



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

[Advanced manufacturing \(1\)](#)

[Advanced materials \(4\)](#)

[Autonomous systems  
& robotics \(1\)](#)

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

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

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

[Cyber security \(1\)](#)

[Energy \(1\)](#)

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

[Information technology \(3\)](#)

[Materials science \(4\)](#)

[Medical sciences \(1\)](#)

[Photonics \(3\)](#)

[Quantum science \(4\)](#)

[S&T policy \(3\)](#)

[Sensors \(2\)](#)

## FEATURE ARTICLES

### [Laser ablation boosts terahertz emission](#)

[Science Daily, 17SEP2015](#)

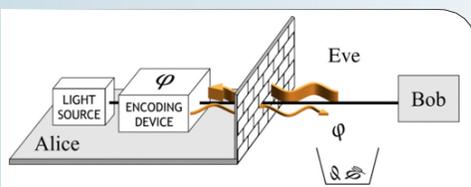
THz technology could be the next important breakthrough in medicine, security, chemistry, and information technology. However, generation of THz waves is difficult. An international team of researchers (Japan, Greece, China) reports on the first terahertz emitter based on femtosecond-laser-ablated gallium arsenide, demonstrating a 65% enhancement in THz emission at high optical power compared to the nonablated device. Counter-intuitively, the ablated device shows significantly lower photocurrent and carrier mobility. This behavior is a result of n-doping, shorter carrier lifetime, and enhanced photoabsorption arising from the ablation process. **TECHNICAL ARTICLE**

*Tags: Breakthrough technology, Terahertz technology, Featured Article*

### [Researchers develop simple way to ward off Trojan attacks on quantum cryptographic systems](#)

[PhysOrg.com, 17SEP2015](#)

In the quantum version of a Trojan-horse attack, photons are injected into the optical modules of a quantum key distribution system in an attempt to read information direct from the encoding devices. An international team of researchers (UK, Japan) proposes a new approach, modifying the transmitter so that reflected light will be too weak to reveal any useful information. The modifications would include adding an attenuator to reduce the pulse to just one photon, an isolator, and a filter which would prevent the transfer of any wavelengths



not initially specified to be in the channel. **TECHNICAL ARTICLE**

*Tags: Cyber security, Quantum science, Featured Article*

*Representation of the Trojan-horse attack against an optical QKD setup. Credit: Phys. Rev. X 5, 031030 – Published 9 September 2015.*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### [Souped-up software reduces guesswork, tedium in computer-aided engineering](#)

[PhysOrg.com, 17SEP2015](#)

Researchers at the University of Wisconsin-Madison have developed software that assists in optimizing the design of parts for just about anything—from bicycles and airplanes to bridges and furniture. It helps designers quickly identify component shapes, topologies that maintain their structural integrity while using the least amount of material possible. Researchers claim that the software is fast, robust and reliable.

*Tags: Advanced manufacturing*

### ADVANCED MATERIALS

#### [Nanoelectronics could get a boost from carbon research](#)

[Science Daily, 17SEP2015](#)

Researchers at Lawrence Livermore National Laboratory have created linear chains of carbon atoms, called carbyne, from laser-melted graphite. Its linear shape gives carbyne unique electrical properties that are sensitive to stretching and bending, and it is 40 times stiffer than diamond. Carbyne could have a number of novel properties, including the ability to adjust the amount of electrical current traveling through a circuit, depending on the user's needs.

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

#### [Researchers achieve near-perfect absorption of sounds waves](#)

[PhysOrg.com, 16SEP2015](#)

Researchers in Hong Kong used two decorated membrane resonators built together, both of which were tuned to the same frequency. The impedance of both was set to match the environment, which was normal air. Technically, the material created by the team does not absorb sound, instead it scatters sound waves and then dissipates them, resulting in sound wave

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[BACK TO TOP](#)

reduction of 99.7 percent. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

### [Researchers show how natural materials can self-assemble into surfaces with stunning optical properties](#)

[PhysOrg.com](#), 15SEP2015

Researchers in Canada have shown how plant cellulose can self-assemble into wrinkled surfaces that give rise to effects like iridescence and color change. Their findings provide a foundation to understand structural color in nature, as well as yield insights that could guide the design of devices like optical humidity sensors.

