June 25, 2016 Ramadhan 20, 2016 Volume 6, Issue 26

Astronomy & Physics Weekly News

Dept. of Applied Physics & Astronomy - **University of Sharjah**

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مركز الشارقة لعلوم الفضاء والفلك

Sharjah Center for Astronomy & Space Sciences

Top News

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Designe by Mohamed Bakir

Possibility of new particle discovery at LHC fading

File Image.

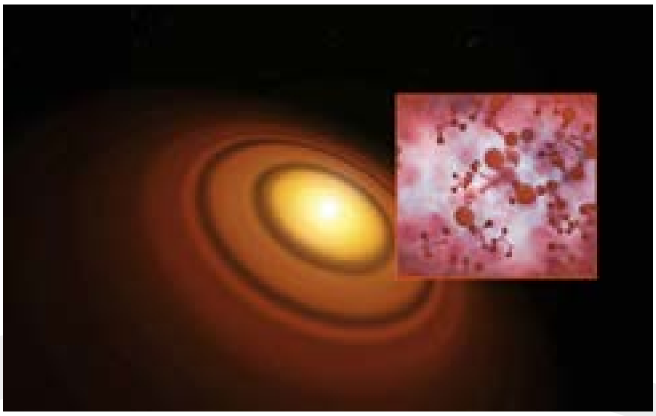
The physics community is apparently starting to lose its buzz over the possibility of the discovery of a new particle by researchers working at the CERN LHC facility near Geneva. As more data is studied, it appears more and more likely that the blip that was seen last December was simply an anomaly in the data.

The discovery of a new particle, one that has not been predicted by the Standard Model, would cause more than a stir in the high energy physics world—it would actually be a revolutionary event, setting physicists off on new paths of discovery for years to come. That is why news that a team working on the ATLAS and CMS projects at the LHC caused a stir late last year when they reported a 750 GeV diphoton "bump" in the data, one that was reported in two separate experiments.

But now, as time passes, more and more it seems likely that all the fuss will have been about nothing—researchers on both projects at the LHC have been working diligently since last month to find the bump once again, and if that happens, to verify it. But, neither team has been forthcoming regarding results thus far, leading to speculation that they have not found anything to report. And now it does not appear that any new information will be given until at least the middle of next month when the International Conference on High Energy Physics will take place in August, in Chicago—though there have been rumors that if the LHC team does find something exciting, they could make an announcement at a special seminar next month in Geneva. The thinking here is apparently, that if no announcements are made by the earlier time frame, than there will be no need for waiting for the second, as it would be a pretty good sign that no "bumps" have been seen and thus topics of discussion will move over to more mundane themes.

In the meantime, physicists around the world will no doubt continue blogging or giving interviews ...Read More...

First Detection of Methyl Alcohol in a Planet-forming Disc



This artist's impression shows the closest known protoplanetary disc, around the star TW Hydrae in the huge constellation of Hydra (The Female Watersnake). The organic molecule methyl alcohol (methanol) has been found by the Atacama Large Millimeter/Submillimeter Array (ALMA) in this disc. This is the first such detection of the compound in a young planet-forming disc. Image courtesy ESO/M. Kornmesser.

The organic molecule methyl alcohol (methanol) has been found by the Atacama Large Millimeter/submillimeter Array (ALMA) in the TW Hydrae protoplanetary disc. This is the first such detection of the compound in a young planet-forming disc. Methanol is the only complex organic molecule as yet detected in discs that unambiguously derives from an icy form.

Its detection helps astronomers understand the chemical processes that occur during the formation of planetary systems and that ultimately lead to the creation of the ingredients for life.

The protoplanetary disc around the young star TW Hydrae is the closest known example to Earth, at a distance of only about 170 light-years. As such it is an ideal target for astronomers to study discs. This system closely resembles what astronomers think the Solar System looked like during its formation more than four billion years ago.

ALMA is the most powerful observatory in existence for mapping the chemical composition and the distribution of cold gas in nearby discs. These unique capabilities have now been exploited by a group of astronomers led by Catherine Walsh (Leiden Observatory, the Netherlands) to investigate the chemistry of the TW Hydrae protoplanetary disc.

