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جامعة الشارقة
UNIVERSITY OF SHARJAH

Inside this issue:

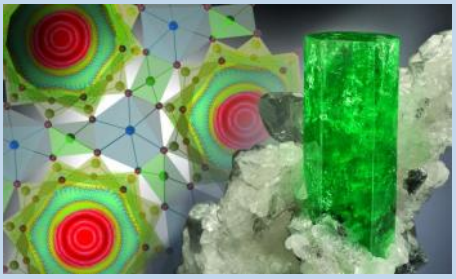
New state of water molecule discovered

Neutron scattering and computational modeling have revealed unique and unexpected behavior of water molecules under extreme confinement that is unmatched by any known gas, liquid or solid states.

In a paper published in Physical Review Letters, researchers at the Department of Energy's Oak Ridge National Laboratory describe a new tunneling state of water molecules confined in hexagonal ultra-small channels - 5 angstrom across - of the mineral beryl. An angstrom is 1/10-billionth of a meter, and individual atoms are typically about 1 angstrom in diameter.

The discovery, made possible with experiments at ORNL's Spallation Neutron Source and the Rutherford Appleton Laboratory in the United Kingdom, demonstrates features of water under ultra confinement in rocks, soil and cell walls, which scientists predict will be of interest across many disciplines.

"At low temperatures, this tunneling water exhibits quantum motion through the separating potential walls, which is forbidden in the classical world," said lead author Alexander Kolesnikov of ORNL's Chemical and Engineering Materials Division. "This means that the oxygen and hydrogen atoms of the water molecule are 'delocalized' and therefore simultaneously ...Read More...



ORNL researchers discovered that water in beryl displays some unique and unexpected characteristics. Credit: Jeff Scovil

Hubble captures birthday bubble

This new NASA/ESA Hubble Space Telescope image, released to celebrate Hubble's 26th year in orbit, captures in stunning clarity what looks like a gigantic cosmic soap bubble. The object, known as the Bubble Nebula, is in fact a cloud of gas and dust illuminated by the brilliant star within it. The vivid new portrait of this dramatic scene wins the Bubble Nebula a place in the exclusive Hubble hall of fame, following an impressive lineage of Hubble anniversary images.

Twenty six years ago, on 24 April 1990, the NASA/ESA Hubble Space Telescope was launched into orbit aboard the space shuttle Discovery as the first space telescope of its kind. Every year, to commemorate this momentous day in space history, Hubble spends a modest portion of its observing time capturing a spectacular view of a specially chosen astronomical object.

This year's anniversary object is the Bubble Nebula, also known as NGC 7635, which lies 8 000 light-years away in the constellation Cassiopeia. This object was first discovered by William Herschel in 1787 and this is not the first time it has caught Hubble's eye. However, due to its very large size on the sky, previous Hubble images have only shown small sections of the nebula, providing a much less spectacular ...Read More..

The Bubble Nebula, also known as NGC 7635, which lies 8 000 light-years away. This stunning new image was observed by the NASA/ESA Hubble Space Telescope to celebrate its 26th year in space. Credit: NASA, ESA, Hubble Heritage Team

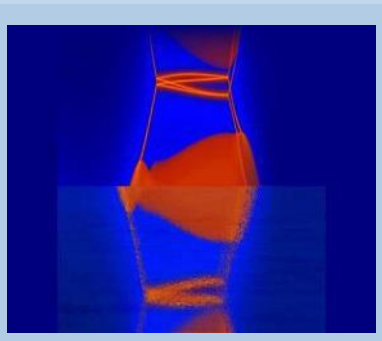
Electrons slide through the hourglass on surface of bizarre material

A team of researchers at Princeton University has predicted the existence of a new state of matter in which current flows only through a set of surface channels that resemble an hourglass. These channels are created through the action of a newly theorized particle, dubbed the "hourglass fermion," which arises due to a special property of the material. The tuning of this property can sequentially create and destroy the hourglass fermions, suggesting a range of potential applications such as efficient transistor switching.

In an article published in the journal Nature this week, the researchers theorize the existence of these hourglass fermions in crystals made of potassium and mercury combined with either antimony, arsenic or bismuth. The crystals are insulators in their interiors and on their top and bottom surfaces, but perfect conductors on two of their sides where the fermions create hourglass-shaped channels that enable electrons to flow.