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

### [Building the electron superhighway](#)

[Nanowerk](#), 14SEP2015

Organic semiconductors may allow flexible electronics to be manufactured at low cost. But the basic science of how to get electrons to move quickly and easily in these organic materials remains murky. Researchers at the University of Vermont have invented a new way to create “an electron superhighway” in a low-cost blue dye called phthalocyanine that promises to allow electrons to flow faster and farther in organic semiconductors. Researchers report that their invention will aid in the hunt for alternatives to traditional silicon-based electronics. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Flexible electronics*

## AUTONOMOUS SYSTEMS & ROBOTICS

### [Robot can assess its situation and call a human for help when it needs assistance](#)

[PhysOrg.com](#), 16SEP2015

RoboSAM (ROBOTic Smart Assistant for Manufacturing), developed by researchers at the University of Maryland based on the Baxter industrial robot platform, is able to estimate the probability it can complete a task before beginning it, and can ask a “human on call” for help if necessary. RoboSAM’s abilities may provide a path forward towards smarter, more versatile industrial robots and more interesting duties for the humans who work with them. [TECHNICAL ARTICLE](#)

*Tags: Autonomous systems & robotics*

## BIG DATA

### [King - Man + Woman = Queen: The Marvelous Mathematics of Computational Linguistics](#)

[MIT Technology Review](#), 17SEP2015

The ability to number-crunch vast amounts of words is creating a new science of linguistics. In their new approach, researchers in Australia treat languages like vector spaces with precise mathematical properties and explore one of the curious mathematical properties of vector space: that adding and subtracting vectors

produces another vector in the same space. They found that the difference between vectors is a powerful tool for studying language and the relationship between words.

[TECHNICAL ARTICLE](#)

*Tags: Big data, Artificial intelligence, S&T Australia*

## COMMUNICATIONS TECHNOLOGY

### [Millimeter Wave Energy Harvesting](#)

[arXiv](#), 05SEP2015

Although the millimeter wave band seems attractive for wireless applications, the path to energy harvesting is unclear. Researchers at UT Austin consider a scenario where low-power devices extract energy and/or information from the incident mmWave signals. Numerical results reveal several network and device level design insights. At the device level, the overall performance can be substantially improved by optimally splitting the received signal for energy and information extraction, and by deploying multi-antenna arrays. [TECHNICAL ARTICLE](#)

*Tags: Communications technology*

## ENERGY

### [What’s the best way to charge millions of electric vehicles at once?](#)

[PhysOrg.com](#), 18SEP2015

An international team of researchers (UK, Slovakia) sees EV charging as a theoretical problem of allocation of scarce (network) resources to a population of heterogeneous and mobile agents. They compared two charging strategies, “max-flow” and “proportional fairness.” According to the researchers, the proportional fairness algorithm reaches a maximum Gini (used to measure income inequality) of 0.45, which is comparable with the level of inequality in the US society, and thus may be judged socially acceptable. “The max-flow algorithm,” however, reaches a Gini of 0.91, which measures a level of inequality considerably higher than present in any contemporary society. [TECHNICAL ARTICLE](#)

*Tags: Energy*

## IMAGING TECHNOLOGY

### [Slow light speeds up the microscopic world](#)

[PhysOrg.com](#), 17SEP2015

Researchers in the UK demonstrate the use of slow light to enhance the guiding of submicrometer dielectric particles on a photonic crystal waveguide. Studies are based on a range of particle sizes, and they observed a four-fold enhancement in guiding velocity simply by changing the wavelength of the exciting laser within the slow light region. Optical forces can allow scientists to move, collect and sort minuscule particles in the biological world, including separating abnormal from healthy cells or viruses. [TECHNICAL ARTICLE](#)

*Tags: Imaging technology, S&T UK*

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“It is the facts that matter, not the proofs. Physics can progress without the proofs, but we can't go on without the facts.” RICHARD FEYNMAN

## INFORMATION TECHNOLOGY

### **Map brings needed attention to underpinning of Internet**

Techexplore, 17SEP2015

Authors of the paper InterTubes: A Study of the US Long-haul Fiber-optic Infrastructure are drawing attention to the physical side of the wired Internet and its future. It is either taken for granted or implicitly assumed that the physical infrastructure of tomorrow's Internet will have the capacity, performance, and resilience required to develop and support ever more bandwidth-hungry, delay-intolerant, or QoS-sensitive services and applications. According to the authors, very little is known about today's physical Internet where individual components such as cell towers, routers or switches, and fiber-optic cables are concrete entities with well-defined geographic locations.

