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Mr. Ludovic Pouille, French Ambassador to the UAE, visits SCASS (Mar. 07, 2019)
‘Mole’ on Mars Hits Rocky Snag Beneath the Red Planet’s Surface

NASA’s InSight lander deploys its heat probe on Mars on Feb. 12, 2019. (Image: © NASA/JPL-Caltech/DLR)

The first Martian “mole” encountered some obstacle underground as the NASA InSight lander dug below the surface, NASA reported.

The InSight Mars lander, which touched down on Mars in November, deployed a probe as part of its Heat and Physical Properties Package (also called HP3). The probe, or “mole,” is designed to burrow underground and measure heat coming from inside Mars, information that will help scientists better understand the planet’s structure and formation.

But the 16-inch (40 centimeters) probe made it only three-quarters of the way out of its housing structure on Feb. 28 before stopping short. A second attempt, on Saturday (March 2), yielded little progress. In a statement, NASA officials said the data received so far suggests that the mole is at a 15-degree tilt and has hit some rock or gravel. While the instrument is designed to get around rocky obstacles, the German instrument team plans to stop the procedure for further investigation.

“The team has decided to pause the hammering for now to allow the situation to be analyzed more closely and jointly come up with strategies for overcoming the obstacle,” Tilman Spohn, HP3 principal investigator at the German Aerospace Center (DLR), said in a blog post. This pause will last for about two weeks, he added.

While the probe isn’t moving right now, it’s otherwise working as it is supposed to. Once everything is set, the probe will release pulses of heat of 50 degrees Fahrenheit (28 degrees Celsius) to measure how quickly the heat dissipates under the surface.

“This property, known as thermal conductivity, helps calibrate sensors embedded in a tether trailing from the back of the mole,” NASA officials said. “Once the mole is deep enough, these tether sensors can measure Mars’ natural heat coming from inside the planet, which is generated by radioactive materials decaying and energy left over from Mars’ formation.” ....Read More...

SpaceX Dragon capsule splashes down in Atlantic Ocean: NASA

SpaceX’s Dragon Capsule splashdown.

The SpaceX Dragon capsule successfully splashed down in the Atlantic Ocean on Friday after more than six days in space, completing its demonstration mission for US space agency NASA.

“Good splashdown of Dragon confirmed!” the SpaceX account tweeted along with an image of the capsule showing its four main white and orange parachutes deployed as two boats speed toward it.

Live footage from NASA showed the capsule’s main parachutes opened without a hitch, and it splashed down at 8:45 am (1345 GMT), completing a mission to demonstrate that it could reliably and safely carry astronauts to the International Space Station (ISS).

Launched on Saturday from the Kennedy Space Center in Florida, Dragon docked at ISS the following day before detaching early Friday for its return to Earth. It represents the first private space mission to the ISS, as well as the first time a space vessel capable of carrying people was launched by the US in eight years.

SpaceX, founded by Elon Musk in 2002, was selected along with the Boeing group by NASA in 2014 to develop the next generation of space vehicles for US astronauts, after the end of the 1981-2011 space shuttle program. Only a test dummy was aboard for the test, but the first manned flight aboard Dragon is scheduled for July with two astronauts -- a date that could be postponed until later this year.

Pre splashdown report
Crew Dragon, the new space capsule built by SpaceX for NASA, began its return to Earth Friday -- the trickiest part of a mission to prove it can take US astronauts to the International Space Station and bring them back safely.

Dragon gently and successfully undocked from the ISS Friday at 0732 GMT as they flew 250 miles over Sudan.

After umbilical wires and hooks latching it to the ISS were released, the unmanned white module’s thrusters fired several times, easing it away from the ...Read More...
Glimpsing the hearts of galaxies

The unified model of AGN states that all AGN contain the same components, simply viewed at different angles. From the inside out, AGN contain a supermassive black hole; an accretion disk and a hot corona of gas; a fast-moving gas region; an obscuring torus of dust; and a slower-moving gas region. Some AGN have powerful jets, which may be pointed toward Earth. Astronomy: Roen Kelly

Inside all huge galaxies lies a supermassive black hole. Some are shining brightly, while others are barely visible—but all of them can teach us something about how galaxies evolve.

