May 28, 2016 | Shaaban 20, 1437 | Volume 6, Issue 22

Astronomy & Physics Weekly News

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مركز الشارقة لعلوم الفضاء والفلك
Sharjah Center for Astronomy & Space Sciences

Top News

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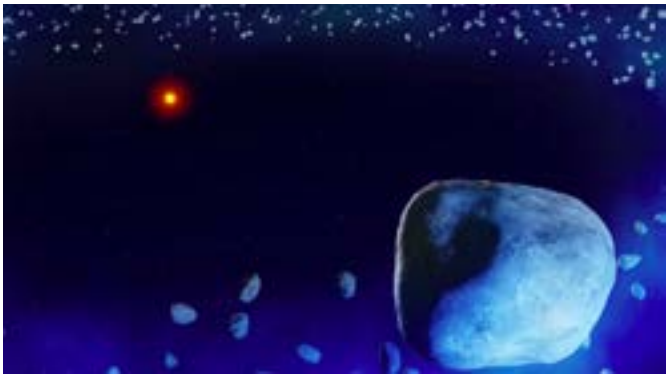


Illustration of the dust ring surrounding HD 181327. Image via Amanda Smith, University of Cambridge

Comets orbiting nearby sunlike star

An international team of astronomers have found the first evidence of icy comets orbiting a nearby sunlike star.

Their study, published May 23, 2016 in Monthly Notices of the Royal Astronomical Society, is a first step in establishing the properties of comet clouds around sunlike stars just after the time of their birth, and could give a glimpse into how our own solar system developed.

Using data from the Atacama Large Millimeter Array (ALMA), the researchers detected very low levels of carbon monoxide gas around the star, in amounts that are consistent with the comets in our own solar system.

Comets are essentially 'dirty snowballs' of ice and rock, sometimes with a tail of dust and evaporating ice trailing behind them, and are formed early in the development of stellar systems. They are typically found in the outer reaches of our solar system, but become most clearly visible when they visit the inner regions. For example, Halley's Comet visits the inner solar system every 75 years, some take as long as 100,000 years between visits, and others only visit once before being thrown out into interstellar space.

It's believed that when our solar system was first formed, the Earth was a rocky wasteland, similar to Mars today, and that comets colliding with the young planet brought many elements and compounds, including water, along with them. The star in this study, HD 181327, has a mass about 30% greater than the sun and is located 160 light-years away in the Painter [Pictor] constellation. The system is ...Read More...

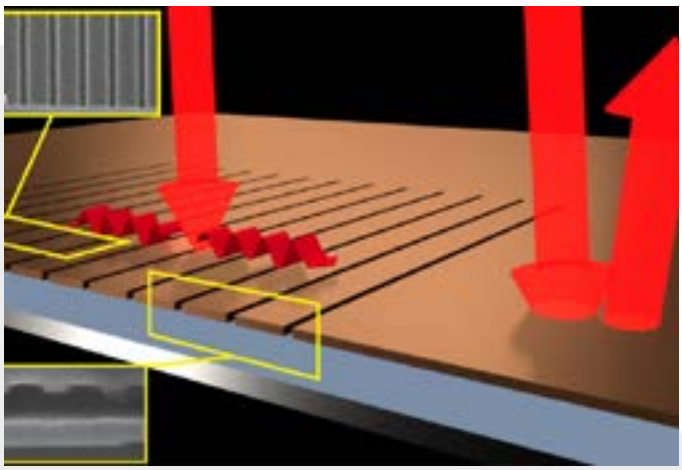
Optics breakthrough to revamp night vision

A breakthrough by an Australian collaboration of researchers could make infra-red technology easy-to-use and cheap, potentially saving millions of dollars in defense and other areas using sensing devices, and boosting applications of technology to a host of new areas, such as agriculture.

Infra-red devices are used for improved vision through fog and for night vision and for observations not possible with visible light; high-quality detectors cost approximately $100,000 (including the device at the University of Sydney) some require cooling to -200°C.

