October 03, 2015
Dhu'l Hijjah 19, 1436
Volume 5, Issue 40

Astronomy & Physics News

Department of Physics—United Arab Emirates University
Weekly Scientific News Compiled by Dr. Ilias Fernini

INTERNATIONAL YEAR OF LIGHT 2015

Inside this issue:

A satellite launcher for the Middle East

Swiss Space Systems (Holding) SA, trough its subsidiary S3 Middle East, announces major partnership with D&B Group to deliver access to space to the Middle East. The goal is to develop, manufacture, certify and operate unmanned suborbital shuttles to locally launch small satellites up to 250 kg by 2019.

Swiss Space Systems (Holding) SA has announced the signature of a major investment and partnership agreement from D&B Group to open an S3 Middle-East subsidiary, and to develop access to Space from the Middle East. This investment has far-reaching implications for S3's continued global expansion plans.

The "Space for All" vision of S3 is progressively earning its reputation through a commitment to aerospace excellence. For this, the ambitions of Middle Eastern countries are complementary and hereby we have to thanks Dr Amin Abbas Forati chairman of the D&B group for all his effort and choose the UAE between all Arab countries to became the first country who has this technology and with the opening of S3 Middle East, the D&B group will introduce the UAE to the prestigious clan of future space launcher countries…..Read More….

NASA's Big Mars Story

Every time NASA ballyhoos a press conference to announce an exciting discovery about Mars, the public bets heavily that the news will either be about water (What, again?) or life (Finally!) This week's communique is about both, and neither. But there's no gainsaying the fact that it's exciting.

It concerns the seasonally changing features on crater walls and other vertical topography, known as recurrent slope lineae. These things look like long, dark fingers running downhill, and they become prominent when summertime Mars warms up to temperatures that, while cold for Earth, are considered balmy on the Red Planet.

The lineae resemble seepage - melt water just below the dry, martian surface that's oozing its way downhill. Now, researchers using spectral analysis from an orbiter have determined that it most likely is water - not any of the other possible phenomena. That's a strong indicator that there are subsurface reservoirs at very shallow depth on Mars. In other words, Mars apparently has lakes today; they're just covered by a rusty, dusty carapace of boring dirt. ...Read More...

File Image.

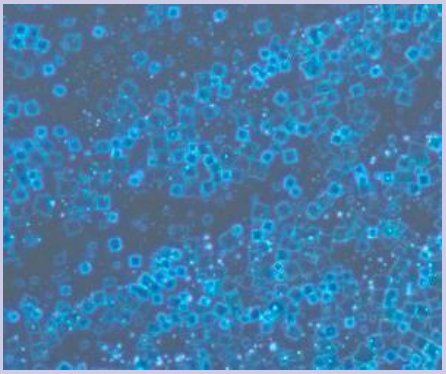
A different type of 2-D semiconductor

To the growing list of two-dimensional semiconductors, such as graphene, boron nitride, and molybdenum disulfide, whose unique electronic properties make them potential successors to silicon in future devices, you can now add hybrid organic-inorganic perovskites. However, unlike the other contenders, which are covalent semiconductors, these 2D hybrid perovskites are ionic materials, which gives them special properties of their own.

Researchers at the U.S. Department of Energy (DOE)'s Lawrence Berkeley National Laboratory (Berkeley Lab) have successfully grown atomically thin 2D sheets of organic-inorganic hybrid perovskites from solution. The ultrathin sheets are of high quality, large in area, and square-shaped. They also exhibited efficient photoluminescence, color-tunability, and a unique structural relaxation not found in covalent semiconductor sheets.

"We believe this is the first example of 2D atomically thin nanostructures made from ionic materials," says Peidong Yang, a chemist with Berkeley Lab's Materials Sciences Division and world authority on nanostructures, who first came up with the idea for this research some 20 years ago.

"The results of our study open up opportunities for fundamental research on the synthesis and characterization of atomically thin 2D hybrid perovskites and introduces a new family of 2D solution-processed semiconductors for nanoscale optoelectronic devices, such as field effect transistors and photodetectors." ...Read More...



Ultrathin sheets of a new 2-D hybrid perovskite are square-shaped and relatively large in area, properties that should facilitate their integration into future electronic devices. Image courtesy of Peidong Yang, Berkeley Lab .

