



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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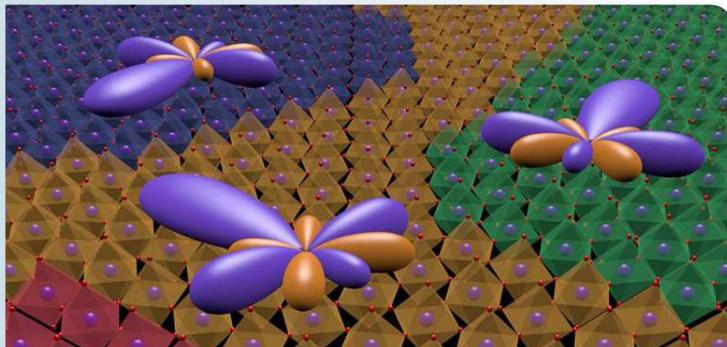
## FEATURE ARTICLES

### [Physicists uncover novel phase of matter](#)

[PhysOrg.com, 26OCT2015](#)

An international team of researchers (USA - CalTech, Iowa State University, University of Kentucky, Israel) has discovered an unusual form of matter. This phase, characterized by an unusual ordering of electrons, offers possibilities for new electronic device functionalities and could hold the solution to a long-standing mystery in condensed matter physics having to do with high-temperature superconductivity. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Featured Article*



Artist's rendition of spatially segregated domains of multipolar order in the Sr<sub>2</sub>IrO<sub>4</sub> crystal. The orientation of the multipolar order in each domain is depicted by the multi-lobed object. Credit: Liuyan Zhao

### [Researchers demonstrate atomically thin excitonic laser](#)

[Nanowerk, 20OCT2015](#)

An international team of researchers (USA - University of Washington, Stanford University, Oak Ridge National Laboratory, University of Tennessee, China) embedded a monolayer of tungsten disulfide into a special microdisk resonator to achieve bright excitonic lasing at visible light wavelengths. Until now coherent light emission considered essential for "on-chip" applications, had not been realized in this material. This is a major step towards two-dimensional on-chip optoelectronics for high-performance optical communication and computing applications. [TECHNICAL ARTICLE](#)

*Tags: Photonics, Government S&T, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MATERIALS

#### [Aligning nanorods using light](#)

[Nanotechweb, 22OCT2015](#)

Researchers in Hong Kong have shown that forcing semiconductor nanorods to align in a certain way by applying light to them while they self-assemble allows these structures to emit linearly polarized light. The discovery could help make better optoelectronics devices from these materials. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

#### [Fast nanodroplets surf on graphene](#)

[Nanotechweb, 20OCT2015](#)

Diffusion usually involves a particle hopping from one site to another. An international team of researchers (UK, Switzerland) has observed exceedingly fast transport of water nanodroplets on graphene. Stretching the graphene or controlling the interactions between the graphene and substrate can control the speed of these ripples. The diffusion of adsorbates on surfaces is a key parameter in chemical engineering. These findings may also be relevant for graphene-based water filters. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

### AUTONOMOUS SYSTEMS & ROBOTICS

#### [Video Friday: Origami Drone, Tesla Autopilot Fail, and Crowdsourced Robots](#)

[IEEE Spectrum, 23OCT2015](#)

Lockheed Martin and KAMAN Corporations demonstrated how the remotely piloted K-MAX helicopter can be used to perform wildland firefighting scenarios, including cargo drops, single target water drops, and progressive line building with a bucket.

*Tags: Autonomous systems & robotics*

#### [Dive of the RoboBee](#)

[Science Daily, 21OCT2015](#)

Designed by researchers at Harvard University, the RoboBee is a microrobot, smaller than a paperclip, that flies and hovers like an insect, flapping its tiny, nearly

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invisible wings 120 times per second. A swimming RoboBee changes its direction by adjusting the stroke angle of the wings, the same way it does in air. Like a flying version, it is still tethered to a power source. Their analysis of flapping-wing locomotion is not limited to insect-scaled vehicles. The strategy has the potential to be adapted to larger aerial-aquatic robotic designs.

*Tags: Autonomous systems & robotics*

## BIG DATA

**[New general-purpose optimization algorithm promises order-of-magnitude speedups on some problems.](#)**

[MIT News](#), 23OCT2015

A team of researchers in the US (MIT, UC Berkeley) has developed a new “cutting-plane” algorithm, a general-purpose algorithm for solving optimization problems. The algorithm improves on the running time of its most efficient predecessor, and the researchers offer some reason to think that they may have reached the theoretical limit. If you represent the range of possibilities as a sphere rather than a circle, then you use a plane, rather than a line, to cut some of them off. Hence the name for the technique: the cutting-plane method. [TECHNICAL ARTICLE](#)