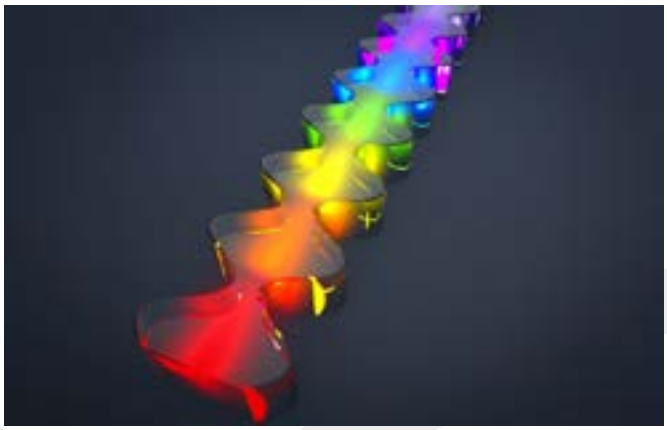
Now, research spearheaded by researchers at the University of Sydney has demonstrated a dramatic increase in the absorption efficiency of light in a layer of semiconductor that is only a few hundred atoms thick - to almost 99 percent light absorption from the current inefficient 7.7 percent.

The findings will be published overnight in the high-impact journal Optica. ...Read More...



When light falls on a very thin, uniform layer almost all of it is reflected (right-hand arrows). By etching thin grooves in the film, the light is directed sideways and almost all of it is absorbed (left-hand arrows) even though the amount of material is very small. Insets show electron micrographs of the structuring. The absorbing layer is only 0.041 μm thick. Credit: Dr Thomas P. White, Australian National University.

Speedy terahertz-based system could detect explosives



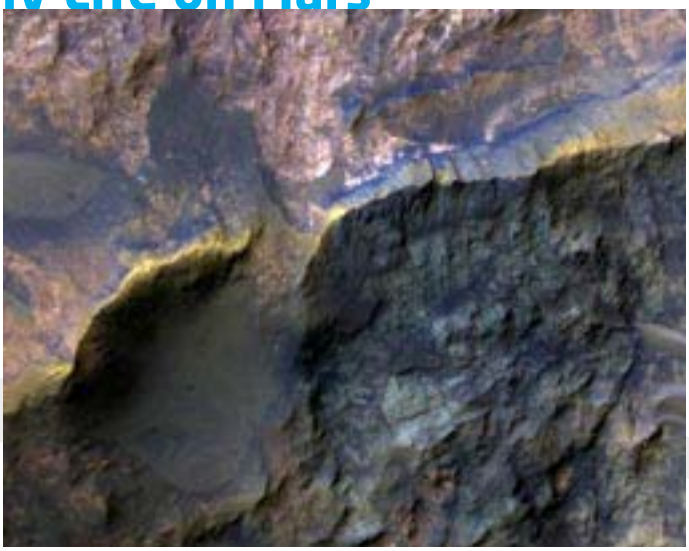
An artist's embellishment of an image of the "gain medium" used to produce terahertz frequency combs. The different colors indicate that different wavelengths of oscillating terahertz radiation travel different distances through the medium, which has a different refractive index for each of them. Credit: Yan Liang/ L2Molecule.com

Terahertz spectroscopy, which uses the band of electromagnetic radiation between microwaves and infrared light, is a promising security technology because it can extract the spectroscopic "fingerprints" of a wide range of materials, including chemicals used in explosives. But traditional terahertz spectroscopy requires a radiation source that's heavy and about the size of a large suitcase, and it takes 15 to 30 minutes to analyze a single sample, rendering it impractical for most applications.

In the latest issue of the journal Optica, researchers from MIT's Research Laboratory of Electronics and their colleagues present a new terahertz spectroscopy system that uses a quantum cascade laser, a source of terahertz radiation that's the size of a computer chip. The system can extract a material's spectroscopic signature in just 100 microseconds.

The device is so efficient because it emits terahertz radiation in what's known as a "frequency comb," meaning a range of frequencies that are perfectly evenly spaced. ...Read More...

Potential Habitats for Early Life on Mars



Ancient layered clay-bearing bedrock (top left) and carbonate bedrock (bottom right) are exposed in the central uplift of an unnamed crater approximately 42 kilometers in diameter in eastern Hesperia Planum, Mars. The image was taken by the High Resolution Imaging Science Experiment (HiRISE) instrument aboard the Mars Reconnaissance Orbiter. Credit: NASA/JPL/ University of Arizona

Recently discovered evidence of carbonates beneath the surface of Mars points to a warmer and wetter environment in that planet's past. The presence of liquid water could have fostered the emergence of life.

A new study by James Wray at the Georgia Institute of Technology and Janice Bishop of the SETI Institute, as well as other collaborators, has found evidence for widespread buried deposits of iron- and calcium-rich Martian carbonates, which suggests a wetter past for the Red Planet.