In a galaxy like the Milky Way, light comes entirely from a combination of shining stars and glowing gas. However, in an active galaxy, the energy output is too high to attribute to these factors alone. The excess energy is concentrated in the galaxy's center—its active galactic nucleus.

Active galactic nuclei (AGN) are found throughout the cosmos in many forms. Some hide within seemingly normal galaxies, while the brightest pump out so much energy they outshine their host galaxy entirely. AGN are manifestations of the supermassive black holes found in nearly every galaxy we see, and they have played an important role in shaping the universe.

Quasi-stellar objects

Observations of galactic centers had turned up odd results since the early 1900s, but initially received little attention. By the late 1950s, astronomers surveying the sky with radio telescopes were attempting to match radio sources with visible objects such as stars and galaxies. They discovered that while many optical counterparts were normal-looking galaxies, some appeared as bright blue stars often embedded in fuzzy halos barely discernible in the wash of light from the star.

These oddballs, initially dubbed “radio stars” and later “quasi-stellar radio sources,” remained mysterious until 1963, when Dutch astronomer Maarten Schmidt observed the starlike counterpart of radio source 3C 273 from Palomar Observatory in California. He examined the source’s spectra, spreading out the light by wavelength to identify features associated with the emission and absorption of energy by different atoms. ...Read More...

What Does the Milky Way Weigh? Hubble and Gaia Investigate

Illustration only.

We can’t put the whole Milky Way on a scale, but astronomers have been able to come up with one of the most accurate measurements yet of our galaxy’s mass, using NASA’s Hubble Space Telescope and the European Space Agency’s Gaia satellite.

The Milky Way weighs in at about 1.5 trillion solar masses (one solar mass is the mass of our Sun), according to the latest measurements. Only a few percent of this is contributed by the approximately 200 billion stars in the Milky Way and includes a 4-million-solar-mass supermassive black hole at the center. Most of the rest of the mass is locked up in dark matter, an invisible and mysterious substance that acts like scaffolding throughout the universe and keeps the stars in their galaxies.

Earlier research dating back several decades used a variety of observational techniques that provided estimates for our galaxy’s mass ranging between 500 billion to 3 trillion solar masses. The improved measurement is near the middle of this range.

“We want to know the mass of the Milky Way more accurately so that we can put it into a cosmological context and compare it to simulations of galaxies in the evolving universe,” said Roeland van der Marel of the Space Telescope Science Institute (STScI) in Baltimore, Maryland. “Not knowing the precise mass of the Milky Way presents a problem for a lot of cosmological questions.”

The new mass estimate puts our galaxy on the beefier side, compared to other galaxies in the universe. The lightest galaxies are around a billion solar masses, while the heaviest are 30 trillion, or 30,000 times more massive. The Milky Way’s mass of 1.5 trillion solar masses is fairly normal for a galaxy of its brightness.

Astronomers used Hubble and Gaia to measure the three-dimensional movement of globular star clusters—isolated spherical islands each containing hundreds of thousands of stars each that orbit the center of our galaxy. Although we cannot see it, dark matter is the dominant form of matter in the universe, and it can be weighed through its influence on visible objects like the globular clusters. ...Read More...
Scientists track deep history of planets' motions, and effects on Earth's climate

Scientists have long posited that periodic swings in Earth's climate are driven by cyclic changes in the distribution of sunlight reaching our surface. This is due to cyclic changes in how our planet spins on its axis, the ellipticity of its orbit, and its orientation toward the sun - overlapping cycles caused by subtle gravitational interplays with other planets, as the bodies whirl around the sun and by each other like gyrating hula-hoops.

But planetary paths change over time, and that can change the cycles' lengths. This has made it challenging for scientists to untangle what drove many ancient climate shifts. And the problem gets ever more difficult the further back in time you go; tiny changes in one planet's motion may knock others' askew - at first slightly, but as eons pass, these changes resonate against each other, and the system morphs in ways impossible to predict using even the most advanced math. In other words, it's chaos out there.