*Tags: Big data, Mathematics*

## COMMUNICATIONS TECHNOLOGY

**[Benefits and risks of the ‘Internet of Things’](#)**

[PhysOrg.com](#), 23OCT2015

A team of researchers in the US (University of Washington, UC San Diego) work in the area of online data collection, trying to identify who is gathering information and what’s being done with it. They developed a tool called ShareMeNot that detects and blocks online advertising and other embedded content that tracks people without their permission. Their current interests include the field of “augmented reality,” which includes technologies like Google Glass or Microsoft’s HoloLens that take computer-generated information including graphics, sound or videos and project it into a real-world setting. [TECHNICAL ARTICLE](#)

*Tags: Communications technology, Information technology*

**[NASA takes Lasercom a step forward](#)**

[PhysOrg.com](#), 23OCT2015

Researchers at NASA have developed a new miniaturized lasercom transceiver called the Space Optical Communication and Navigation System that improved LLCD’s precision by several orders of magnitude in laboratory testing. The breadboard technology is made up of commercially available components simulating both ground and space terminals. It recently demonstrated in laboratory testing that it could provide micrometer-level distance and speed measurements over a 622 megabits-per-second (Mbps) laser communication link.

*Tags: Communications technology, Government S&T*

## COUNTER WMD

**[‘Bioscavengers’ could stop nerve agents in their tracks](#)**

[Defense Systems](#), 20OCT2015

To date, researchers have identified one human protein, butyrylcholinesterase—nicknamed bioscavenger—that has proved to be effective against nerve agents. But it is cumbersome, requiring a large dose of hundreds of milligrams to protect against even small levels of a nerve agent. So DTRA is looking for alternative bioscavengers that could degrade the nerve agent before it can act. [BAA](#)

*Tags: Counter WMD, Military technology*

## CYBER SECURITY

**[The future of encryption](#)**

[PhysOrg.com](#), 23OCT2015

As data and computation move to the cloud, homomorphic encryption, developed by a team of researchers in the US (Stanford University, UCLA, UT Austin), allows the data to be processed without ever having to give away access to it. For instance, a web application could process your tax return using encrypted financial information without actually seeing any of it. Researchers are still figuring out how to turn the idea of homomorphic encryption into a practical reality. [TECHNICAL ARTICLE](#)

*Tags: Cyber security*

## ENERGY

**[Capacitor breakthrough](#)**

[EurekAlert](#), 21OCT2015

A great deal of effort has been devoted to improving energy density of dielectric capacitors. Carbon nanotubes embedded in uniquely designed and structured 3D architectures have enabled an international team of researchers (China, USA - University of Delaware) to address the low ability of dielectric capacitors to store energy as it decreases the distance between opposing electrodes and therefore increases the ability of the capacitor to store an electrical charge. The capacitors have applications in accessory power supply and hybrid power systems. [TECHNICAL ARTICLE](#)

*Tags: Energy*

**[Scientists build heat engine from a single atom](#)**

[Science Magazine](#), 21OCT2015

In the new engine, developed by researchers in Germany, a calcium ion converts heat to motion when it is hit by noise coming from a set of electrodes. When the noise stops, the ion slides back into its starting position, and the process begins again. When the noise is turned on and off at just the right rate, the ion travels ever farther along the funnel from one cycle to the next resulting in a sort of flywheel that gradually builds up usable energy. The work provides

“If we all did the things we are capable of, we would astound ourselves.”

—THOMAS A. EDISON

a way to study the ultimate and fundamental limits of the application of heat engines.

*Tags: Energy, Particle physics, S&T Germany*

### [Synthetic batteries for the energy revolution](#) Science Daily, 21OCT2015

Researchers in Germany have developed a system on the basis of organic polymers and a harmless saline solution. In contrast to conventional batteries, the electrodes of a redox-flow battery come in a dissolved form. The polymer solutions are transferred to an electrochemical cell, in which the polymers are electrochemically reduced or oxidized, thereby charging or discharging the battery. The energy density of the system presented in the study is ten watt-hours per liter. The new redox-flow battery can withstand up to 10,000 charging cycles without losing a crucial amount of capacity. The battery is ideally suited as energy storage for large wind farms and photovoltaic power stations. [TECHNICAL ARTICLE](#)

*Tags: Energy, Battery, Biotechnology, S&T Germany*

### [Turning up the heat: Holey metamaterials enhance thermal energy harvesting](#) Science Daily, 19OCT2015

It's estimated that the U.S. fails to use more than half of the energy it generates—mostly because it escapes as waste heat. Researchers at the University of Colorado found a way to enhance thermal emission of hot bodies at the lower end of the spectrum (around 1 THz) by manipulating the surface of the object. They used computer modeling to design a bowtie-shaped antenna that would effectively capture the enhanced thermal emission.

