



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

[Advanced materials \(3\)](#)

[Autonomous systems & robotics \(2\)](#)

[Big data \(1\)](#)

[Biotechnology \(1\)](#)

[Breakthrough technology \(1\)](#)

[Communications technology \(1\)](#)

[Cyber security \(2\)](#)

[Energy \(1\)](#)

[Environmental science \(1\)](#)

[Information technology \(2\)](#)

[Materials science \(6\)](#)

[Microelectronics \(1\)](#)

[Neuroscience \(2\)](#)

[Photonics \(2\)](#)

[Quantum science \(5\)](#)

[S&T policy \(2\)](#)

[Sensors \(1\)](#)

## FEATURE ARTICLES

### [New theory leads to radiationless revolution](#)

[Nanowerk, 28AUG2015](#)

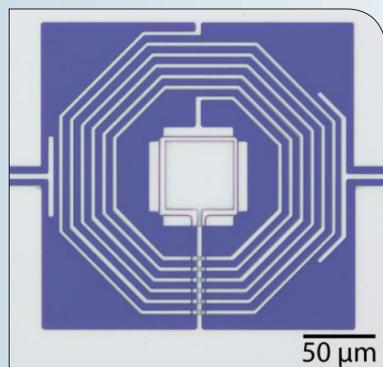
An international team of researchers (Australia, Germany, Russia, Singapore) demonstrates experimentally that dielectric nanoparticles can exhibit a radiationless anapole mode invisible. The fundamental new theory could be used in quantum computers, lead to new laser technology and may even hold the key to understanding how matter itself hangs together. [TECHNICAL ARTICLE](#)

*Tags: Breakthrough technology, Materials science, Featured Article*

### [Seeing quantum motion; even one day ripples in the fabric of space-time?](#)

[Science Daily, 28AUG2015](#)

Using microwave frequency radiation pressure, an international team of researchers (USA-Caltech, South Korea, Germany, Canada) manipulated the thermal fluctuations of a micrometer-scale mechanical resonator to produce a stationary quadrature-squeezed state with a minimum



*Because quantum motion, or noise, is theoretically an intrinsic part of the motion of all objects, Schwab and his colleagues designed a device that would allow them to observe this noise and then manipulate it. The micrometer-scale device consists of a flexible aluminum plate that sits atop a silicon substrate. Credit: Chan Lei and Keith Schwab/Caltech*

variance of 0.80 times that of the ground state. Their results are relevant to the quantum engineering of states of matter at large length scales, the study of decoherence of large quantum systems, the realization of ultrasensitive sensing of force and motion, and they improve the precision of very sensitive measurements. [TECHNICAL ARTICLE](#)

*Tags: Quantum science, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MATERIALS

#### [Reversible writing with light](#)

[Nanowerk, 01SEP2015](#)

An international team of researchers (Israel, UK, Germany) describes a new methodology to reversibly assemble nanoparticles using light that does not require the particles to be functionalized with light-responsive ligands. Their strategy is based on the use of a photoswitchable medium that responds to light in such a way that it modulates the interparticle interactions. Nanoparticle assembly proceeds quantitatively and without apparent fatigue, both in solution and in gels. This method can be used for removing pollutants and delivery of tiny amounts of drugs. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

#### [Global Conference on Materials Science and Nanotechnology 2016 CHINA](#)

[Physics World, 29AUG2015](#)

The 1st Global Conference on Materials Science and Nanotechnology will be hosted by Global Cognition group. Tentative themes include basic research and applications for electronics devices, construction, energy, medicine, transportation. Venue: Beijing, China. Date: July 28-29, 2016. [Conference Site](#)

*Tags: Advanced materials, S&T China*

#### [Electric Glue Can Set Anywhere](#)

[IEEE Spectrum, 27AUG2015](#)