The ALMA observations have revealed the fingerprint of gaseous methyl alcohol, or methanol (CH_3OH), in a protoplanetary disc for the first time. Methanol, a derivative of methane, is one of the largest complex organic molecules detected in discs to date. Identifying its presence in pre-planetary objects represents ...Read More...

China to send Chang'e-4 to south pole of moon's far-side

The lander of Chang'e-4 will be equipped with descent and terrain cameras, and the rover will be equipped with a panoramic camera, he said. Like China's first lunar rover Yutu, or Jade Rabbit, carried by Chang'e-3, the rover of Chang'e-4 will carry subsurface penetrating radar to detect the near surface structure of the moon, and an infrared spectrometer to analyze the chemical composition of lunar samples.

China aims to send the Chang'e-4 lunar probe to land in the south pole region of the far side of the moon in 2018, according to China National Space Administration (CNSA).

Scientists plan to send a relay satellite for Chang'e-4 to the halo orbit of the Earth-Moon Lagrange Point L2 in late May or early June 2018, and then launch the Chang'e-4 lunar lander and rover to the Aitken Basin of the south pole region about half a year later, said Liu Tongjie, deputy director of the CNSA's Lunar Exploration and Space Program Center.

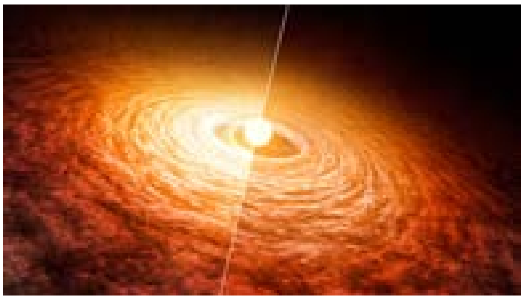
"We plan to land Chang'e-4 at the Aitken Basin because the region is believed to be a place with great scientific research potential," Liu told Xinhua in an exclusive interview.

With its special environment and complex geological history, the far side of the moon is a hot spot for scientific and space exploration. However, landing and roving there requires the relay satellite to transmit signals.

The transmission channel is limited, and the landscape is rugged, so the Chang'e-4 mission will be more complicated than Chang'e-3, China's first soft landing mission on the moon, which was completed in 2013, said Liu.

The lander of Chang'e-4 will be equipped with descent and terrain cameras, and the rover will be equipped with a panoramic camera, he said. Like China's first lunar rover Yutu, or Jade Rabbit, carried by Chang'e-3, the rover of Chang'e-4 will carry subsurface penetrating radar to detect the near surface structure of the moon, and an infrared spectrometer to analyze the chemical composition ...Read More...

Gluttonous Star May Hold Clues to Planet Formation



The brightness of outbursting star FU Orionis has been slowly fading since its initial flare-up in 1936. Researchers found that it has dimmed by about 13 percent in short infrared wavelengths from 2004 (left) to 2016 (right). Image courtesy NASA/JPL-Caltech.

In 1936, the young star FU Orionis began gobbling material from its surrounding disk of gas and dust with a sudden voraciousness. During a three-month binge, as matter turned into energy, the star became 100 times brighter, heating the disk around it to temperatures of up to 12,000 degrees Fahrenheit (7,000 Kelvin). FU Orionis is still devouring gas to this day, although not as quickly.

This brightening is the most extreme event of its kind that has been confirmed around a star the size of the sun, and may have implications for how stars and planets form. The intense baking of the star's surrounding disk likely changed its chemistry, permanently altering material that could one day turn into planets.

