



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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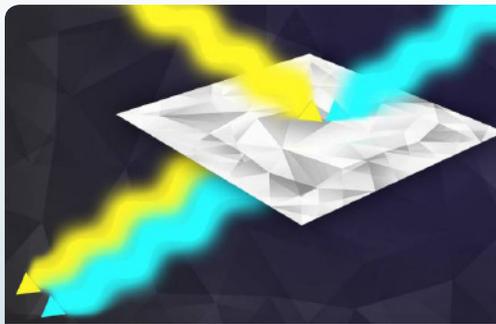
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## FEATURE ARTICLES

## S&T NEWS ARTICLES



In the researchers' new system, a returning beam of light is mixed with a locally stored beam, and the correlation of their phase, or period of oscillation, helps remove noise caused by interactions with the environment.

Illustration: Jose-Luis Olivares/MIT

### [Quantum sensor's advantages survive entanglement breakdown](#)

[MIT News, 09MAR2015](#)

Two years ago, researchers at MIT showed that systems that begin with entangled light could offer much more efficient means of securing optical communications. Now they demonstrate that entanglement can also improve the performance of optical sensors, even when it doesn't survive light's interaction with the environment. This research can potentially lead to the development of a quantum LIDAR which is able to spot almost-invisible objects in a very noisy background. [TECHNICAL ARTICLE](#)

Tags: [Communications Technology](#), [Quantum science](#), [Featured Article](#)

### [A new way to control information by mixing light and sound](#)

[Science Daily, 03MAR2015](#)

A team of researchers from the US (Yale University, Sandia National Laboratory, UT Austin) has developed a device that combines photons and phonons to conduct sophisticated signal processing tasks. Using circuits that control photons rather than electrons, individual components can be made far smaller and support immense information bandwidths. [TECHNICAL ARTICLE](#)

Tags: [Communications Technology](#), [Featured Article](#)

### ADVANCED MANUFACTURING

#### [2D nitrogenated crystals new potential rival for graphene](#)

[Science Daily, 09MAR2015](#)

Researchers in South Korea synthesized nitrogenated 2D crystals using a simple chemical reaction in liquid phase without using a template. They verified its structure and confirmed its semiconducting nature by testing it with a field effect transistor. The unique geometric and electronic structure of the nitrogenated crystals make it potentially suitable for use in electronics, sensors and catalysis. [TECHNICAL ARTICLE](#)

Tags: [Advanced manufacturing](#), [Advanced materials](#)

### ADVANCED MATERIALS

#### [New formula for identifying suitable graphene substrate](#)

[PhysOrg.com, 10MAR2015](#)

Interactions with the substrate material often lead to a loss of the amazing properties that characterize this special form of carbon. An international team of researchers (Germany, UK, Finland, USA) was able to demonstrate that the influence exerted by the substrate on the electronic properties of graphene can be estimated by means of a simple structural parameter. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Materials science](#)

#### [Using E-petals for making stretchable metal conductors](#)

[PhysOrg.com, 08MAR2015](#)

An international team of researchers (Hong Kong, China) has developed elastomeric petals (E-petals) which are directly replicated from the natural rose petal as new and versatile substrates for stretchable and printable electronics. They have biomimicking topographic surfaces which can inhibit the propagation of microcracks formed in the conducting layer deposited on them, regardless of the type of conductive materials and deposition methods. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Flexible electronics](#)

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**Chemists develop new way to make cost-effective material for electricity storage**

Science Daily, 06MAR2015

Researchers in Canada have developed a technique that allows them to use a consumer grade heat lamp to make coatings that can be painted onto surfaces to conduct electricity or convert electricity into hydrogen fuels. Once the solution was painted onto a surface and heated up, it transformed into a catalytic coating. These coatings can be used in flexible electronic devices. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, S&T Canada*

**AUTONOMOUS SYSTEMS & ROBOTICS****Video Friday: Drone Dogfight, 3D-Printed Arm, and Kicking a Robot**

IEEE Spectrum, 06MAR2015

Insurance companies often don't want to cover prosthetics for kids, because kids grow and the prosthetics will need to be replaced every six months or so. That's why projects to make prosthetics cheaper, like this one at the University of Central Florida, are so important.

*Tags: Autonomous systems & robotics*

**BIG DATA****Minfer: Inferring Motif Statistics From Sampled Edges**

arXiv, 24FEB2015

Characterizing motif statistics is important for understanding complex networks such as online social networks and communication networks. Only "RESampled graph," a snapshot of the graph generated by sampling edges from the graph at random, is available to researchers. An international team of researchers (Hong Kong, USA) proposes a framework and implement a system called Minfer, which can take the given RESampled graph and accurately infer the underlying graph's motif statistics. Experiments using large scale datasets show the method to be accurate.