New precise particle measurement improves subatomic tool

Physicists at Southern Methodist University, Dallas, have achieved a new precise measurement of a key subatomic particle, opening the door to better understanding some of the deepest mysteries of our universe. The researchers calculated the new measurement for a critical characteristic - mass - of the top quark.

Quarks make up the protons and neutrons that comprise almost all visible matter. Physicists have known the top quark's mass was large, but have encountered great difficulty trying to clearly determine it.

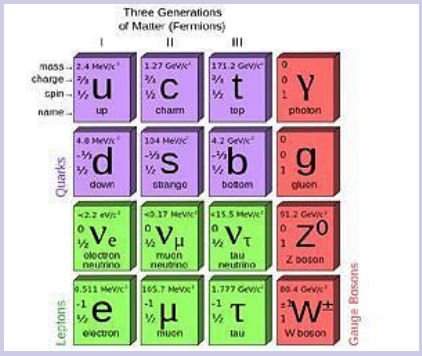
The newly calculated measurement of the top quark will help guide physicists in formulating new theories, said Robert Kehoe, a professor in SMU's Department of Physics. Kehoe leads the SMU group that performed the measurement.

Top quark's mass matters ultimately because the particle is a highly sensitive probe and key tool to evaluate competing theories about the nature of matter and the fate of the universe. Physicists for two decades have worked to improve measurement of the top quark's mass and narrow its value.

"Top" bears on newest fundamental particle, the Higgs boson

The new value from SMU confirms the validity of recent measurements by other physicists, said Kehoe. But it also adds growing uncertainty about aspects of physics' Standard Model.

The Standard Model is the collection ..Read More



The Standard Model holds that the top quark - known familiarly as "top" - is central in two of the four fundamental forces in our universe - the electroweak force, by which particles gain mass, and the strong force, which governs how quarks interact.

Iron-gallium alloy shows promise as a power-generation device

An alloy first made nearly two decades ago by the U. S. Navy could provide an efficient new way to produce electricity. The material, dubbed Galfenol, consists of iron doped with the metal gallium. In new experiments, researchers from UCLA, the University of North Texas (UNT), and the Air Force Research Laboratories have shown that Galfenol can generate as much as 80 megawatts of instantaneous power per square meter under strong impacts. The team describes the findings, which could lead to the development of wireless impact detectors and other applications, in a paper in the Journal of Applied Physics.

Galfenol is a magnetoelastic material—one in which the state of magnetization can be changed by squeezing, pushing or otherwise deforming the material. Conversely, when exposed to a magnetic field, magnetoelastic materials respond by changing shape. If the materials are prevented from deforming—for example, by being held in a clamp—they instead will generate a large force.

"In general this means a magnetoelastic material can convert mechanical energy into magnetic energy, and vice versa," explained John P. Domann, a mechanical engineering graduate student at UCLA and first author of the paper. Galfenol converts energy with high efficiency; it is able ...Read More...

This picture is of the experimental setup showing the Hopkinson bar surrounded by a water-cooled electromagnet. A cylinder of Galfenol is inside of the electromagnet, sandwiched between the Hopkinson bars. The magnet was used to apply a wide range of static magnetic fields to Galfenol while it was mechanically impacted. Credit: John Domann/UCLA

Pluto's Big Moon Charon Reveals a Colorful and Violent History

NASA's New Horizons spacecraft has returned the best color and the highest resolution images yet of Pluto's largest moon, Charon - and these pictures show a surprisingly complex and violent history.

At half the diameter of Pluto, Charon is the largest satellite relative to its planet in the solar system. Many New Horizons scientists expected Charon to be a monotonous, crater-battered world; instead, they're finding a landscape covered with mountains, canyons, landslides, surface -color variations and more.

"We thought the probability of seeing such interesting features on this satellite of a world at the far edge of our solar system was low," said Ross Beyer, an affiliate of the New Horizons Geology, Geophysics and Imaging (GGI) team from the SETI Institute and NASA Ames Research Center in Mountain View, California, "but I couldn't be more delighted with what we see!"