Up to now, researchers are able to calculate the relative motions of the planets and their possible effects on our climate with reasonable reliability back only about 60 million years - a relative eyeblink in the 4.5 billion-plus life of Earth.

This week, in a new paper in the Proceedings of the National Academy of Sciences, a team of researchers has pushed the record way back, identifying key aspects of the planets' motions from a period around 200 million years ago. The team is led by geologist and paleontologist Paul Olsen of Columbia University's Lamont-Doherty Earth Observatory.

Last year, by comparing periodic changes in ancient sediments drilled from Arizona and New Jersey, Olsen and colleagues identified a 405,000-year cycle in Earth's orbit that apparently has not changed at all over the past... Read More...

Silicon carbide ‘stardust’ in meteorites leads to understanding of erupting stars

Silicon carbide grains are among the most durable bits that can be extracted from a meteorite; these are four taken from the Murchison meteorite. The width of an average human hair is about thousand times larger than the 100 nm scale bar.

What do tiny specks of silicon carbide stardust, found in meteorites and older than the solar system, have in common with pairs of aging stars prone to eruptions?

A collaboration between two Arizona State University scientists - cosmochemist Maitrayee Bose and astrophysicist Sumner Starrfield, both of the School of Earth and Space Exploration - has uncovered the connection and pinpointed the kind of stellar outburst that produced the stardust grains.

Their study has just been published in the Astrophysical Journal.

The microscopic grains of silicon carbide - a thousand times smaller than the average width of a human hair - were part of the construction materials that built the sun and planetary system. Born in nova outbursts, which are repeated cataclysmic eruptions by certain types of white dwarf stars, the silicon carbide grains are found today embedded in primitive meteorites.

"Silicon carbide is one of the most resistant bits found in meteorites," Bose said. "Unlike other elements, these stardust grains have survived unchanged from before the solar system was born."

Violent birth

A star becomes a nova - a "new star" - when it suddenly brightens by many magnitudes. Novae occur in pairs of stars where one star is a hot, compact remnant called a white dwarf. The other is a cool giant star so large its extended outer atmosphere feeds gas onto the white dwarf. When enough gas collects on the white dwarf, a thermonuclear eruption ensues, and the star becomes a nova.

Although powerful, the eruption doesn't destroy the white dwarf or its companion, so novae can erupt over and over, repeatedly throwing into space gas and dust grains made in the explosion. From there the dust grains merge with clouds of interstellar gas to become the ingredients of new star systems. Read More...
Physicists May Have Found a Way to ‘Untangle’ Information Trapped in a Black Hole

Black holes are gravitational monsters, squeezing gas and dust down to a microscopic point like great cosmic trash compactors. Modern physics dictates that, after being consumed, information about this matter should be forever lost to the universe. But a new experiment suggests that there might be a way to use quantum mechanics to gain some insight into the interior of a black hole.

“In quantum physics, information cannot possibly be lost,” Kevin Landsman, a physics graduate student at the Joint Quantum Institute (JQI) at the University of Maryland in College Park, told Live Science. “Instead, information can be hidden, or scrambled” among subatomic, inextricably linked particles.

Landsman and his co-authors showed that they could measure when and how quickly information was scrambled inside a simplified model of a black hole, providing a potential peek into the otherwise impenetrable entities. The findings, which appear today (March 6) in the journal Nature, could also help in the development of quantum computers.

Black holes are infinitely dense, infinitely small objects formed from the collapse of a giant, dead star that went supernova. Because of their massive gravitational pull, they suck in surrounding material, which disappears behind what’s known as their event horizon—the point past which nothing, including light, can escape.

In the 1970s, the famous theoretical physicist Stephen Hawking proved that black holes can shrink over their lifetimes. According to the laws of quantum mechanics—the rules that dictate the behavior of subatomic particles at tiny scales—pairs of particles spontaneously pop into existence just outside a black hole’s event horizon. One of these particles then falls into the black hole while the other is propelled outward, stealing a tiny smidgeon of energy in the process. Over extremely long timescales, enough energy is pilfered that the black hole will evaporate, a process known as Hawking radiation, as Live Science has previously reported.