[TECHNICAL ARTICLE](#)

*Tags: Big data*

**BIOTECHNOLOGY****Bioengineers put human hearts on a chip to aid drug screening**

Science Daily, 09MAR2015

Researchers at UC Berkeley have created a 'heart-on-a-chip' that effectively uses human cardiac muscle cells derived from adult stem cells to model how a human heart reacts to cardiovascular medications. One day the system could replace animal models to screen for the safety and efficacy of new drugs. [TECHNICAL ARTICLE](#)

*Tags: Biotechnology, Medical technology*

**COMMUNICATIONS TECHNOLOGY****Traveling without moving: Quantum communication scheme transfers quantum states without transmitting physical particles**

PhysOrg.com, 10MAR2015

Researchers in China developed a scheme that can transport an unknown qubit in a nondeterministic manner without prior entanglement sharing or classical communication between the participants. [TECHNICAL ARTICLE](#)

*Tags: Communications Technology, Quantum science, S&T China*

**Magnetic vortices in nanodisks reveal information**

Science Daily, 03MAR2015

An international team of researchers (Germany, France) has found a new way to electrically read out the orientation of magnetic vortices in nanodisks. Their new method relies on measuring characteristic microwaves emanating from the vortices. The new knowledge about these signals could be used in the construction of extremely small components for novel memory technology or wireless data transmission. [TECHNICAL ARTICLE](#)

*Tags: Communications Technology, Microelectronics*

**CYBER SECURITY****New model of cybercrime factors in perishability of stolen data**

PhysOrg.com, 10MAR2015

A team of researchers in the US describes a computer-based model that captures the network economics of cybercrime activity and permits the policy evaluation of interventions. A novel feature of the model is its inclusion of the critical time element and perishability of stolen cyber financial products decreasing over time. It also identifies different demand prices for different financial products. The network economic framework permits quantifiable evaluation of various policy interventions investigated in the study.

*Tags: Cyber security*

**ENERGY****Longer life cycle for lithium-ion batteries?**

Science Daily, 06MAR2015

By combining a high-performance silicon electrode architecture with a room temperature ionic liquid electrolyte containing the new bis-fluorosulfonylamide anion, researchers at Arizona State University demonstrate a highly energy-dense lithium-ion cell with an impressively long cycling life, maintaining over 75 percent capacity over 500 charge/discharge cycles with almost perfect current efficiency. [TECHNICAL ARTICLE](#)

*Tags: Energy, Battery*

“A science is not mere knowledge, it is knowledge which has undergone a process of intellectual digestion.”

JOHN HENRY NEWMAN

### **Holding energy by the threads: Researchers spin cotton into capacitive yarn**

Science Daily, 05MAR2015

Using a process called “Natural Fiber Welding,” a team of researchers in the US (Drexel University, US Naval Academy, Bradley University, AFOSR) is embedding functionalized materials at the molecular level to strategically alter the yarn made of cellulose (cotton, linen, bamboo, viscose, rayon), for a variety of uses, including energy storage. [TECHNICAL ARTICLE](#)

Tags: Energy, Flexible electronics

### **Energy-generating cloth could replace batteries in wearable devices**

Science Daily, 04MAR2015

An international team of researchers (South Korea, Australia) created a novel TNG (triboelectric nanogenerators) fabric out of a silvery textile coated with nanorods and a silicon-based organic material. When they stacked four pieces of the cloth together and pushed down on the material, it captured the energy generated from the pressure. Energy was used to power LED, LCD and a vehicle’s keyless entry remote. The cloth worked for more than 12,000 cycles. [TECHNICAL ARTICLE](#)

Tags: Energy, Flexible electronics

## ENVIRONMENTAL SCIENCE

### **Nano-device used to create and control rogue optical waves**

PhysOrg.com, 10MAR2015

An international team of researchers (Saudi Arabia, the Netherlands, UK) proposed new theoretical ideas to explain the formation of rare energetic natural events such as rogue waves. They developed a planar photonic crystal chip, which was then used to generate ultrafast (163 fs long) and subwavelength (203 nm wide) nanoscale rogue optical waves. The photonic chip offered an ‘exceptional level of controllability’ over these rare events, thus proving the theory. [TECHNICAL ARTICLE](#)