Researchers in Singapore have developed a glue nicknamed "Voltaglue" that hardens when a low voltage is applied to it. The glue consists of a layer of hydrogel, into which are dissolved carbon molecules called carbenes that are attached to plastic dendrimers, which are typically spherical large molecules. Using electrodes to apply two volts across the glue causes the carbenes to start bonding with other dendrimers and nearby surfaces. Once the voltage is removed, the bonding activity stops. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

*continued...*

[BACK TO TOP](#)

## AUTONOMOUS SYSTEMS &amp; ROBOTICS

**Is a Cambrian Explosion Coming for Robotics?**

IEEE Spectrum, 31AUG2015

About half a billion years ago, life on earth experienced a short period of very rapid diversification called the “Cambrian Explosion.” Many of the base hardware technologies on which robots depend—particularly computing, data storage, and communications—have been improving at exponential growth rates. Two newly blossoming technologies—“Cloud Robotics” and “Deep Learning”—could leverage these base technologies in a virtuous cycle of explosive growth.

*Tags: Autonomous systems & robotics, Science without borders*

**Video Friday: Mini Surgical Robot, Precision Drones, and Bioinspired Robotics at Harvard**

IEEE Spectrum, 28AUG2015

Researchers at the Australian National University (ANU) and the University of Sydney have developed a world-first radio-tracking drone to locate radio-tagged wildlife.

*Tags: Autonomous systems & robotics*

## BIG DATA

**Searching big data faster**

Science Daily, 26AUG2015

Researchers at MIT have been investigating techniques to make biological and chemical data easier to analyze by compressing it. They present a theoretical analysis that demonstrates why their previous compression schemes have been so successful. They identify properties of data sets that make them amenable to compression and present an algorithm for determining whether a given data set has those properties. They also show that several existing databases of chemical compounds and biological molecules do indeed exhibit them. TECHNICAL ARTICLE

*Tags: Big data*

## BIOTECHNOLOGY

**Using DNA origami to build nanodevices of the future**

Science Daily, 28AUG2015

DNA has the advantage of being inherently “coded.” Researchers in Japan used this inherent coding to manipulate and “fold” DNA to form “origami nanostructures.” They used a double layer of lipids containing both a positive and a negative charge to facilitate the assembly of DNA origami units, nanodevices such as nanomotors for use in targeted drug delivery inside the body.

TECHNICAL ARTICLE

*Tags: Biotechnology, S&T Japan*

## COMMUNICATIONS TECHNOLOGY

**Magnetic fields provide a new way to communicate wirelessly**

PhysOrg.com, 01SEP2015

Researchers at UC San Diego demonstrated a technique called magnetic field human body communication, which uses the body as a vehicle to deliver magnetic energy between electronic devices. Magnetic fields are able to pass freely through biological tissues, so signals are communicated with much lower path losses and potentially, much lower power consumption. Path losses are 10 million times lower than those associated with Bluetooth radios. The link works well on the body, but they did not test the technique’s power consumption.

*Tags: Communications Technology*

## CYBER SECURITY

**Cyberattacks of the 21st Century (Part II)**

MIT Technology Review, 27AUG2015

Researchers at Georgetown University in Washington have been studying trends in cyberattacks that have occurred since 2000. The same attacks are appearing over and over again. Attacks exploiting known vulnerabilities are not subsiding, which shows that valuable lessons are not being learned from past experiences. They conclude that cyberattacks are on the increase and that precautions must be taken to secure important data as a matter of urgency.