More evidence of sound waves carrying mass

A trio of researchers at Columbia University has found more evidence showing that sound waves carry mass. In their paper published in the journal Physical Review Letters, Angelo Esposito, Rafael Krichevsky and Alberto Nicolis describe using effective field theory techniques to confirm the results found by a team last year attempting to measure mass carried by sound waves.

For many years physicists have felt confident that sound waves carry energy—but there was no evidence to suggest they also carry mass. There seemed to be no reason to believe that they would generate a gravitational field. But that changed last year when Nicolis and another physicist Riccardo Penco found evidence that suggested conventional thinking was wrong. They had used quantum field theory to show that sound waves moving through superfluid helium carried a small amount of mass with them. More specifically, they found that phonons interacted with a gravitational field in a way that forced them to carry mass along as they moved through the material. In this new effort, the researchers report evidence that suggests the same results hold true for most materials.

Using effective field theory, they showed that a single-watt sound wave that moved for one second in water would carry with it a mass of approximately 0.1 milligrams. They further note that the mass was found to be a fraction of the total mass of a system that moved with the wave, as it was displaced from one site to another.

Importantly, the researchers did not actually measure mass being carried by a sound wave—they used math to prove it happens. For real-world measurement, they suggest experiments could be conducted with sound waves as they move through a Bose-Einstein condensate made of very cold atoms—such a setup should show enough mass being carried to allow for measurement. But they also note a better approach might be to measure the mass being carried by sound waves moving through the Earth as part of a quake. That much sound could carry billions of kilograms of mass, which might be visible on devices that measure gravitational fields.
Researchers develop ‘acoustic metamaterial’ that cancels sound

The mathematically designed, 3D-printed acoustic metamaterial is shaped in such a way that it sends incoming sounds back to where they came from, Ghaffarivardavagh and Zhang say. Inside the outer ring, a helical pattern interferes with sounds, blocking them from transmitting through the open center while preserving air’s ability to flow through. Credit: Cydney Scott for Boston University

Boston University researchers, Xin Zhang, a professor at the College of Engineering, and Reza Ghaffarivardavagh, a Ph.D. student in the Department of Mechanical Engineering, released a paper in Physical Review B demonstrating it’s possible to silence noise using an open, ringlike structure, created to mathematically perfect specifications, for cutting out sounds while maintaining airflow.

“Today’s sound barriers are literally thick heavy walls,” says Ghaffarivardavagh. Although noise-mitigating barricades, called sound baffles, can help drown out the whoosh of rush hour traffic or contain the symphony of music within concert hall walls, they are a clunky approach not well suited to situations where airflow is also critical. Imagine barricading a jet engine’s exhaust vent—the plane would never leave the ground. Instead, workers on the tarmac wear earplugs to protect their hearing from the deafening roar.

Ghaffarivardavagh and Zhang let mathematics—a shared passion that has buoyed both of their engineering careers and made them well-suited research partners—guide them toward a workable design for what the acoustic metamaterial would look like.

They calculated the dimensions and specifications that the metamaterial would need to have in order to interfere with the transmitted sound waves, preventing sound—but not air—from being radiated through the open structure. The basic premise is that the metamaterial needs to be shaped in such a way that it sends incoming sounds back to where they came from, they say.

As a test case, they decided to create a structure that could silence sound from a loudspeaker. Based on their calculations, they modeled the physical dimensions that would most effectively silence noises. Bringing those models to life, they used 3-D printing to materialize an open, noise-canceling structure made of plastic.

Trying it out in the lab, the researchers sealed the loudspeaker into one end of a PVC pipe. ...Read More...

Physicists discover surprisingly complex states emerging out of simple synchronized networks

Fireflies glowing in unison. Credit: Radim Schreiber

Fireflies, heart cells, clocks, and power grids all do it—they can spontaneously sync up, sending signals out in unison. For centuries, scientists have been perplexed by this self-organizing behavior, coming up with theories and experiments that make up the science of sync. But despite progress being made in the field, mysteries still persist—in particular how networks of completely identical elements can fall out of sync.