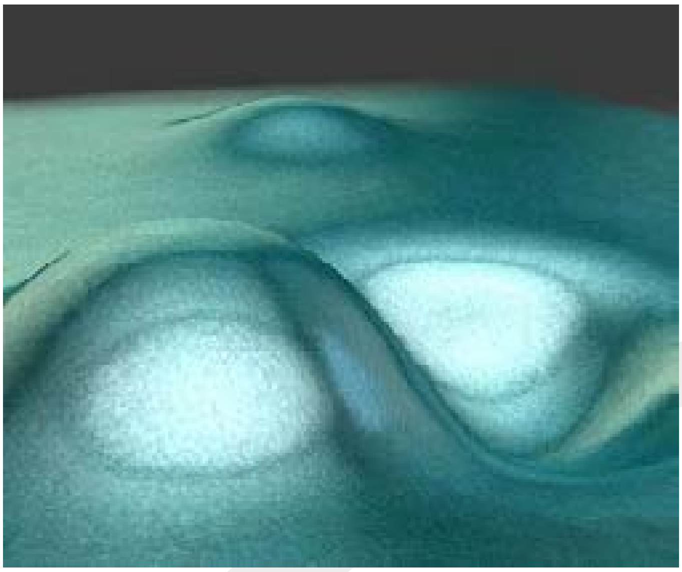
"By studying FU Orionis, we're seeing the absolute baby years of a solar system," said Joel Green, a project scientist at the Space Telescope Science Institute, Baltimore, Maryland. "Our own sun may have gone through a similar brightening, which would have been a crucial step in the formation of Earth and other planets in our solar system."

Visible light observations of FU Orionis, which is about 1,500 light-years away from Earth in the constellation Orion, have shown astronomers that the star's extreme brightness began slowly fading after its initial 1936 burst. But Green and colleagues wanted to know more about the relationship between the star and surrounding disk. Is the star still gorging on it? Is its composition changing? When will the star's brightness return to pre-outburst levels?

To answer these questions, scientists needed to observe the star's brightness at infrared wavelengths, which are longer than the human eye can see and provide temperature measurements.

Green and his team compared infrared data obtained in 2016 using the Stratospheric Observatory for Infrared Astronomy, SOFIA, to observations made with NASA's Spitzer Space Telescope in 2004. SOFIA, the world's largest airborne observatory, is jointly operated ...Read More...

Drum beats from a one atom thick graphite membrane



This is an artist's impression of two coupled, vibrational modes of a graphene drum. The coupling can be tuned electrically to transfer energy between the modes and hybridize them. Image courtesy Nanoelectronics group, TIFR Mumbai.

Researchers from the Tata Institute of Fundamental Research, Mumbai, have demonstrated the ability to manipulate the vibrations of a drum of nanometre scale thickness - realizing the world's smallest and most versatile drum.

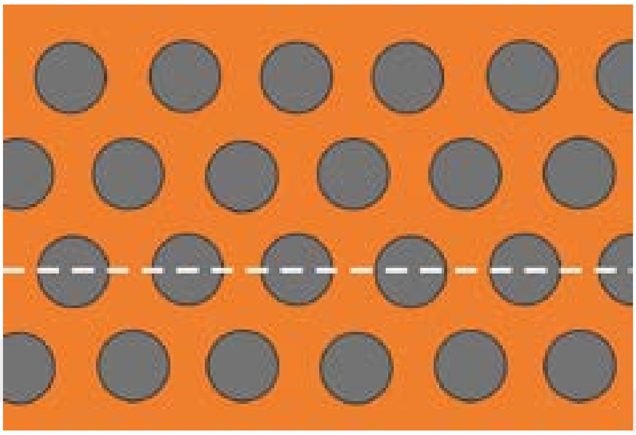
This work has implications in improving the sensitivity of small detectors of mass - very important in detecting the mass of small molecules like viruses. This also opens the doors to probing exciting new aspects of fundamental physics.

The work, recently published in the journal Nature Nanotechnology, made use of graphene, a one-atom thick wonder material, to fabricate drums that have highly tunable mechanical frequencies and coupling between various modes. Coupling between the modes was shown to be controllable which led to the creation of new, hybrid modes and, further, allowed amplification of the vibrations.

The experiment consisted of studying the mechanical vibrational modes, or 'notes', similar to a musical drum. The small size of the drum (diameter 0.003 mm, or 30 times smaller than the diameter of human hair) gave rise to high vibrational frequencies in the range of 100 Mega Hertz - implying that this drum vibrates 100 million times in one second.

The work done by lead author, PhD student John Mathew, in the nanoelectronics group led by Prof. Mandar Deshmukh, showed that the notes of these drums could be controlled by making use of an electrical force that bends, or strains, the drum. The bending of the drum also ... Read More...