TECHNICAL ARTICLE

*Tags: Cyber security*

**The 20 Most Infamous Cyberattacks of the 21st Century (Part I)**

MIT Technology Review, 25AUG2015

Researchers at Georgetown University in Washington, D.C. discuss the most egregious attacks of the 21st century and conclude that the trend is increasing sharply. In a two-part post, here are 20 of the most infamous attacks this paper discusses. TECHNICAL ARTICLE

*Tags: Cyber security*

## ENERGY

**Artificial leaf harnesses sunlight for efficient fuel production**

Science Daily, 28AUG2015

The new system, developed by researchers at Caltech, consists of three main components: two electrodes—one photoanode and one photocathode—and a membrane. The photoanode uses sunlight to oxidize water molecules, generating protons and electrons as well as oxygen gas. The photocathode recombines the protons and electrons to form hydrogen gas. A key part of the design is the plastic membrane, which keeps the oxygen and hydrogen gases separate. TECHNICAL ARTICLE

*Tags: Energy, Government S&T*

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“Technology feeds on itself. Technology makes more technology possible.” ALVIN TOFFLER

## ENVIRONMENTAL SCIENCE

### [How to get rid of a satellite after its retirement](#) PhysOrg.com, 01SEP2015

An international team of researchers (UK, Spain) has developed a method to eliminate satellites in highly elliptical orbits (HEO) by taking advantage of the same gravitational effects that affect HEO orbits to reduce the cost of eliminating the satellites once they have reached retirement. Their program finds the best conditions and time windows for satellites to re-enter into the Earth's atmosphere, where they can safely disintegrate with minimum risk to other satellites. [TECHNICAL ARTICLE](#)

*Tags: Environmental science, Satellite technology, Space technology*

## INFORMATION TECHNOLOGY

### [Graphics processors accelerate pattern discovery](#)

Science Daily, 28AUG2015

By developing a parallelized code that utilizes the capabilities of GPUs, including simultaneous execution of code on multiple GPU cores and efficient memory access patterns, researchers in Singapore were able to expedite the search by up to 100 times. GPUs are also around 20 times cheaper than computer processors for equivalent performance. Beyond biology, the technique has applications in pattern detection in digital circuits and other non-random networks, graph mining and graph databases. [TECHNICAL ARTICLE](#)

*Tags: Information technology, Pattern recognition*

### [Microsoft Says Programmable Chips Will Make AI Software Smarter](#)

MIT Technology Review, 25AUG2015

Microsoft began using FPGAs to power parts of its Bing search engine last year, and reported it was testing their use to power the virtual neurons of deep learning in February. The research has now advanced to using some of the most powerful FPGAs available, and it looks like a practical way to deliver a major boost to the power of deep learning.

*Tags: Information technology*

## MATERIALS SCIENCE

### [Functional catalyst for alternative fuel source by depositing nanosheets on a flexible carbon cloth](#)

PhysOrg.com, 01SEP2015

An international team of researchers (Singapore, Taiwan) has devised a molybdenum-nickel-based hydrogen evolution catalyst that can be deposited on a flexible, conductive carbon fiber cloth. Analytical studies show that Ni-Mo-S/C

catalyst, when prepared using the reaction solution with a nickel-to-molybdenum ratio of 1:1, has better overpotential values and is more stable than MoS<sub>2</sub> in neutral electrolyte. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

### [Super water-repellant coatings can now take the pressure](#)

Science Daily, 31AUG2015

Conventional superhydrophobic coatings that repel liquids by trapping air inside microscopic surface pockets tend to lose their properties when liquids are forced into those pockets. An international team of researchers (USA-Brookhaven National Laboratory, Germany) fabricated superhydrophobic surfaces that can withstand pressures that are 10 times greater than the average pressure a surface would experience. The surfaces resist the infiltration of liquid into the nanoscale pockets. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Government S&T*

### [Using ultrathin sheets to discover new class of wrapped shapes](#)

Science Daily, 31AUG2015

A team of researchers in the US (UMass Amherst, Lawrence Berkeley National Laboratory) use much thinner sheets than before to encapsulate droplets of one fluid within another. Thinner, highly-bendable sheets lift constraints and allow for a new class of wrapped shapes. Such wrapping techniques could be used to contain toxic or corrosive liquids, to physically isolate a delicate liquid cargo or to shrink-wrap drops. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