"Identification of these ancient carbonates and clays on Mars represents a window into history when the climate on Mars was very different from the cold and dry desert of today," notes Bishop.

The fate of water on Mars has been energetically debated by scientists because the planet is currently dry and cold, in contrast to the widespread fluvial features that etch much of its surface. Scientists believe that if water did once flow on the surface of Mars, the planet's ...Read More...

Hunting for Dark Matter's "Hidden Valley

Kathryn Zurek (Credit: Roy Kaltschmidt/Berkeley Lab)

Kathryn Zurek realized a decade ago that we may be searching in the wrong places for clues to one of the universe's greatest unsolved mysteries: dark matter. Despite making up an estimated 85 percent of the total mass of the universe, we haven't yet figured out what it's made of.

Now, Zurek, a theoretical physicist at the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab), says thanks to extraordinary improvements in experimental sensitivity, "We increasingly know where not to look." In 2006, during grad school, Zurek began to explore the concept of a new "Hidden Valley" model for physics that could hold all of the answers to dark matter.

"I noticed that from a model-builder's point of view that dark matter was extraordinarily undeveloped," she said. It seemed as though scientists were figuratively hunting in the dark for answers. "People were focused on models of just two classes of dark matter candidates, rather than a much broader array of possibilities."

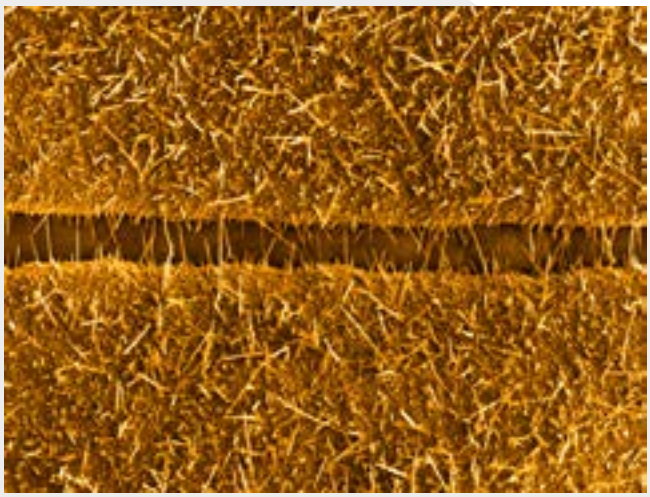
Physicist and author Alan Lightman has described dark matter as an "invisible elephant in the room" - you know it's there because of the dent it's making in the floorboards ...Read More...

The next generation of carbon monoxide nano-sensors

The detection of carbon monoxide (CO) in the air is a vital issue, as CO is a poisonous gas and an environmental pollutant. CO typically derives from the incomplete combustion of carbon-based fuels, such as cooking gas and gasoline; it has no odour, taste, or colour and hence it is difficult to detect. Scientists have been investigating sensors that can determine CO concentration, and a team from the Okinawa Institute of Science and Technology Graduate University (OIST), in tandem with the University of Toulouse, has found an innovative method to build such sensors.

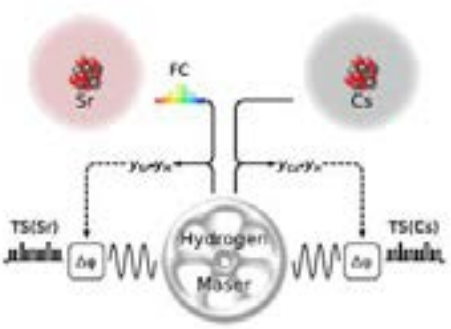
As a tool for CO detection, scientists use extremely small wires: copper oxide nanowires. Copper oxide nanowires chemically react with CO, creating an electrical signal that can be used to quantify CO concentration. These nanowires are so thin that it is possible to fit more than 1.000 of them in the average thickness of a human hair.

Two issues have hampered the use of nanowires. "The first problem is the integration of nanowires into devices that are big enough to be handled and that can also be easily mass produced," said Prof Mukhles Sowwan, director of the Nanoparticles by Design Unit at OIST. ...Read More...



Adaptation of a scanning electron microscopy image of copper oxide nanowires bridging the gap between neighbouring copper microstructures.

Could optical clocks redefine the length of a second?