High-resolution images of the Pluto-facing hemisphere of Charon, taken by New Horizons as the spacecraft sped through the Pluto system on July 14, and transmitted to Earth on Sept. 21, reveal details of a belt of fractures and canyons just north of the moon's equator. This great canyon system stretches across the entire face of Charon, more than a thousand miles, and probably around onto Charon's far side. Four times as long as the Grand Canyon, and twice as deep in places, these faults and canyons indicate a titanic geological upheaval in Charon's past.

"It looks like the entire crust of Charon has been split open," said John Spencer, deputy lead for GGI at the Southwest ...Read More...

NASA's New Horizons captured this high-resolution enhanced color view of Charon just before closest approach on July 14, 2015. The image combines blue, red and infrared images taken by the spacecraft's Ralph/Multispectral Visual Imaging Camera (MVIC); the colors are processed to best highlight the variation of surface properties across Charon.

The Most Stable Source of Light in the World

In order to be able to detect planets comparable to Earth, the CHEOPS satellite, which will be sent into orbit at the end of 2017, must be able to measure the luminosity of a star with inimitable accuracy. In order to test CHEOPS detectors researchers need a stable source of light.

However there was no instrument capable of producing a light source with sufficient stability to be used as a reference... until today. A team from the University of Geneva (UNIGE), Switzerland, has just filed for a European patent. Designed by Swiss researchers and built by the University of Berne, the CHEOPS satellite's mission will be to study exoplanets that have already been identified and which are located close to our solar system.

Thanks to high-precision photometry, the satellite will detect the passage (transit) of a planet in front of its star, by measuring the latter's diminishing luminosity at that precise moment. Scientists will thus be able to deduce the diameter of the exoplanet under observation.

In order to detect planets similar to planet Earth, the satellite must therefore ...Read More..

The CHEOPS satellite instrument.

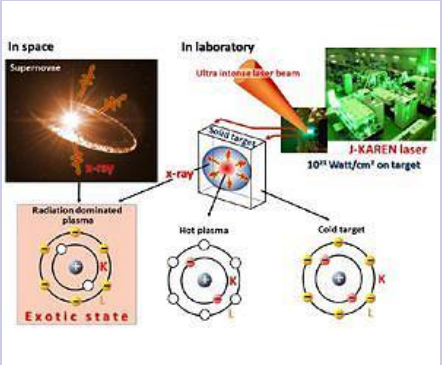
How do atoms alter during a supernova explosion?

A research group from Osaka University, in collaboration with an international research team, successfully realized in laboratory the world of exotic atoms under extreme state through high - brightness X-ray sources, typically realized in supernova explosions.

A world first research produced highly unusual plasma composed of hollow atoms by utilizing the Japan Atomic Energy Agency (JAEA) Kansai Advanced Relativistic Engineering Laser (J-KAREN), one of the world's most powerful compact femtosecond laser facility.

For this research, Anatoly FAENOV of the Division of Photon Science and Technology of the Institute for Academic Initiatives and Mamiko NISHIUCHI of the JAEA's Quantum Beam Science Center, along with an international collaborative research team, performed an experiment to demonstrate that it is possible to remove the two most deeply bound electrons from atoms, emptying the inner most quantum shell and leading to a distinctive plasma state through the generation of ultra-bright x-rays (See Fig.1).

The irradiation of an incredibly powerful high contrast J-KAREN laser beam to a solid matter allowed successfully to attain X-rays with a radiative temperature of 15,000,000 , and a plasma state of 3,000,000 (Fig.2). In addition, it was discovered that multiple inner-shell electron excitations were generated, causing an explosive increase in the number of ...Read More...



Hollow multicharged ions by ultraintense X-ray photo pumping in space (Supernova explosions) and laboratory (ultra-intense visible femtosecond lasers). (Upper right) A photo of J-KAREN, KPSI and JAEA's high power laser facility. Image courtesy Osaka University.