The research was performed by Princeton University postdoctoral researcher Zhijun Wang and former graduate student Aris Alexandradinata, now a postdoctoral researcher at Yale University, working with Robert Cava, Princeton's Russell Wellman Moore Professor of Chemistry, and Associate Professor of Physics B. Andrei Bernevig.

The new hourglass fermion exists - theoretically for now, until detected experimentally - in a family of materials broadly called topological insulators, which were first observed experimentally in the mid-2000s and have since ...Read More...



This is an illustration of the hourglass fermion predicted to lie on the surface of crystals of potassium mercury antimony. Image courtesy Bernevig, et al., Princeton University.

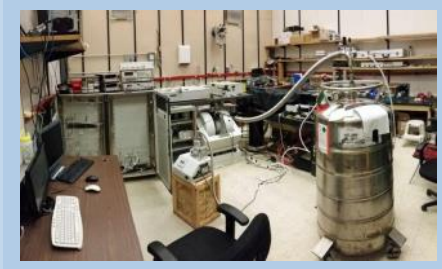
Inverse spin Hall effect: A new way to get electricity from magnetism

By showing that a phenomenon dubbed the "inverse spin Hall effect" works in several organic semiconductors - including carbon-60 buckyballs - University of Utah physicists changed magnetic "spin current" into electric current. The efficiency of this new power conversion method isn't yet known, but it might find use in future electronic devices including batteries, solar cells and computers.

"This paper is the first to demonstrate the inverse spin Hall effect in a range of organic semiconductors with unprecedented sensitivity," although a 2013 study by other researchers demonstrated it with less sensitivity in one such material, says Christoph Boehme, a senior author of the study published April 18 in the journal Nature Materials.

"The inverse spin Hall effect is a remarkable phenomenon that turns so-called spin current into an electric current. The effect is so odd that nobody really knows what this will be used for eventually, but many technical applications are conceivable, including very odd new power-conversion schemes," says Boehme, a physics professor.

His fellow senior author, distinguished professor Z. Valy Vardeny, says that by using pulses of microwaves, the inverse spin Hall effect and organic semiconductors to convert spin current into electricity, this new electromotive force generates electrical current in a way different ...Read More...

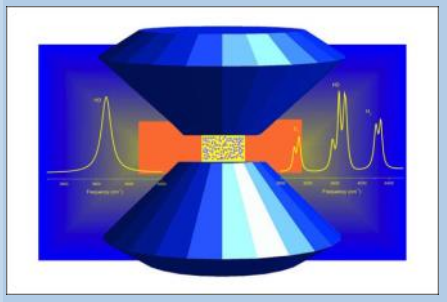


A view of the University of Utah physics laboratory where researchers showed that a phenomenon named the inverse spin Hall effect works in several organic semiconductors when pulsed microwaves are applied to the materials. The effect converts so-called spin current to electric current and may find use in future generations of batteries, solar cells and electronic devices. Credit: Christoph Boehme, University of Utah

Pressing the simplest element to exotic quantum states

The hydrogens—hydrogen and its isotopes—are the simplest and most abundant of the elements in the universe. Conceptually hydrogen, with a single proton and electron is the simplest atomic system in the periodic table of the elements, yet has exceptionally complex behavior due to its light mass and interactions with other hydrogen atoms.

As a neutral electron spin-polarized gas, it does not form a liquid in the T→0 K limit; unpolarized it readily forms stable molecules that solidify at ~14 K. When pressurized to millions of bars it is predicted to dissociate to an atomic metal, predicted to have exotic properties such as high-temperature superconductivity, metastability, and a liquid state at megabar pressures in the low temperature limit. Understanding these quantum effects and establishing the phase diagram of the various isotopes of molecular hydrogen has been an intriguing scientific challenge for decades. Harvard physicists have taken yet another step toward a more complete understanding of the hydrogens.
In the latest issue of Physical Review Letters, Professor Isaac Silvera and research scholars, Dr. Ranga Dias and Dr. Ori Noked study hydrogen deuteride and report the discovery of two novel quantum phase transitions that significantly depart from the behavior of pure hydrogen or deuterium and provide a clear demonstration of how the dissociation process may proceed. ...Read More...



Microscopic 'timers' reveal likely source of galactic space radiation

Most of the cosmic rays that we detect at Earth originated relatively recently in nearby clusters of massive stars, according to new results from NASA's Advanced Composition Explorer (ACE) spacecraft. ACE allowed the research team to determine the source of these cosmic rays by making the first observations of a very rare type of cosmic ray that acts like a tiny timer, limiting the distance the source can be from Earth.