Tags: Environmental science

## INFORMATION TECHNOLOGY

### **Optical fibres light the way for brain-like computing**

PhysOrg.com, 10MAR2015

An international team of researchers (UK, Singapore) has demonstrated how neural networks and synapses in the brain can be reproduced, with optical pulses

as information carriers, using special fibres made from glasses that are sensitive to light, known as chalcogenides. The research paves the way for scalable brain-like computing systems that enable ‘photonic neurons’ with ultrafast signal transmission speeds, higher bandwidth and lower power consumption than their biological and electronic counterparts. [TECHNICAL ARTICLE](#)

Tags: Information Technology, Artificial intelligence

### **Skyrmions get a sonic touch**

Nanowerk, 06MAR2015

Although difficulties in finding practical ways of controlling them have hampered progress, skyrmions are emerging as promising candidates for memory and data storage devices. By applying a sound wave with a frequency of 18 megahertz, researchers in Japan were able to measure the elastic stiffness of the skyrmions from the tiny distortions across the crystal induced by ultrasonic energy. The experiment demonstrates that ultrasound could be used as a convenient tool to search for skyrmions in other materials. [TECHNICAL ARTICLE](#)

Tags: Information Technology, S&T Japan

### **Reading speed harnessed to automatically control text display rates**

Science Daily, 03MAR2015

Researchers in Germany have developed a software system that recognizes how fast a text on a display screen is being read and then allows the text to scroll forward line by line at the right speed. The technology makes use of commercially available eye-tracking glasses, which are able to capture the motion of the user’s eyes and convert this into a reading speed.

Tags: Information Technology, S&T Germany

## MATERIALS SCIENCE

### **Determining structural evolution under pressure**

PhysOrg.com, 09MAR2015

The study of material properties under the conditions of extreme high pressures and strain rates is very important for understanding hyper velocity impact engineering and inertial confinement fusion capsules. Researchers at Lawrence Livermore National Laboratory designed an experimental platform to drive samples to high pressures without melting using a laser-generated plasma piston drive. They report important findings that can be used to determine the evolution of structures under high pressure and strain rates. [TECHNICAL ARTICLE](#)

Tags: Materials science, Government S&T

[continued...](#)

## [New research provides a general formula for understanding how layered materials form different surface patterns](#)

PhysOrg.com, 09MAR2015

Researchers at MIT report that the patterning process they describe applies to everything from the folds on the surface of the brain to wrinkles on an aging face, and from the buckling of tree bark to the ridged skin of a pumpkin. By understanding the factors that produce these patterns it should become easier to design synthetic materials with exactly the kinds of surfaces needed for specific applications—such as better traction, or water-shedding properties. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

## FEATURED RESOURCE

### [Science 2.0](#)

Science 2.0 is a place where world-class scientists write articles and discuss issues without being filtered by size or editorial limitations. [RSS](#)

## [Graphene meets heat waves](#)

Science Daily, 06MAR2015

Based on first-principles physics, an international team of researchers (Switzerland, France) has shown that atomically thin sheets of materials at room temperature behave in the same way as three-dimensional materials at extremely low temperatures. They show that the thermal transport is described by waves, not only in graphene but also in other materials that have not been studied yet. Their simulations provide a valuable tool for researchers studying graphene, whether to cool down circuits at the nanoscale, or to replace silicon in tomorrow's electronics. [TECHNICAL ARTICLE](#)

Tags: *Materials science, Advanced materials*

## [Squeezing out new science from material interfaces](#)

Science Daily, 06MAR2015

With more than five times the thermal conductivity of copper, diamond is the ultimate heat spreader. By applying extreme pressure in a diamond anvil cell to metal films on diamond, researchers at the University of Illinois at Urbana-Champaign have determined the physical process dominating this unexplained heat flow, which has implications for understanding and improving heat flow between any two materials. This helps researchers understand how heat enters materials like diamond. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

## NEUROSCIENCE

### [Researchers study brain-to-brain interfaces](#)

Medical Express, 09MAR2015

Using a combination of technologies—including EEG, the Internet and TMS (transcranial magnetic stimulation)—researchers were able to transmit a thought all the way from India to France. Words were first coded into binary notation. Then the resulting EEG signal from the person thinking the 1 or the 0 was transmitted to a robot-driven TMS device positioned over the visual cortex of the receiver's brain.