Spintronics: Resetting the future of heat assisted magnetic recording



A 3D visualization of the cluster and the ground state potential with the moving electron emitting white light (rainbow colored beam). Credit: Nils W. Rosemann

This paves the way to fast and energy efficient ultrahigh density data storage. The results are published now in the new journal Physical Review Applied. To increase data density further in storage media, materials systems with stable magnetic domains on the nanoscale are needed. For overwriting a specific nanoscopic region with new information, a laser is used to heat locally the bit close to the so called Curie-Temperature, typically several hundred degrees Celsius.

Upon cooling, the magnetic domain in this region can be reoriented in a small external magnetic field, known as Heat Assisted Magnetic Recording (HAMR). In industry, Iron-Platinum materials are currently used as magnetic media for the development of such HAMR-data storage devices.

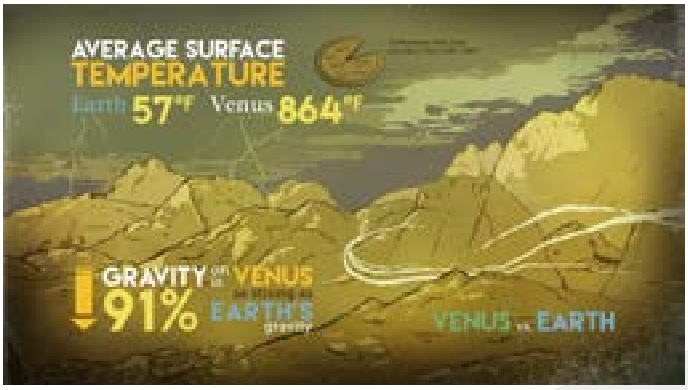
Magnetic signals mapped at BESSY II before and after heating

A HZB team has now examined a new storage media system of Dysprosium and Cobalt, which shows key advantages with respect to conventional HAMR materials: A much lower writing temperature, a higher stability of the magnetic bits, and a versatile control of the spin orientation within individual magnetic bits.

They achieved this by sputtering a thin film of Dysprosium and Cobalt onto a nanostructured membrane. The membrane was produced by scientific cooperation partners at the Institute of Materials Science of Madrid. The system shows a honeycomb antidot pattern with distances of 105 nanometers between nanoholes, which are 68 nanometers in diameter.

These nanoholes act themselves as pinning centers for stabilizing magnetic wall displacements. ...Read More...

"Electric Wind" Can Strip Earth-Like Planets of Oceans and Atmospheres



Venus and Earth are similar sizes and have similar gravity - but Venus is bone dry and more than ten times as hot as our home planet. Recent NASA research describes a key process that removes water from the Venusian atmosphere. Image courtesy NASA and Conceptual Image Lab.

Venus has an "electric wind" strong enough to remove the components of water from its upper atmosphere, which may have played a significant role in stripping Earth's twin planet of its oceans, according to new results from the European Space Agency's Venus Express mission by NASA-funded researchers.

"It's amazing, shocking," said Glyn Collinson, a scientist at NASA's Goddard Space Flight Center, Greenbelt, Maryland. "We never dreamt an electric wind could be so powerful that it can suck oxygen right out of an atmosphere into space. This is something that has to be on the checklist when we go looking for habitable planets around other stars." Collinson is lead author of a paper about this research published in Geophysical Research Letters, a journal of the American Geophysical Union.

Venus is in many ways the most like Earth in terms of its size and gravity, and there's evidence that it once had oceans worth of water in its distant past. However, with surface temperatures around 860 degrees Fahrenheit (460 Centigrade), any oceans would have long since boiled away to steam and Venus is uninhabitable today. Yet Venus' thick atmosphere, about 100 times the pressure of Earth's, has 10,000 to 100,000 times less water than Earth's atmosphere.

Something had to remove all that steam, and the current thinking is that much of the early steam dissociated to hydrogen and oxygen: the light hydrogen escaped, while the oxygen oxidized rocks over billions of years. Also the solar wind - a million-mile-per-hour stream of electrically conducting gas blowing from the sun - could have slowly but surely eroded the remainder of an ocean's worth of oxygen and water from Venus' upper atmosphere. "We found that the electric wind, which people thought was just one small cog in a big machine, is in fact this big ...Read More...