"Before the ACE observations, we didn't know if this radiation was created a long time ago and far, far away, or relatively recently and nearby," said Eric Christian of NASA's Goddard Space Flight Center in Greenbelt, Maryland. Christian is co-author of a paper on this research published April 21 in Science.

Cosmic rays are high-speed atomic nuclei with a wide range of energy - the most powerful race at almost the speed of light. Earth's atmosphere and magnetic field shield us from less-energetic cosmic rays, which are the most common. However, cosmic rays will present a hazard to unprotected astronauts traveling beyond Earth's magnetic field because they can act like microscopic bullets, damaging structures and breaking apart molecules in living cells. NASA is currently researching ways to reduce or mitigate the effects of cosmic radiation to protect astronauts traveling to Mars.

Cosmic rays are produced by a variety of violent events in space. Most cosmic rays originating within our solar system have relatively low energy and come from explosive ...Read More..

This is a cluster of massive stars seen with the Hubble Space Telescope. The cluster is surrounded by clouds of interstellar gas and dust called a nebula. The nebula, located 20,000 light-years away in the constellation Carina, contains the central cluster of huge, hot stars, called NGC 3603. Image courtesy NASA/U. Virginia/INAF, Bologna, Italy/ USRA/ Ames/STScI/ AURA

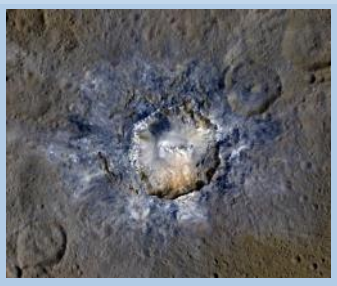
Landslides and Bright Craters on Ceres Revealed in Marvelous New Images from Dawn

Now in orbit for just over a year at dwarf planet Ceres, NASA's Dawn spacecraft continues to astound us with new discoveries gleaned from spectral and imagery data captured at ever decreasing orbits as well as since the probe arrived last December at the lowest altitude it will ever reach during the mission.

Mission scientists have just released marvelous new images of Haulani and Oxo craters revealing landslides and mysterious slumps at several of the mysterious bright craters on Ceres – the largest asteroid in the main Asteroid Belt between Mars and Jupiter.

The newly released image of oddly shaped Haulani crater right, shows the crater in enhanced color and reveals evidence of landslides emanating from its crater rim.

"Rays of bluish ejected material are prominent in this image. The color blue in such views has been associated with young features on Ceres," according to the Dawn science team. "Enhanced color allows scientists to gain insight into materials and how they relate to surface morphology." Look at the image closely and you'll see its actually ...Read More...



Ceres' Haulani Crater, with a diameter of 21 miles (34 kilometers), shows evidence of landslides from its crater rim. Credits: NASA/ JPL-Caltech/UCLA/MPS/DLR/IDA

Numerical simulations shed new light on early universe

Innovative multidisciplinary research in nuclear and particle physics and cosmology has led to the development of a new, more accurate computer code to study the early universe. The code simulates conditions during the first few minutes of cosmological evolution to model the role of neutrinos, nuclei and other particles in shaping the early universe.

Anticipating precision cosmological data from the next generation of "Extremely Large" telescopes, the BURST code developed by scientists at Los Alamos National Laboratory in collaboration with colleagues at University of California San Diego, "promises to open up new avenues for investigating existing puzzles of cosmology," says Los Alamos physicist Mark Paris of the Nuclear and Particle, Astrophysics and Cosmology group. "These include the nature and origin of visible matter and the properties of the more mysterious 'dark matter' and 'dark radiation.' "

"The BURST computer code allows physicists to exploit the early universe as a laboratory to study the effect of fundamental particles present in the early universe," Paris explains. "Our new work in neutrino cosmology allows the study of the microscopic, quantum nature of fundamental particles—the basic, subatomic building blocks of nature—by simulating the universe at its largest, cosmological scale," said Paris.

"The frontiers of fundamental physics have traditionally been studied with particle colliders, such as the Large Hadron Collider at CERN, by smashing together subatomic particles at great energies," says UCSD physicist George Fuller, who collaborated with Paris and ...Read More...

Los Alamos scientists developed the BURST computer code to predict -- to unprecedented precision -- the amounts of light nuclei synthesized in the Big Bang. Credit: Los Alamos National Laboratory

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SCASS Observatory:

First Open House on April 29, 2016

The Sharjah Center for Astronomy and Space Sciences is establishing monthly observing sessions at the observatory. These sessions are open to the public free of charge. Visitors have the opportunity to gaze through the 17" reflector, as well as several smaller scopes.

