits sent by the now defunct Arecibo radio telescope in 1974. But if E.T. sent us such a string, how could we Earthlings even begin to decode it? A new mathematical approach proposes a way.

For anyone trying to interpret the Arecibo message — a drawing depicting a person, the DNA double helix, the solar system and the telescope itself, among other information)pictured on the right) — they'd first have to understand that it was an image at all, and that the image was 23 pixels wide and 73 pixels tall. The image is several different coloured tiny squares grouped together on a black background. As it sent the signal, the radio antenna encoded the 1,679 bits by flipping between two different frequencies, representing binary ones and zeroes respectively. If you line the bits up differently — placing more or fewer than 23 pixels per row — the image will look like a random mess. So any alien civilisation receiving the message would have to get it exactly right to decode it.

We'd face a similar challenge if aliens sent us a message. How would we know the number and size of its dimensions? The Arecibo scientists built a clue into the transmission: 23 and 73 are prime numbers — a scheme other intelligent life might recognize, if they too find primes to be interesting. But alien messages could come in many forms and have many dimensions, says Brian McConnell, a computer scientist at Notion Labs in San Francisco, and author of *The Alien Communication Handbook*. A message might be a database in which each element is not just a



value but a list of values, or a list of lists. A message in the form of a physics simulation could include a series of measures for each point in spacetime.

A new decoding method, dev eloped by Hector Zenil, a computer scientist at the University of Cambridge takes a string of bits — an incoming message — and looks at every possible combination of dimension number and size. 100 bits, for example, might be 1×100 or 10×10 (two dimensions) or 4x5x5 (three dimensions) or 2x2x5x5 (four dimensions) and so on.

It then looks at each possible configuration's orderliness in two ways. To get a measure of **local order**, it breaks the message into patches. For each patch, it searches a catalogue of trillions of tiny computer programs the researchers had previously created to explore algorithmic space, and counts how many programs generate an identical patch. The researchers also measure each possible configuration's global order by seeing how much an image compression algorithm can shrink it without losing information — mathematically, randomness is less compressible than regular patterns. By combining the local and global scores, the researchers have a sense of how likely each configuration is to be the correct one.

In Carl Sagan's sci-fi novel *Contact*, and the movie based on it, the characters spend a lot of time figuring out that a message received from aliens is in three dimensions (specifically a video). With the new decoding method, they would have solved it in seconds!

https://www.sciencenews.org/article/decode-arecibo-alien-message-math

ARCHAEOLOGY - Southwark: Rare Roman mausoleum unearthed in London

A "completely unique" Roman mausoleum has been discovered by archaeologists in south London. The remains of the structure at the Liberty of Southwark site in Borough have been described as "extremely rare" and feature preserved floors and walls. Archaeologists think the site was used as some form of burial ground or tomb for wealthier members of Roman society.





The dig was led by the Museum of London Archaeology (MOLA) on behalf of Landsec and Transport for London (TfL). MOLA believes the quality of preservation makes it the most intact Roman mausoleum ever to be discovered in Britain. Alongside the central mosaic, raised platforms were found and steps on the lowest side were still intact. Excavators were surprised to find two layers to the site, with another similarly designed mosaic found beneath the first floor.

While the site is believed to be a burial location, no coffins were found. However, more than 100 coins, fragments of pottery, roofing tiles and pieces of metal were discovered. Antonietta Lerz, senior archaeologist at MOLA, says the site is a "microcosm for the changing fortunes of Roman London" and provides "a fascinating window" into the life of its settlers.

Landsec and TfL say they are committed to restoring and retaining the mausoleum for permanent public display. https://www.bbc.co.uk/news/uk-england-london-65890080

QUANTUM BIOLOGY - Research group describes how cilia's motor works

The outside of many eukaryotic cells are covered in hair-like organelles known as **cilia**. In the human body, their rhythmic movements—or beating—serve some fascinating jobs. Waving like arms, they are responsible for pushing the egg along the oviduct. They also give sperm their tails; thus playing roles in both women's and men's fertility. They sweep viruses and dust out of our airways. Their dysfunction is linked to various types of lung disease, and indeed COVID-19 is known to target cells in the airways possessing cilia.