Now, in a new study in the March 8 issue of the journal Science, Caltech researchers have shown experimentally how a simple network of identical synchronized nanomachines can give rise to out-of-sync, complex states. Imagine a line of Rockette dancers: When they are all kicking at the same time, they are in sync. One of the complex states observed to arise from the simple network would be akin to the Rockette dancers kicking their legs “out of phase” with each other, where every other dancer is kicking a leg up, while the dancers in between have just finished a kick.

The findings experimentally demonstrate that even simple networks can lead to complexity, and this knowledge, in turn, may ultimately lead to new tools for controlling those networks. For example, by better understanding how heart cells or power grids display complexity in seemingly uniform networks, researchers may be able to develop new tools for pushing those networks back into rhythm.

“We want to learn how we can just tickle, or gently push, a system in the right direction to set it back into a synced state,” says Michael L. Roukes, the Frank J. Roshek Professor of Physics, Applied Physics, and Bioengineering at Caltech, and principal investigator of the new Science study. “This could perhaps engender a form of new, less harsh defibrillators, for example, for shocking the heart back into rhythm.”

Synchronized oscillations were first noted as far back as the 1600s, when the Dutch scientist Christiaan Huygens, known for discovering the Saturnian moon Titan, noted that two pendulum clocks hung from a common support would eventually come to tick in unison. Through the centuries, mathematicians and other scientists have come up with various ways to explain the strange phenomenon, seen also in heart and brain cells, ...Read More...
Chances for life expand when passing stars push binaries together

Planetary systems can be harsh environments in their early history. The young worlds orbit suns in stellar nurseries, clusters of stars where violent encounters are commonplace. None of this makes it easy for life to get going, but now astronomers at the University of Sheffield find one positive of this tumultuous period. A model developed by undergraduate student Bethany Wootton and Royal Society Dorothy Hodgkin Fellow Dr. Richard Parker looks at how the habitable zone—the region around a star where the temperature allows liquid water to exist—changes around pairs of stars, so-called binary systems.

The two scientists discovered that an encounter with a passing third star may squeeze the binary pair together, expanding the habitable zone in the process. Their results appear in a new paper in the journal Monthly Notices of the Royal Astronomical Society.

The habitable zone, sometimes called the 'Goldilocks zone' as the temperature is not too hot and not too cold, is thought to be essential for the development of life on a planet. If a planet lies outside this zone, then the formation of the complex molecules needed for life is less likely to happen.

Around one third of stellar systems in our galaxy are thought to be made up of two or more stars, and this fraction is much higher when stars are young. If these stars are a relatively large distance apart, the size of the Goldilocks zone around each star is governed by the radiation from the individual star. If the two stars are closer, the size of the Goldilocks zone increases because each star feels additional warmth from the other and this increases the likelihood of a planet being located in the right place for life to develop.

Wootton and Parker looked at how this changed in stellar nurseries. They used computer simulations to model the interactions between young stars in these clusters, calculating how these encounters affected the binary pairs. In a typical stellar nursery with 350 binaries, the two researchers found that 20 would have their stars squeezed together, and their Goldilocks zones then expanded. .. Read More...

New surprises from Jupiter and Saturn

The latest data sent back by the Juno and Cassini spacecraft from giant gas planets Jupiter and Saturn have challenged a lot of current theories about how planets in our solar system form and behave.

The detailed magnetic and gravity data have been “invaluable but also confounding,” said David Stevenson from Caltech, who will present an update of both missions this week at the 2019 American Physical Society March Meeting in Boston. He will also participate in a press conference describing the work. Information for logging on to watch and ask questions remotely is included at the end of this news release.

"Although there are puzzles yet to be explained, this is already clarifying some of our ideas about how planets form, how they make magnetic fields and how the winds blow," Stevenson said.

Cassini orbited Saturn for 13 years before its dramatic final dive into the planet's interior in 2017, while Juno has been orbiting Jupiter for two and a half years.

Juno's success as a mission to Jupiter is a tribute to innovative design. Its instruments are powered by solar energy alone and protected so as to withstand the fierce radiation environment.

Stevenson says the inclusion of a microwave sensor on Juno was a good decision.

"Using microwaves to figure out the deep atmosphere was the right, but unconventional, choice," he said. The microwave data have surprised the scientists, in particular by showing that the atmosphere is evenly mixed, something conventional theories did not predict.