Tags: *Neuroscience*

## PHOTONICS

### [Creating Lasers in the Sky](#)

IEEE Spectrum, 10MAR2015

An international team of researchers (Russia, Austria, USA) has succeeded in pumping more than 200 gigawatts of power into a 0.1-millimeter-wide filament formed in the ambient air by a laser. They describe how they created laser pulses in the mid-infrared part of the spectrum. By making them 100 femtoseconds (10<sup>-13</sup> s) long, they could pack sufficient energy in these pulses to carve out a filament in the air several meters long. [TECHNICAL ARTICLE](#)

Tags: *Photonics*

## QUANTUM SCIENCE

### [Graphene quantum dots split Cooper pairs](#)

Physics World, 10MAR2015

An international team of researchers (Finland, Russia) built a device to split superconducting “Cooper pairs” of electrons to create entangled pairs of electrons. The device employs two quantum dots made of graphene. Although other types of quantum dots have been used for this purpose, the latest research suggests that graphene quantum dots should deliver long-lived entangled electron pairs that could be used in quantum computers.

[TECHNICAL ARTICLE](#)

Tags: *Quantum science*

### [How to make a tougher quantum computer](#)

Physics World, 09MAR2015

A team of researchers in the US (UC Santa Barbara, Google) has created a system of nine qubits that is robust to errors that would normally destroy a quantum computation. The device relies on a quantum error-correction protocol, which the team says could be deployed in practical quantum computers of the future. [TECHNICAL ARTICLE](#)

Tags: *Quantum science*

**Electron spins controlled using sound waves**

Nanowerk, 06MAR2015

Researchers at Cornell University not only created spin transitions with sound, but they also used sound to coherently control the quantum state of the spin. As the driven mechanical oscillator interacts with the electron spins inside, energy flows back and forth in between. This marks a huge step forward in understanding electron spin. [TECHNICAL ARTICLE](#)

Tags: *Quantum science*

**S&T POLICY****Fueling the US innovation economy: New study shows innovation impacts from federal R&D**

EurekaAlert, 06MAR2015

According to a new analysis of patent output across various federal agencies from 2000-2013, completed by Battelle, the R&D programs at NIH, NSF, DOE and NIST are particularly productive patent generators. [The report](#)

Tags: *S&T policy*

**SCIENCE WITHOUT BORDERS****Goodbye P value—is it time to let go of one of science’s most fundamental measures?**

PhysOrg.com, 10MAR2015

Scientists often conduct experiments to investigate whether there is a difference between two conditions. According to an international team of researchers (UK, USA), scientists should focus on estimating the size of the difference. They already know effect sizes and confidence intervals, so they can let the P value become a thing of the past. [TECHNICAL ARTICLE](#)

Tags: *Science without borders*

**SENSORS****Data driven discoveries: Imagine smart cities with thousands of strategically placed sensors**

Science Daily, 06MAR2015

Researchers at DOE’s Argonne National Laboratory have developed the Waggle platform which outfits researchers with a next-generation data collection experience. “Wagglers” can add their own mix of sensors, specific to what they’re researching, and install programs onto a single low-power “system on a chip” (SoC) computer board, complete with a Linux-based operating system to control them.

Tags: *Sensors, Government S&T*

**Flexible sensors turn skin into a touch-sensitive interaction space for mobile devices**

Science Daily, 04MAR2015

Researchers in Germany have developed flexible silicone rubber stickers with pressure-sensitive sensors that fit snugly to the skin. By operating these touch input stickers, users can use their own body to control mobile devices. Because of the flexible material used, the sensors can be manufactured in a variety of shapes, sizes and personalized designs.

Tags: *Sensors, Flexible electronics, S&T Germany*

**Making night vision, thermal imaging affordable**

Science Daily, 04MAR2015

Researchers at UT Dallas have created a device using Schottky diodes in CMOS technology that detects electromagnetic waves to create images at nearly 10 terahertz, which is the highest frequency for electronic devices. The chip can be mass produced inexpensively and has a smaller pixel. The next step in the research is to realize CMOS devices that can reach even higher frequencies, up to 40 terahertz.

Tags: *Sensors, Terahertz technology*

**New materials discovered to detect neutrons emitted by radioactive materials**

Science Daily, 04MAR2015

A team of researchers from the US (Johns Hopkins University, University of Maryland, NIST) has successfully shown that boron-coated vitreous carbon foam can be used in the detection of neutrons emitted by radioactive materials. The next steps in the series of experiments include investigating other unique detector geometries, such as multiple layers of boron-coated thin films, the use of optically transparent neutron absorbers, and finalizing a design for a potential prototype detector. [TECHNICAL ARTICLE](#)

Tags: *Sensors*

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