Unexpected excess of giant planets in star cluster

This artist's impression shows a hot Jupiter planet orbiting close to one of the stars in the rich old star cluster Messier 67, in the constellation of Cancer (The Crab). Astronomers have found far more planets like this in the cluster than expected. This surprise result was obtained using a number of telescopes and instruments, among them the HARPS spectrograph at ESO's La Silla Observatory in Chile. The denser environment in a cluster will cause more frequent interactions between planets and nearby stars, which may explain the excess of hot Jupiters. Image courtesy ESO and L. Calcada.

An international team of astronomers have found that there are far more planets of the hot Jupiter type than expected in a cluster of stars called Messier 67. This surprising result was obtained using a number of telescopes and instruments, among them the HARPS spectrograph at ESO's La Silla Observatory in Chile. The denser environment in a cluster will cause more frequent interactions between planets and nearby stars, which may explain the excess of hot Jupiters.

A Chilean, Brazilian and European team led by Roberto Saglia at the Max-Planck-Institut fur extraterrestrische Physik, in Garching, Germany, and Luca Pasquini at ESO, has spent several years collecting high-precision measurements of 88 stars in Messier 67. This open star cluster is about the same age as the Sun and it is thought that the Solar System arose in a similarly dense environment.

The team used HARPS, along with other instruments, to look for the signatures of giant planets on short-period orbits, hoping to see the tell-tale "wobble" of a star caused by the presence of a massive object in a close orbit, a kind of planet known as a hot Jupiters. This hot Jupiter signature has now been found for a total of three stars in the cluster alongside earlier evidence for several other planets.

A hot Jupiter is a giant exoplanet with a mass of more than about a third of Jupiter's mass. They are "hot" because they are orbiting close to their parent stars, as indicated by an orbital period (their "year") that is less than ten days in duration. That is very different from the Jupiter we are familiar with in our own Solar System, which has a year lasting around 12 Earth- years and is much ...Read More...

Particle zoo in a quantum computer: First experimental quantum simulation of particle physics phenomena

Researchers simulated the creation of elementary particle pairs out of the vacuum by using a quantum computer. Credit: IQOQI/ Harald Ritsch

Elementary particles are the fundamental buildings blocks of matter, and their properties are described by the Standard Model of particle physics. The discovery of the Higgs boson at the CERN in 2012 constitutes a further step towards the confirmation of the Standard Model.

However, many aspects of this theory are still not understood because their complexity makes it hard to investigate them with classical computers. Quantum computers may provide a way to overcome this obstacle as they can simulate certain aspects of elementary particle physics in a well-controlled quantum system.

Physicists from the University of Innsbruck and the Institute for Quantum Optics and Quantum Information (IQOQI) at the Austrian Academy of Sciences have now done exactly that: In an international first, Rainer Blatt's and Peter Zoller's research teams have simulated lattice gauge theories in a quantum computer. They describe their work in the journal Nature.

Simulation of particle-antiparticle pairs using a quantum computer

Gauge theories describe the interaction between elementary particles, such as quarks and gluons, and they are the basis for our understanding of fundamental processes.

"Dynamical processes, for example, the collision of elementary particles or the spontaneous creation of particle-antiparticle pairs, are extremely difficult to investigate," explains Christine Muschik, theoretical physicist at the IQOQI. "However, scientists quickly reach a limit when processing numerical calculations on classical computers. For this reason, it has been proposed to simulate these processes by using a programmable quantum system." In recent years, many interesting concepts have been ...Read More...