"Any explanation for this has to be unorthodox," Stevenson said.

Researchers are exploring weather events concentrating significant amounts of ice, liquids and gas in different parts of the atmosphere as possible explanations, but the matter is far from sealed. Other instruments on board Juno, gravity and magnetic sensors, have also sent back perplexing data. The magnetic field ...Read More...
Researchers at WSU have created a fluid with a negative effective mass for the first time, which could open the door to studying the deeper mysteries of the Universe. Credit: ESA/Hubble, ESO, M. Kornmesser

In the course of looking for possible signs of extra-terrestrial intelligence (ETI), scientists have had to do some really outside-of-the-box thinking. Since it is a foregone conclusion that many ETIs would be older and more technologically advanced than humanity, those engaged in the Search for Extra-Terrestrial Intelligence (SETI) have to consider what a more advanced species would be doing.

A particularly radical idea is that spacefaring civilizations could harness radiation emitted from black holes (Hawking radiation) to generate power. Building on this, Louis Crane, a mathematician from Kansas State University (KSU), recently authored a study that suggests how surveys using gamma telescopes could find evidence of spacecraft powered by tiny artificial black holes.

The study, “Searching for Extraterrestrial Civilizations Using gamma Ray Telescopes,” recently appeared online. This is the second paper published by Dr. Crane on the subject, the first of which was co-authored by Shawn Moreland (a physics grad student with KSU) and published in 2009 – titled “Are Black Hole Spacecraft Possible?”

In the first paper, Crane and Westmoreland explored the possibility of using Hawking radiation from an artificial black hole. They concluded that it was at the edge of possibility, but that quantum gravity effects (which are currently unknown) could be an issue. In her most recent paper, Crane took things a step further by describing how the resulting gamma-rays such a system would produce could aid in the search for ETIs.

The concept of a black hole-powered spacecraft was first introduced by famed science fiction author Arthur C. Clarke in his 1975 novel Imperial Earth. A similar idea was presented by Charles Sheffield in his 1978 short story “Killing Vector.” In both cases, Clarke and Sheffield describe how advanced civilizations could extract energy from rotating black holes to meet their energy needs.

Aside from being pure science-fiction gold, the ability to harness a black hole to generate power would offer some pretty hefty advantages. As Dr. Crane described to Universe Today via email: “An advanced civilization would want to harness a microscopic black hole because it could throw in matter and get out energy. It would be the ultimate energy source. In particular, it could propel a starship large enough to be shielded to relativistic velocities. None of the starship concepts NASA studied turned out to be viable... It might be the only possibility.”

In addition, the signatures associated with this sort of technological activity (aka “technosignatures”) would indicate a very high level of advancement. Given the sheer energy requirements for creating an artificial black hole, plus the technical challenges associated with harnessing it, the process would be beyond anything less than a Type II civilization on the Kardashev Scale.

“To produce an artificial black hole, we would need to focus a billion-ton gamma ray laser to nuclear dimensions,” said Dr. Crane. “It’s like making as many high-tech nuclear bombs as there are automobiles on Earth. Just the scale of it is beyond the current world economy. A civilization which fully utilized the solar system would have the resources.”

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**Mr. Ludovic Pouille, French Ambassador to the UAE, visits SCASS**  
**(Mar. 07, 2019)**

HE Mr. Ludovic Pouille, the French Ambassador to the UAE, and his wife visited the Sharjah Center for Astronomy and Space Sciences on March 07, 2019. Prof. Hamid Al-Naimiy, the Chancellor of the University of Sharjah, and SCASS General Director welcomed the French Ambassador to the Center. Ms. Raja Rabia, the French General Consul, as well as Ms. Sabine Sciortino, the Director, Cultural, and Cooperation Counselor, were also part of the French delegation. Mr. Ludovic had the chance to tour the space exhibitions, the planetarium, and the research laboratories. He was very impressed by the achievements of the center just four years after its inauguration.

Prof. Hamid Al-Naimiy, the Chancellor of the University of Sharjah, and SCASS General Director, explained to the French Ambassador, Mr. Ludovic Pouille, the different sections of the International Space Station.