The Observatory will be open to the public at the following times for viewing (weather permitting, must have mostly clear skies):

Friday – April 29, 2016: 19:00 – 22:00.

The usual open house schedule is for the second and fourth Friday of the month. If it's cloudy, then try again the following Friday if the weather looks good.

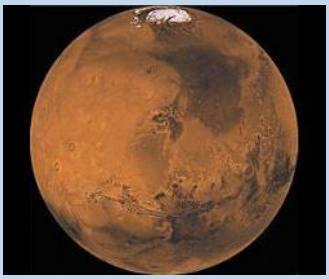
NASA seeks industry ideas for an advanced Mars satellite

NASA is soliciting ideas from U.S. industry for designs of a Mars orbiter for potential launch in the 2020s. The satellite would provide advanced communications and imaging, as well as robotic science exploration, in support of NASA's Journey to Mars.

The orbiter would substantially increase bandwidth communications and maintain high-resolution imaging capability. It also may use experimental cutting-edge technologies, such as high-power solar electric propulsion or an optical communications package, which could greatly improve transmission speed and capacity over radio frequency systems.

Under the direction of NASA's Mars Exploration Program, the agency's Jet Propulsion Laboratory in Pasadena, California, is conducting pre-formulation planning for this possible orbiter mission. Pre-formulation plans include the procurement of industry studies for a solar-powered orbiting spacecraft.

This effort seeks to take advantage of industry capabilities to improve deep space, solar electric propulsion-enabled ...Read More...



About 1000 Viking Orbiter red- and violet-filter images have been processed to provide global color coverage of Mars at a scale of 1 km/pixel. Image courtesy NASA/JPL/USGS.

Diphoton bump at LHC leads to generation of hundreds of theoretical papers

Last year, two teams working at the LHC reported that they had found proton-to-proton collisions that had led to the creation of more photon pairs (with energies of approximately 750 GeV) than was expected, leading to theories that the evidence might be pointing to a new particle than no one has theorized. This discovery led to a plethora of teams creating papers seeking to be the first to explain this seeming anomaly—so many papers have been submitted to journals for publication that editors have had to pick and choose which to publish. One example is Robert Garisto with Physical Review Letters, who has published an editorial describing the onrush and the decision to publish just four papers in their latest edition, which the editorial team believes is representative of the four main ideas.

In the first paper, Christoffer Petersson with Chalmers University of Technology in Sweden and Riccardo Torre with Institut de Théorie des Phénomènes Physiques in Switzerland, suggest the bump represents the existence of a boson with very weak interactions that is possibly a supersymmetric partner of the still hypothetical fermion called the goldstino.

In the second paper, the trio Yuichiro Nakai, Ryosuke Sato and Kohsaku Tobioka with affiliations to institutions in the U.S., Israel, and Japan suggest that the bump is evidence of a pion-like boson (a particle made of exotic quarks) which is not currently included in the standard model, and which may be associated with a new type of strong force.

In the third paper a small team from China suggests ...Read More...

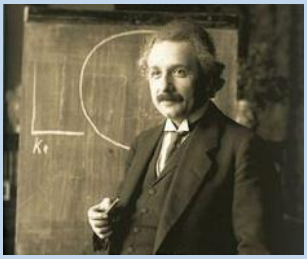
Europe to launch satellites for Earth, Einstein

Europe is set to launch two satellites on Friday with very important missions: one will track environmental damage to Earth, while the other will test a mainstay of physics theory.

Setting off on a Russian Soyuz rocket will be Sentinel-1B with its Earth surveillance radar, and Microscope, a French-built orbiter seeking to poke a hole in Einstein's theory of general relativity.
They will be hoisted from Europe's launch pad in Kourou, French Guiana, at 2102 GMT Friday.

Sentinel-1B is the twin of Sentinel-1A, launched two years ago.
The pair are equipped with sophisticated, cloud-penetrating radar with which to monitor Earth's surface by day and night, regardless of the weather conditions.

Their mission is to track climate and environmental change and assist in disaster relief operations. Sentinel-1A and 1B are part of the 3.8-billion-euro ($4.3-billion) Copernicus project, which will ultimately sport six orbiters in all. It is a joint undertaking of the European Space Agency and the European Commission. ...Read More...



Einstein -