Supercomputers on the trail of dark matter

Galaxy clusters, which contain a significant amount of dark matter. In this image, the dark matter appears to align well with the blue-hued hot gas. Credit: NASA

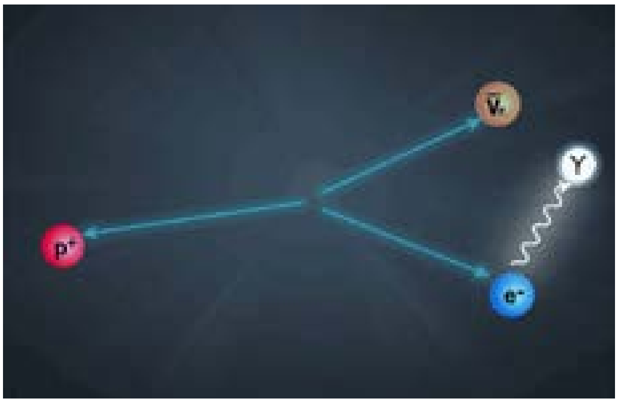
Almost all mass on Earth, humans included, derives from the atomic nuclei. These nuclei consist mainly of protons and neutrons, also called nucleons. Each nucleon in turn is made of three constituent quarks. However, the number of quark particles in the nucleon is actually much higher. This is due to what are known as quantum fluctuations, where pairs of particles and anti-particles form spontaneously in a vacuum and immediately disintegrate again. A research team from Cyprus, Germany and Italy led by Constantia Alexandrou of the Computation-based Science and Technology Research Center of the Cyprus Institute and the Physics Department of the University of Cyprus in Nicosia, has now for the first time calculated the scalar quark content of the proton. For the elaborate simulations in a CHRONOS (Computationally-Intensive, High-Impact Research On Novel Outstanding Science) project they made extensive use of the graphics processors (GPUs) of the CSCS supercomputer 'Piz Daint'. The researchers expect that their calculations will aid research into physical processes in particle physics and the as yet unknown dark matter that accounts for an estimated 21 percent of matter in the universe.

Quark condensates couple to the Higgs-boson

For every quark, there exists an anti-quark. A tightly coupled quark/anti-quark pair forms a condensate, similar to a water droplet on a pane of glass. This condensate is called the scalar quark content, and has a scalar quantum number. So the condensates can couple to the Higgs boson, which itself is a scalar particle. The Higgs boson – it is suspected – could interact with scalar particles of dark matter. "If we are to interpret experimental results as direct evidence for dark matter, then it is essential to know the numeric value we determined for the condensates and hence the exact proportion of scalar quark content in the nucleon, in particular what are known as strange quarks", says Alexandrou.

Quarks interact mutually via gluon particles, and quarks with gluons via their respective colour charges, which may be red, green or blue. The strong force acting and being transmitted by the gluons – called the ...Read More...

Physicists measured something new in the radioactive decay of neutrons



When a free neutron (green) undergoes a process known as beta decay, it produces a proton (red), an antineutrino (gold) and an electron (blue), as well as a photon (white). An experiment at NIST measured the range of energies that a given photon produced by beta decay can possess, a range known as its energy spectrum. Credit: N. Hanacek / NIST

A physics experiment performed at the National Institute of Standards and Technology (NIST) has enhanced scientists' understanding of how free neutrons decay into other particles. The work provides the first measurement of the energy spectrum of photons, or particles of light, that are released in the otherwise extensively measured process known as neutron beta decay. The details of this decay process are important because, for example, they help to explain the observed amounts of hydrogen and other light atoms created just after the Big Bang.

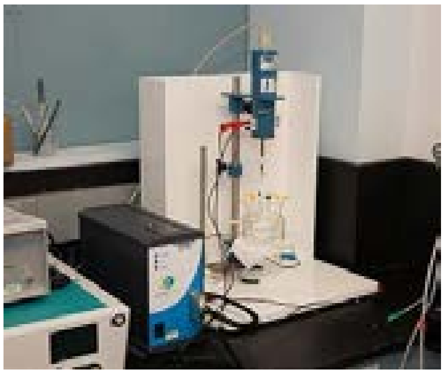
Published in Physical Review Letters, the findings confirm physicists' big-picture understanding of the way particles and forces work together in the universe—an understanding known as the Standard Model. The work has stimulated new theoretical activity in quantum electrodynamics (QED), the modern theory of how matter interacts with light. The team's approach could also help search for new physics that lies beyond the Standard Model.

Neutrons are well known as one of the three kinds of particles that form atoms. Present in all atoms except the most common form of hydrogen, neutrons together with protons form the atomic nucleus. However, "free" neutrons not bound within a nucleus decay in about 15 minutes on average. Most frequently, a neutron transforms through the beta decay process into a proton, an electron, a photon, and the antimatter version of the neutrino, an abundant but elusive particle that rarely interacts with matter.