### [Evidence suggests subatomic particles could defy the standard model](#)

Science Daily, 27AUG2015

CERN researchers found a small, but notable, difference in the predicted rates of decay of leptons, suggesting that as-yet undiscovered forces or particles could be interfering in the process. The discovery could prove to be a significant lead in the search for non-standard phenomena. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Particle physics*

### [Developing component scale composites using nanocarbons](#)

Nanotechweb, 26AUG2015

Despite many promising results, the issues of repeatability and scale-up have yet to be adequately addressed. Researchers in the UK explore techniques for component-scale manufacture of hierarchical composites by liquid

*continued...*

infusion using both carbon nanotube and graphene materials. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Advanced materials, S&T UK*

### [Next-generation X-ray source fires up](#)

[Nature News, 26AUG2015](#)

The crucial innovation of the fourth-generation machines is to employ a narrower vacuum pipe in which to circulate the electrons. In MAX IV, developed by researchers in Sweden, the pipe is about half as wide as a typical existing synchrotron. This makes it possible to get stronger magnetic fields using more compact bending and focusing magnets, which are also less expensive and can consume ten times less electricity. MAX IV promises to open up new avenues for researchers.

*Tags: Materials science, Particle physics, S&T Sweden*

## FEATURED RESOURCE

### [Nature Video](#)

For selected articles and letters, Nature presents streaming videos featuring interviews with scientists behind the research and analysis from Nature editors. [Nature Video YouTube channel!](#)

## MICROELECTRONICS

### [Surface plasmons move at nearly the speed of light and travel farther than expected, possibly leading to faster electronic circuits](#)

[Science Daily, 28AUG2015](#)

Researchers at DOE's Pacific Northwest National Laboratory applied two laser pulses to a gold sample surface: pump, to generate the surface plasmon, and probe to detect the surface plasmon. By continuously tuning the pump and probe pulses they captured the confined waves propagating on video. They detected plasmons at least 250 microns away from the generation source, far enough to be useful in electronic circuits. This finding opens up the option for ultra-fast computers.

[TECHNICAL ARTICLE](#)

*Tags: Microelectronics, Government S&T*

## NEUROSCIENCE

### [Researchers help identify the neural basis of multitasking](#)

[Science Daily, 01SEP2015](#)

By studying networks of activity in the brain's frontal cortex an international team of researchers (Germany, USA - University of Pennsylvania) shows that the degree to which these networks reconfigure themselves while

switching from task to task predicts people's cognitive flexibility. A more fundamental understanding of how the brain manages multitasking could lead to better interventions for medical conditions. [TECHNICAL ARTICLE](#)

*Tags: Neuroscience*

### [Neurobiology: Light-activated learning](#)

[Science Daily, 28AUG2015](#)

An international team of researchers (Germany, France) has synthesized a light-dependent switch that enables them to control the activity of a particular class of receptors which is crucial for the formation and storage of memories. The compound provides a powerful new tool for researchers interested in probing the mechanisms that underlie short- and long-term memory. The technique will lead to new insights into the mechanisms underlying synaptic plasticity and memory formation. [TECHNICAL ARTICLE](#)

*Tags: Neuroscience*

## PHOTONICS

### [New, ultrathin optical devices shape light in exotic ways](#)

[PhysOrg.com, 31AUG2015](#)

A team of researchers in the US (Caltech, JPL) has made optical devices from silicon nanopillars that are precisely arranged into a honeycomb pattern to create a "metasurface" that can control the paths and properties of passing light waves. The devices could lead to ultracompact optical systems such as advanced microscopes, displays, sensors, and cameras that can be mass-produced using the same photolithography techniques used to manufacture computer microchips. [TECHNICAL ARTICLE](#)

*Tags: Photonics*

### [Scientists 'squeeze' light one particle at a time](#)

[Science Daily, 31AUG2015](#)

Researchers in the UK report that they have successfully demonstrated the squeezing of individual photons using a semiconductor quantum dot. Thanks to the enhanced optical properties of this system and the technique used to make the measurements, they were able to observe the light as it was scattered, and proved that it had indeed been squeezed. Squeezing creates a very specific form of light which is "low-noise" and is potentially useful in technology designed to pick up faint signals, such as the detection of gravitational waves. [TECHNICAL ARTICLE](#)

*Tags: Photonics, S&T UK*

## QUANTUM SCIENCE

### [Quantum computer that 'computes without running' sets efficiency record](#)

[PhysOrg.com, 31AUG2015](#)

So far the efficiency of counterfactual computation (CFC) has had an upper limit of 50%, limiting its practical applications.