The Cs clock transition frequency is comparedagainst the maser flywheel frequency. The acquired offset Cs yH is used to correct the classical timescale TS(Cs) generated from the maser utilizing a phase stepper (Df). An equivalent scheme is applicable when referencing the timescale TS(Sr)to an optical frequency standard. For that purpose, the clock laser light is down-converted to the microwave regime using a femtosecond frequency comb (FC) before comparing against the flywheel. Moreover, both maser offsets can be analyzed toyield the Sr clock frequency in SI units. Credit: Christian Grebing

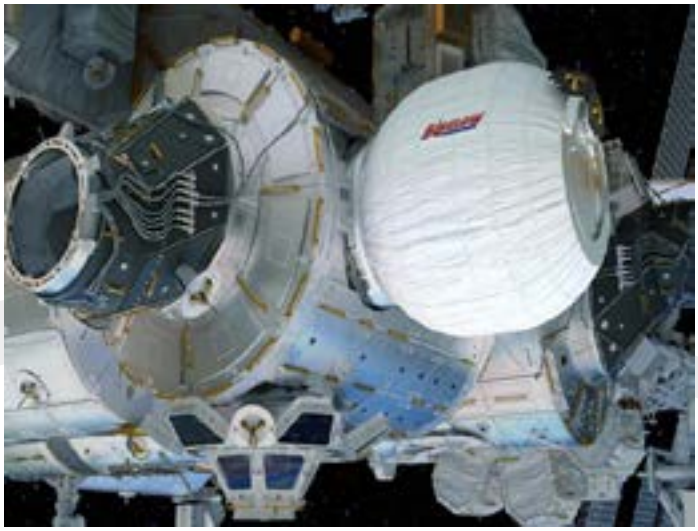
GPS-based navigation, communication systems, electrical power grids and financial networks all rely on the precise time kept by a network of around 500 atomic clocks located around the world.

In The Optical Society's journal for high impact research, Optica, researchers present a way to use optical clocks for more accurate timekeeping than is possible with today's system of traditional atomic clocks. The researchers also measured an optical clock's frequency—analogous to it's "ticking"—with unprecedented precision.

A more accurate global time keeping system would allow financial networks to use more precise time stamps and thus handle even more transactions in shorter amounts of time. It would also allow GPS and other satellite-based navigation systems to provide even more precise location information.

Although optical clocks have been more accurate than microwave clocks for some time, their complexity and resulting long ...Read More...

The Bigelow Expandable Module Is About To Blow Up



This computer rendering shows the Bigelow Expanded Activity Module in its fully expanded configuration. Image: NASA

People who aren't particularly enthusiastic about space science and space exploration often accuse those of us who are, of "living in a bubble." There are so many seemingly intractable problems here on Earth, so they say, that it's foolish to spend so much money and time on space exploration. But if all goes well with the Bigelow Expandable Activity Module (BEAM) at the ISS this week, astronauts may well end up living in a sort of bubble.

Expandable, inflatable habitats could bring about a quiet revolution in space exploration, and the BEAM is leading that revolution. Because it's much more compact and much lighter than rigid steel and aluminum structures, the cost of building them and launching them into space is much lower. The benefits of lower costs for building them and launching them are obvious.

NASA first announced plans to test the BEAM back in 2013. They awarded a $17.8 million contract to Bigelow Aerospace to provide the expandable module, with the idea of testing it for a two-year period. ...Read More...

Space Weather Causing Martian Atmospherics

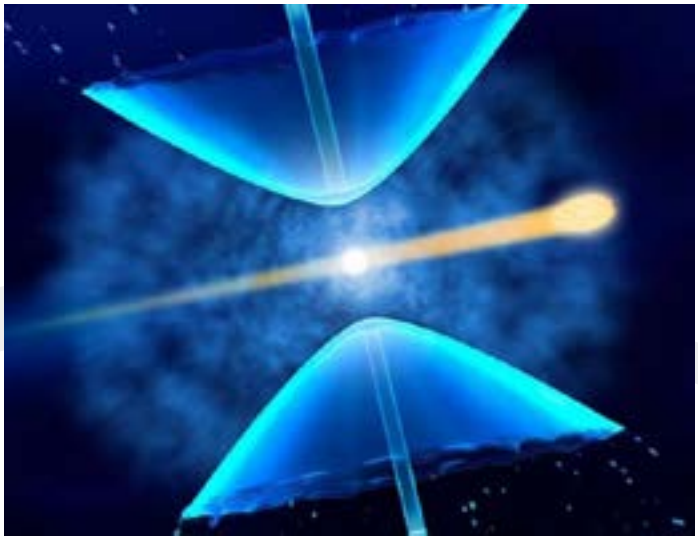
A curious plume-like feature was observed on Mars on May 17, 1997 by the Hubble Space Telescope. It is similar to the features detected by amateur astronomers in 2012, although appeared in a different location. Credit: JPL/NASA/STScI

Strange plumes in Mars' atmosphere first recorded by amateur astronomers four year ago have planetary scientists still scratching their heads. But new data from European Space Agency's orbiting Mars Express points to coronal mass ejections from the Sun as the culprit.