Although researchers know a lot about the roles of cilia, less is known about how they beat. Yet understanding the mechanisms of their motion is important to understanding their function—and, eventually, developing treatments linked to their malfunction. Now, using **cryo**-



electron tomography, scientists from Paul Scherrer Institute PSI have shed new light on their motion.

Cryo-electron tomography is a specialized application of transmission electron microscopy in which samples are imaged as they are tilted, resulting in a series of 2D images that can be combined to produce a 3D reconstruction. Unlike other electron tomography techniques, samples are imaged under cryogenic conditions (<-150 °C).

Cilia consist of an outer structure of nine pairs of microtubules, long tube-like molecules that are part of the cell cytoskeleton, arranged into a circle. Connecting them are hundreds of **dynein motor proteins**. The source of energy for the motor protein dynein is the universal energy-currency of the cell, ATP. When dynein hydrolyses a molecule of ATP, it changes shape, dragging the microtubule on to which it is anchored and causes the microtubule pair to bend. In the latest study, the researchers were interested in how dynein generates its force. To investigate this, they focused on the detailed motion of part of the motor protein known as the outer dynein arms, which is responsible mainly for force generation.

The researchers were able to describe very precisely conformations of the outer dynein arm during different phases of movement. In particular, they identified several intermediate conformations that were previously unknown, which showed how anchorings of the protein on the microtubule cross over at the beginning of the cycle. This piece of research adds one piece to the mammoth jigsaw puzzle that is the complex motion of the cilia. On each cilia, hundreds of dynein motor proteins must work together like synchronized swimmers to coordinate the bending of the microtubules so that the cilia beat.

EARTH SCIENCE - Human impact on Earth's tilt leaves researchers 'surprised'

Earth's rotational pole — the point around which the planet (b) rotates — shifts with changes in the distribution of mass across the globe, wobbling and wandering in a process called polar motion.

The best estimate of the mass of the Earth is 5.9722×10^{24} kg, which is 5.9 sextillion tonnes! You would think that human activity, even at its most extreme, could not possibly affect our planet's tilt...but think again!

Researchers have discovered that between 1993 and 2010 the Earth's rotational pole shifted by 0.8m. The reason for this is that by pumping 2,150 gigatons of water — almost enough water to fill Lake Victoria in Africa, and equivalent to the weight of 5.5 million Empire State Buildings — from underground layers of water-saturated rock known as aquifers, humans caused this "pretty significant" eastward shift. That's because groundwater used for irrigation and other human activities eventually ends up in the ocean, which redistributes mass from where the water was taken to other parts of the globe.



"Earth's rotational pole actually changes a lot," research leader Ki-Weon Seo, a geophysicist at Seoul National University in South Korea, said in a statement. "Our study shows that among climate-related causes, the redistribution of groundwater actually has the largest impact on the drift of the rotational pole." What's more, the extracted groundwater that ended up in the oceans may have boosted global sea level rise by around 0.25 inch (6.24 millimetres). "Groundwater depletion is a significant contributor to sea level rise," the researchers wrote in the study, published in the journal Geophysical Research Letters.

While polar shifts recorded in the last few decades are unlikely to affect the length of days or seasons, the finding illustrates just how much water humans have pumped from the ground. "I'm concerned and surprised," Seo said in the statement.

<u>https://www.livescience.com/planet-earth/human-impact-on-earths-tilt-leaves-researchers-surprised-and-concerned</u>

AMAZING ANIMALS- Octopuses and squid are masters of RNA editing, leaving DNA intact

Octopuses are like aliens living among us — they do a lot of things differently from land animals, or even other sea creatures. Their flexible tentacles taste what they touch and have minds of their own. Octopuses' eyes are colour-blind, but their skin can detect light on its own. They are masters of disguise, changing colour and skin textures to blend into their surroundings or scare off rivals. And to a greater extent than most creatures, octopuses squirt the molecular equivalent of red ink over their genetic instructions with astounding abandon, like a copy editor run amok.