The photons from beta decay are what the research team wanted to explore. These photons have a range of possible energies predicted by QED, which has worked very well as a theory for decades. But no one had actually checked this aspect of QED with high precision.

"We weren't expecting to see anything unusual," said NIST physicist Jeff Nico, "but we wanted to ...Read More...

Efficient hydrogen production made easy



New research from Los Alamos National Laboratory researchers, "Efficient Hydrogen Evolution in Transition Metal Dichalcogenides via a Simple One-Step Hydrazine Reaction," not only presents one of the best hydrogen water splitting electrocatalysts to date, but also opens up a whole new direction for research in electrochemistry and semiconductor device physics. Image courtesy Los Alamos National Laboratory.

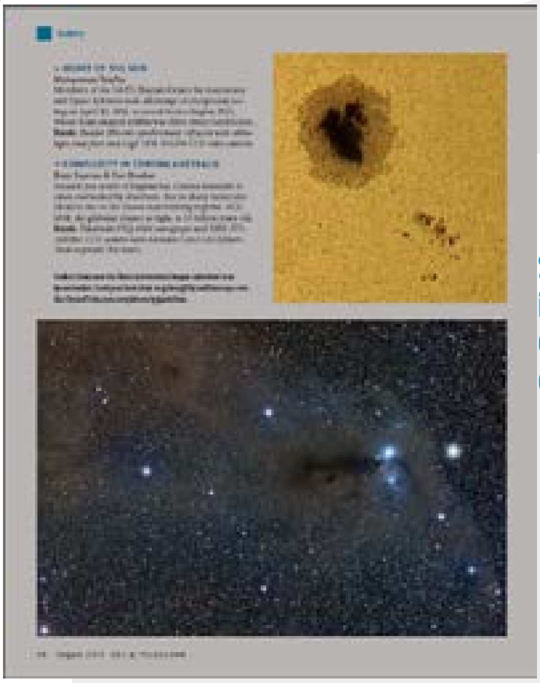
In the 2015 movie "The Martian," stranded astronaut Matt Damon turns to the chemistry of rocket fuel, hydrazine and hydrogen, to create lifesaving water and nearly blows himself up. But if you turn the process around and get the hydrazine to help, you create hydrogen from water by changing conductivity in a semiconductor, a transformation with wide potential applications in energy and electronics.

"We demonstrate in our study that a simple chemical treatment, in this case a drop of dilute hydrazine (N_2H_4) in water, can dope electrons directly to a semiconductor, creating one of the best hydrogen-evolution electrocatalysts," said Gautam Gupta, project leader at Los Alamos National Laboratory in the Light to Energy team of the Lab's Materials Synthesis and Integrated Devices group. The research was published in Nature Communications.

Understanding how to use a simple, room-temperature treatment to drastically change the properties of materials could lead to a revolution in renewable fuels production and electronic applications. As part of the Los Alamos mission, the Laboratory conducts multidisciplinary research to strengthen the security of energy for the nation, work that includes exploring alternative energy sources.

In recent years, the materials science community has grown more interested in the electrical and catalytic properties of layered transition metal dichalcogenides (TMDs). TMDs are primarily metal sulfides and selenides (e.g., MoS_2) with a layered structure, similar to graphite; this layered structure allows for unique opportunities, and challenges, in modifying electrical properties and functionality. Gupta and Aditya Mohite, a physicist with a doctorate in electrical engineering, have been pioneering work at Los Alamos seeking to understand the electrical properties of TMDs and use that ...Read More...

His HE Prof. Hamid Al-Naimiy posing at the Sharjah Center for Astronomy and Space Sciences with the NASA's Director Charles Bolden, the UAE Space Agency Chairman his HE Dr. Khalifa al-Romaithi, and her HE the US Ambassador to the UAE Barbara A. Leaf on June 12, 2016.



SCASS Observation of a Sunspot to appear in Sky & Telescope August 2016 Issue - Credit: Mohamed F. Talafha - Observatory Operator.

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