*Tags: Energy*

## EXPLOSIVES

### [New explosives provide enhanced safety, high energy](#)

PhysOrg.com, 23OCT2015

A team of researchers in the US (Los Alamos National Laboratory, Naval Researcher Laboratory) describe two materials—a dinitro-diamino compound, which displays performance approaching that of conventional high performance materials, but is insensitive to impact spark and friction, making it very safe to handle, and a new heterocyclic ring system called a tricyclic 1,2,3,4-tetrazine, which is more like a conventional energetic in performance and safety. Synthesis of these two materials could usher in a new class of explosives that provide high-energy output with enhanced safety. [TECHNICAL ARTICLE](#)

*Tags: Explosives, Government S&T, Materials science*

## FORECASTING

### [Forecasters look higher for clues to winter weather](#)

Physics World, 23OCT2015

Winds in the polar night jet stream usually blow from the west and have speeds of around 70mph. An international team of researchers (UK, Canada) found that during conditions in which the polar night jet stream wind speeds exceed 90mph, or reverse their direction to flow from the east, forecasts in both the stratosphere and troposphere are more skillful. The strength of stratospheric winds can influence the position of the jet stream in the troposphere, having a major influence on weather across the North Atlantic, and allow freezing polar air to travel further south than would normally be expected. [TECHNICAL ARTICLE](#)

*Tags: Forecasting, Climatology, Environment*

## IMAGING TECHNOLOGY

### [Megapixel CCD Can See Terahertz](#)

PhysOrg.com, 26OCT2015

Terahertz waves are not only difficult to create but also difficult to detect. On the basis of a silicon charge-coupled device, researchers in Switzerland visualized 5–13 THz radiation with photon energy under 2% of the sensor's band-gap energy. The unprecedented small pitch and large number of pixels allow the visualization of complex terahertz radiation patterns in real time and with high spatial detail. [TECHNICAL ARTICLE](#)

*Tags: Imaging technology, S&T Switzerland, Terahertz technology*

## MATERIALS SCIENCE

### [New nanoring design shows potential for generating short magnetic pulses](#)

PhysOrg.com, 21OCT2015

New nanoring design shows potential for generating short magnetic pulses. Ultrashort magnetic pulses are needed to explore magnetic switching in materials—a process that underpins virtually all of today's data storage technology. An international team of researchers (Singapore, UK) has theoretically proposed a nanoring that consists of four alternating gold and nickel sectors. Their calculations predict that this nanoring will generate magnetic pulses shorter than a trillionth of a second when irradiated by an ultrashort laser pulse. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

**Superconducting Spintronics**

arXiv, 02OCT2015

A complete synergy between superconducting and magnetic orders turns out to be possible through the creation of spin-triplet Cooper pairs, which are generated at carefully engineered superconductor interfaces with ferromagnetic materials. Currently, there is intense activity focused on identifying materials combinations that merge superconductivity and spintronics to enhance device functionality and performance. In this article an international team of researchers (Norway, UK) reviews experimental and theoretical advances in this field and provide an outlook for upcoming challenges in superconducting spintronics. [TECHNICAL ARTICLE](#)

Tags: *Materials science***FEATURED RESOURCE****Chinese Academy of Sciences**

CAS has 117 institutes, more than 100 national key laboratories and national engineering research centers, and about 1,000 field stations throughout the country. Links to many English language journals and contents and English abstracts of Chinese articles provided.

**MICROELECTRONICS****Manipulating wrinkles could lead to graphene semiconductors**

PhysOrg.com, 23OCT2015

Graphene can form wrinkles which make the structure more complicated, potentially being applied to device systems. The graphene can also interact with the substrate upon which it is laid, adding further complexity. An international team of researchers (Japan, South Korea) discovered that wrinkles in graphene can restrict the motion of electrons to one dimension, forming a junction-like structure that changes from zero-gap conductor to semiconductor back to zero-gap conductor. The discovery opens the way to the construction of graphene semiconductors not through chemical means—by adding other elements. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Advanced materials, Materials science, S&T Japan***NEUROSCIENCE****New research paves the way to begin developing a computer you can control with your mind**

Science Daily, 21OCT2015

Researchers in the UK used functional magnetic resonance imaging while participants planned and performed simple hand movements inside the scanner. Participants freely

chose which of three hand movements to select. Using machine learning algorithms, the researchers then determined whether they were able to predict which movement the participant was going to perform on the basis of the brain activity measured during the planning phase.