An international team of researchers (China, USA - Yale University) has experimentally demonstrated a slightly different version called a “generalized CFC” that has an efficiency of 85% with the potential to reach 100%. This improvement opens the doors to realizing a much greater variety of applications, such as low-light medical X-rays and the imaging of delicate biological cells and proteins—in certain cases, using only a single photon.

**TECHNICAL ARTICLE**

*Tags: Quantum science*

**Close to the point of more efficient chips**

[Science Daily, 28AUG2015](#)

By using the tip of a scanning tunneling microscope, researchers in Singapore have generated surface plasmon polaritons in a gold grating and demonstrated that the direction of travel of these waves can be controlled. This demonstration is a step toward the development of plasmonic chips rather than electrons to transfer and process data. Such chips promise to be much faster and potentially more energy efficient than current electronic chips. **TECHNICAL ARTICLE**

*Tags: Quantum science, Microelectronics*

**More evidence to support quantum theory's ‘spooky action at a distance’**

[Science Magazine, 28AUG2015](#)

An international team of researchers (the Netherlands, Spain, UK) says it has clinched the case for this concept, sealing up loopholes in previous demonstrations. The experiment closes the ones that might be used to attack certain developing quantum technologies, such as schemes to use entangled particles to securely distribute the keys for encoding secret messages in device independent quantum key distributions. This is a huge technical milestone and a prerequisite for many future quantum technologies, which are sure to enable the probing and eventual understanding of new physics.

**TECHNICAL ARTICLE**

*Tags: Quantum science*

**Neural qubits: Quantum cognition based on synaptic nuclear spins**

[PhysOrg.com, 27AUG2015](#)

Researchers at UC Santa Barbara note that while small molecules and ions would rapidly entangle with a surrounding wet environment and therefore couldn't maintain quantum coherence on macroscopic time scales, nuclear spins are exceptional in being so weakly coupled to environmental degrees of freedom that prolonged phase coherence is likely. **TECHNICAL ARTICLE**

**ARTICLE**

*Tags: Quantum science*

## S&T POLICY

**Rebooting the IT Revolution report now available**

[NSF News, 01SEP2015](#)

A report released September 1st identifies fundamental research needs for advancing the burgeoning Internet of Things and catalyzing cutting-edge innovations that will support future U.S. technology leadership and economic competitiveness. It is based on a March 2015 workshop supported by NSF.

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

**System designed to store and analyze extremely large array-structured data**

[PhysOrg.com, 01SEP2015](#)

DOE's SciDB is an open source database system designed to store and analyze extremely large array-structured data. The advantage for science is that the database can scale on hundreds of nodes, can easily be deployed on commodity hardware or standing DOE supercomputers, has efficient parallel input/output (I/O), includes a large variety of built-in generic analysis tools and it is relatively easy to integrate new algorithms that can transparently access efficient I/O.

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

## SENSORS

**Invisible Drones Could Become Reality with New Meta Material**

[Defense Update, 30AUG2015](#)

Researchers at UC San Diego have created a new design for a cloaking device, using an ultra-thin Teflon substrate, studded with cylinders of ceramic that can ‘bend’ light waves around objects coated with it, creating a cloak. The Teflon has a low refractive index, while the ceramic's refractive index is higher, a combination which allows light to be dispersed through the sheet without any absorption.

**TECHNICAL ARTICLE**

*Tags: Sensors ■*

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