On two occasions in 2012 amateurs photographed cloud-like features rising to altitudes of over 155 miles (250 km) above the same region of Mars. By comparison, similar features seen in the past haven't exceeded 62 miles (100 km). On March 20th of that year, the cloud developed in less than 10 hours, covered an area of up to 620 x 310 miles (1000 x 500 kilometers), and remained visible for around 10 days.

Back then astronomers hypothesized that ice crystals or even dust whirled high into the Martian atmosphere by seasonal winds ...Read More...

First movies of droplets getting blown up by x-ray laser



This illustration shows how an ultrabright X-ray laser pulse (orange beam) vaporizes part of a liquid jet (blue), creating umbrella-shaped films of liquid and sending shock waves through the jet (bright stripes at top and bottom). (SLAC National Accelerator Laboratory)

Researchers have made the first microscopic movies of liquids getting vaporized by the world's brightest X-ray laser at the Department of Energy's SLAC National Accelerator Laboratory. The new data could lead to better and novel experiments at X-ray lasers, whose extremely bright, fast flashes of light take atomic-level snapshots of some of nature's speediest processes.

"Understanding the dynamics of these explosions will allow us to avoid their unwanted effects on samples," says Claudiu Stan of Stanford PULSE Institute, a joint institute of Stanford University and SLAC. "It could also help us find new ways of using explosions caused by X-rays to trigger changes in samples and study matter under extreme conditions. These studies could help us better understand a wide range of phenomena in X-ray science and other applications."

...Read More...

Researchers find new method for doping single crystals of diamond

This is a collection of 0.02, 0.03 and 0.04 carat solitaire diamonds weighing in total 5.36 carats. Credit: Swamibu/Wikipedia

Along with being a "girl's best friend," diamonds also have remarkable properties that could make them ideal semiconductors. This is welcome news for electronics; semiconductors are needed to meet the rising demand for more efficient electronics that deliver and convert power.

The thirst for electronics is unlikely to cease and almost every appliance or device requires a suite of electronics that transfer, convert and control power. Now, researchers have taken an important step toward that technology with a new way to dope single crystals of diamonds, a crucial process for building electronic devices.

"We need the devices to manipulate the power in the way that we want," said Zhengqiang (Jack) Ma, an electrical and computer engineering professor at the University of Wisconsin-Madison. He and his colleagues describe their new method in the Journal of Applied Physics.

For power electronics, diamonds could serve as the perfect material. They are thermally conductive, which means diamond-based ....Read More...

Scientists discover how supermassive black holes keep galaxies turned off

An artist's rendition of the galaxies Akira (right) and Tetsuo (left) in action. Akira's gravity pulls Tetsuo's gas into its central supermassive black hole, fueling winds that have the power to heat Akira's gas. Because of the action of the black hole winds, Tetsuo's donated gas is rendered inert, preventing a new cycle of star formation in Akira. Credit: Kavli IPMU

An international team of scientists has identified a common phenomenon in galaxies that could explain why huge numbers of them turn into cosmic graveyards.

Galaxies begin their existence as lively and colourful spiral galaxies, full of gas and dust, and actively forming bright new stars. However, as galaxies evolve, they quench their star formation and turn into featureless deserts, devoid of fresh new stars, and generally remain as such for the rest of their evolution. But the mechanism that produces this dramatic transformation and keeps galaxies turned off, is one of the biggest unsolved mysteries in galaxy evolution.

Now, thanks to the new large SDSS-IV MaNGA survey of galaxies, a collaborative effort led by the University of Tokyo and involving the University of Oxford has discovered a surprisingly common new phenomenon in galaxies, dubbed "red geysers", that could explain how the process works. Researchers interpret the red geysers as galaxies hosting low-energy ....Read More...

Dept. of Applied Physics & Astronomy




Top: Jupiter (left) - Saturn (right) / Bottom: Mars (left) - Moon (right) - SCASS Observatory, May 22, 2016

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