Physics Department

College of Science - United Arab Emirates University
POB 15551
Al-Ain
United Arab Emirates

Phone: 00-971-3-7136336
Fax: 00-971-3-713-6909
E-mail: physics@uaeu.ac.ae

http://www.cos.uaeu.ac.ae/en/departments/physics/index.shtml

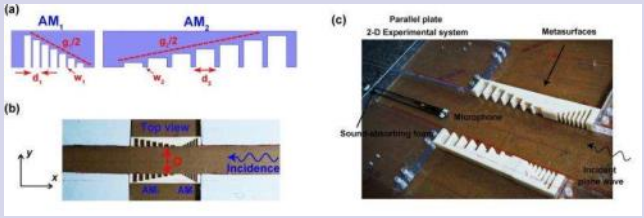
For Previous Issues, click Here

UAEU College of Science
جامعة الإمارات العربية المتحدة
United Arab Emirates University

One-way sound tunnel offers novel way to control acoustic waves

Scientists have designed and built an acoustic one-way tunnel that allows sound to pass through in one direction only while blocking it from passing through in the opposite direction. The tunnel is completely open to light and heat, which can pass through in both directions, but sound waves are blocked in one direction due to acoustic metamaterials placed on the sides of the tunnel. The acoustic one-way tunnel has potential applications for anti-noise windows and vent ducts, as well as medical ultrasound.

The researchers, Yi-Fan Zhu, Xin-Ye Zou, Bin Liang, and Jian-Chun Cheng, from Nanjing University in China, have published their paper on the acoustic one-way tunnel in a recent issue of Applied Physics Letters. "One-way acoustic devices are believed to have deep implications in various situations by breaking through the conventional concept that sound always propagates symmetrically along a given path," Liang told Phys.org, noting some of their previous ...Read More….

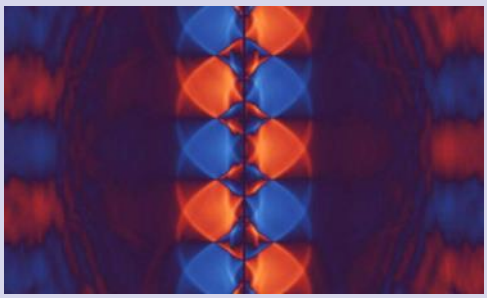


(a) The two acoustic metamaterials have different groove patterns, which are positioned at different sides of the tunnel so that they affect the sound waves differently depending on which direction they're coming from. (b) and (c) Photographs of the open tunnel. Credit: Zhu, et al. ©2015 AIP Publishing

A necklace of fractional vortices

Researchers at Chalmers University of Technology have arrived at how what is known as time-reversal symmetry can break in one class of superconducting material. The results have been published in the highly ranked Nature Physics journal, which also put the Chalmers researchers' study on the cover.

"Symmetries are an important aspect when describing nature", says Mikael Fogelström, who is a professor of theoretical physics at Chalmers University of Technology. "A ball is round and looks the same regardless of how we rotate it; thus, it has rotational symmetry. In the same way, most materials have symmetries that describe what the materials look like and what their properties are. If one or more symmetries breaks, this signals a phase transition to a ...Read More...



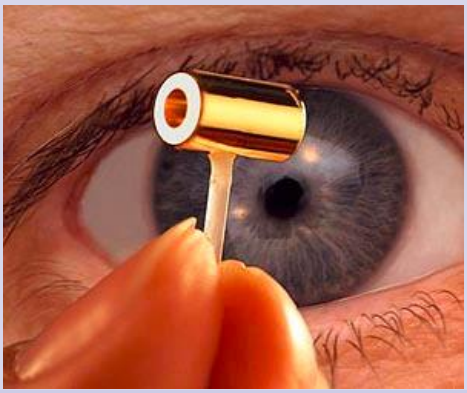
A route to a time-reversal symmetry-broken state for d-wave superconductors is shown to occur via the formation of a necklace of fractional vortices around the perimeter of the material, where neighbouring vortices have opposite current circulation. This vortex pattern is a result of a spectral rearrangement of current-carrying states near the edges. Credit: Mikael Håkansson

Small-scale nuclear fusion may be a new energy source

Fusion energy may soon be used in small-scale power stations. This means producing environmentally friendly heating and electricity at a low cost from fuel found in water. Both heating generators and generators for electricity could be developed within a few years, according to research that has primarily been conducted at the University of Gothenburg.

Nuclear fusion is a process whereby atomic nuclei melt together and release energy. Because of the low binding energy of the tiny atomic nuclei, energy can be released by combining two small nuclei with a heavier one.

A collaboration between researchers at the University of Gothenburg and the University of Iceland has been to study a new ...Read More...



File Image.