These edits modify RNA, the molecule used to translate information from the genetic blueprint



stored in DNA, while leaving the DNA unaltered. Scientists don't yet know for sure why octopuses, and other shellless cephalopods including squid and cuttlefish, are such prolific RNA editors. Researchers are debating whether this form of genetic editing gave cephalopods an evolutionary leg (or tentacle) up or whether the editing is just a sometimes useful accident. Scientists are also probing what consequences the RNA alterations may have under various conditions. Some evidence suggests editing may give cephalopods some of their smarts but could come at the cost of holding back evolution in their DNA.

"These animals are just magical," says Caroline Albertin, a comparative developmental biologist at the Marine Biological Laboratory in Woods Hole, Mass. *"They have all sorts of different solutions to living in the world they come from."* RNA editing may help give the creatures vast numbers of solutions for problems they may face.

Evidence for and against RNA recoding's evolutionary value has come mainly from examining the total genetic makeup, or genomes, of various cephalopod species. But scientists would like to directly test whether recoded RNAs have an effect on cephalopod biology. Doing that will require some new tools and creative thinking.

EXOTIC MATTER - Physicists stumble upon a new state of matter

There are four fundamental states of matter: liquid, solid, gas and plasma – an electrically charged gas found in situations like stars and lightning strikes. However, when one investigates at the quantum, sub-atomic level, there is a whole new realm of matter. By shining a strong beam of light through two chemical compounds, scientists have discovered a unique new state of matter made of particles called **excitons**.



Physicists have discovered an exotic new state of matter that takes the form of a highly ordered crystal of subatomic particles. The new state of matter, called a **"bosonic correlated insulator,"** could lead to the discovery of many new types of exotic materials made from condensed matter, according to the researchers, who detailed their results in a study published in the journal *Science*.

Subatomic particles can be separated into two categories: **fermions** and **bosons**. The primary differences between the two are how they spin and how they interact with each other. Fermions, such as electrons and protons, are often thought of as the building blocks of matter because they make up atoms, and are characterized by their half-integer spin. Two identical fermions cannot occupy the same space at the same time. Bosons, on the other hand, carry force — such as photons, or packets of light — and are thought to be the glue of the universe, tying together the fundamental forces of nature. These particles have whole-integer spins, and multiple bosons can be in the same place at the same time.

But there is a case in which two fermions can become a boson: If a negatively charged electron is secured to a positively charged "hole" in a different fermion, it forms a bosonic particle known as an "**exciton**." To see how excitons interact with one another, the researchers layered a lattice of tungsten disulfide atop a similar lattice of tungsten diselenide in an overlapping pattern called a moiré. Then, they shined a strong beam of light through the lattices — a method known as "**pump-probe spectroscopy.**" These conditions pushed the excitons together until they were so densely packed that they could no longer move, creating a new symmetrical crystalline state with a neutral charge — a bosonic correlated insulator.

The researchers said this is the first time this new state of matter has been created in a "real" matter system, as opposed to synthetic systems, thus providing new insight into the behaviour of bosons. Moreover, the methods the team used to discover this new state of matter could help scientists create additional new types of bosonic materials.

<u>https://www.livescience.com/physics-mathematics/exotic-new-state-of-matter-discovered-by-squishing-subatomic-particles-into-an-ultradense-crystal</u>



WORD(S) OF THE MONTH:

ELLIPSE (noun, "ee-LIPS")

Ellipse is a mathematical term for a type of oval shape. This shape looks like a squashed circle. Earth and other planets in the solar system follow ellipse-shaped paths as they orbit around the Sun.

An ellipse is defined by the location of two points inside the ellipse. These are called the focal points. At each point along an ellipse, the combined distances to the two focal points is the same. A circle is a type of ellipse where the two focal points are stacked on top of each other. When the two focal points are farther apart, you will have a narrower, longer ellipse. Bringing them closer together makes a wider, more circular ellipse.

In architecture, ellipse-shaped rooms can feature some wacky acoustics. Often called "whispering chambers," you can stand at one focal point and hear far-away whispers from the other focal point. One famous example is the National Statuary Hall in Washington, D.C. There's a bronze plaque marking where John Quincy Adams' desk was. (Adams was the sixth president of the United States.) If you stand where his desk stood, you can hear whispers from across the room. Renovations to the room's domed ceiling have likely altered the acoustics since John Quincy Adams' time. But the phenomenon still gave rise to legends that he used to eavesdrop on other politicians.