Tags: *Neuroscience, Biotechnology, S&T UK***Do Deep Neural Networks Learn Facial Action Units When Doing Expression Recognition?**

arXiv, 10OCT2015

Despite being the appearance-based classifier of choice in recent years, relatively few works have examined how much convolutional neural networks (CNNs) can improve performance on accepted expression recognition benchmarks. Researchers at the University of Illinois at Urbana-Champaign show that CNNs can achieve strong performance, but they also introduce an approach to decipher which portions of the face influence the CNN's predictions. [TECHNICAL ARTICLE](#)

Tags: *Neuroscience, Pattern recognition***PHOTONICS****Novel tech that manipulates light has applications beyond holograms**

PhysOrg.com, 21OCT2015

Researchers at North Carolina State University created the direct-write laser scanner (DWLS) which allows creation of nearly perfect geometric phase holograms. The DWLS has found use in astronomy, creating geometric phase holograms for use in mobile displays, holographic imaging, and remote-sensing devices for everything from satellites to cameras. [TECHNICAL ARTICLE](#)

Tags: *Photonics***QUANTUM SCIENCE****Photons open the gateway for quantum networks**

PhysOrg.com, 23OCT2015

An international team of researchers (Denmark, South Korea) reports that they have developed the photonic chip so that the quantum dot emits a single photon at a time and they can control the photon's direction. Their big new achievement is that they can use the quantum dot as a contact for the photons—a kind of transistor. It is an important component for creating a complex network of photons. [TECHNICAL ARTICLE](#)

Tags: *Quantum science, Communications technology***Scalable quantum computer design**

Science Daily, 23OCT2015

All current approaches for adiabatic quantum computation face the same challenge—to encode a generic problem, an all-to-all connectivity is necessary, but the locality of bits limits the available interactions. Researchers in Austria suggest detaching the logical qubit from the physical

implementation. Each physical qubit corresponds to one pair of logical qubits and can be tuned by local fields. Any generic optimization problem can be fully programmed via the fields. By using this approach they are not only avoiding the limitations posed by the hardware but they also make the technological implementation scalable. [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

### [Putting Quantum Systems to Work](#)

[American Physical Society Synopsis, 21OCT2015](#)

An international team of researchers (Spain, UK, Switzerland) has shown that systems in which quantum effects are pronounced can store more energy than systems that are purely classical. They theoretically demonstrated that entangled states can store more energy than non-entangled states. However, this advantage vanishes as the number of particles increases. This finding supports the hypothesis that thermodynamics on a macroscopic scale is insensitive to the underlying microscopic mechanics. The team now plans to study how different kinds of entanglement affect energy storage. [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

## S&T POLICY

### [Graphene's centre of gravity shifts to China?](#)

[Printed Electronics World, 23OCT2015](#)

Europeans won the Nobel Prize for their work on graphene but they are not necessarily winning on the commercial front. In fact, it is the Chinese who might overtake them. Many indicators support this claim, which the article explores. The [Graphene & 2D Materials](#) event takes place in Santa Clara, California between 18 and 19 November 2015.

*Tags: S&T policy, S&T China*

### [New report on energy-efficient computing](#)

[NSF News, 20OCT2015](#)

A report of a workshop outlines key factors limiting progress in computing—particularly related to energy consumption—and novel research that could overcome these barriers. The findings and recommendations in the report are in alignment with the nanotechnology-inspired Grand Challenge for Future Computing announced by the White House Office of Science and Technology Policy.

*Tags: S&T policy, Information technology*

### [China could respond to US patrols within 12 miles of Artificial islands by seizing 209 more rocks and building them into islands](#)

[Next Big Future, 19OCT2015](#)

According to China there are 209 land features still unoccupied in the South China Sea, they could seize them all and build on them in 18 months. China has deployed a sophisticated new dredger known as the Tianjing, or “Sky Whale.” It is now the third largest self-propelled cutter suction dredger in the world with the ability to dredge

to a depth of 30 meters and to move 4,500 cubic meters of clay, compacted sand, gravel, and rocks per hour. Because it is self-propelled, it can make its own way to the southern part of the South China Sea, unlike non-self-propelled vessels, which need to be towed. [The report](#)

*Tags: S&T policy, Military technology, S&T China*

## SENSORS

### [A 'hot' new development for ultracold magnetic sensors](#)

[Science Daily, 20OCT2015](#)

The most sensitive commercial magnetometers require near absolute zero temperatures, but researchers in the UK have now built a device using a large array of high temperature SQUIDS with superior performance at 77K. [TECHNICAL ARTICLE](#)

*Tags: Sensors, S&T UK*

### [Umbrella-shaped diamond nanostructures make efficient photon collectors](#)

[Science Daily, 20OCT2015](#)

By tweaking the shape of the diamond nanostructures into the form of tiny umbrellas, researchers in Japan experimentally showed that the fluorescence intensity of their structures was three to five times greater than that of bulk diamond. They have shown that fluorescence intensity can be achieved by improving the photon collection efficiency of the nitrogen vacancy centers. The nanostructures may find use in highly sensitive magnetic sensors, quantum computing and cryptographic communications. [TECHNICAL ARTICLE](#)

*Tags: Sensors, Advanced materials, S&T Japan*

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