Tags: Information technology

### **Scientists identify new way of information storage and processing based on skyrmions**

PhysOrg.com, 16SEP2015

An international team of researchers (China, Sweden, Ireland, Switzerland) has discovered that skyrmions can be dynamically stabilised in ultra-thin films by their own precessional motion without the need for Dzyaloshinskii-Moriya interaction. This discovery means that a wider range of materials are now open to possible use for next generation information storage and processing. TECHNICAL ARTICLE

Tags: Information technology

### **The future of the Internet**

PhysOrg.com, 16SEP2015

Researchers in the UK survey the ICT landscape to disentangle the threads of the future internet. The substantial challenges posed by massive computing and storage requirements to analyse terabytes of data, produced by various heterogeneous data sources, are only part of the problem. Managing and analysing all this data has necessitated special techniques due to the sheer volume, speed and variety with which these datasets are produced and require processing. TECHNICAL ARTICLE

Tags: Information technology, Big data

## MATERIALS SCIENCE

### **'Careful engineering' induces ferroelectricity in ultrathin film of strontium titanate**

PhysOrg.com, 17SEP2015

Ordinarily the material's bulk serves to isolate polar nanoregions in an insulating matrix. An international team of researchers (USA - University of Wisconsin, University

of Nebraska, Pennsylvania State University, Temple University, UC Santa Barbara, Boise State University, South Korea) fabricated epitaxial films of strontium titanate, spread across a substrate of the same material, no thicker than the size of these polar nanoregions. The electrical boundary conditions in the films drastically changed, forcing the polar nanoregions to interact between themselves and respond in a cooperative manner to the applied electric field. This allowed for the emergence of switchable and stable polarization. TECHNICAL ARTICLE  
Tags: Materials science, Advanced materials

### **A small, inexpensive high frequency comb signal generator**

Science Daily, 15SEP2015

A team of researchers in Italy found that an oscillating magnetic field produced a sudden jump in a quantum mechanical property of the superconductor layers called a phase which produced the voltage pulse. Voltage pulses contained hundreds of harmonics of the original driving frequency, including frequencies thousands of times higher. TECHNICAL ARTICLE

Tags: Materials science, S&T Italy

### **Materials enter a new phase**

RIKEN Research News, 11SEP2015

Researchers in Japan have investigated the mechanisms that give rise to specific phases in a class of materials called iridates whose behavior is predominantly governed by two effects that are roughly equal in magnitude: the repulsive Coulomb force between electrons arising from their electric charge and the spin-orbit interaction. Theoretical analysis indicates that competition or cooperation between these two effects gives rise to a number of exotic phases in iridates. TECHNICAL ARTICLE

Tags: Materials science, S&T Japan

### **A close-up view of materials as they stretch or compress**

Science Daily, 08SEP2015

A team of researchers in the US (AFRL, Argonne National Laboratory, Carnegie Mellon University, Lawrence Livermore National Laboratory) describes how they created a system to squeeze and stretch a material while rotating and bombarding it with high-energy synchrotron X-rays, which capture information about how it responds to mechanical stress. Their approach included developing and validating micromechanical models to help us understand the sources of failure in materials and gain a more complete understanding of their service lifetime capability. TECHNICAL ARTICLE

Tags: Materials science, Government S&T

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## MEDICAL SCIENCES

**Network control: Letting noise lead the way**  
[Science Daily, 17SEP2015](#)

Using a newly-developed computational algorithm, researchers at Northwestern University showed that randomness within and among cells, called “noise,” can be manipulated to control the networks that govern the workings of living cells, promoting cellular health and potentially alleviating diseases such as cancer.

[TECHNICAL ARTICLE](#)

*Tags: Medical sciences, Biotechnology*

## FEATURED RESOURCE

**Science X**

Science X covers a full range of topics - physics, earth science, medicine, nanotechnology, electronics, space, biology, chemistry, computer sciences, engineering, mathematics and other sciences and technologies.

## PHOTONICS

**Discovery of a new photonic crystal where light propagates through the surface without being scattered**

[Nanowerk, 18SEP2015](#)

Researchers in Japan elucidated a new principle whereby electromagnetic waves including light, propagate on the surface in a photonic crystal without being scattered. By slightly adjusting positions of insulator or semiconductor cylinders (nanorods) in a honeycomb lattice, electromagnetic waves can propagate without being scattered even at corners of crystal or by defects. [TECHNICAL ARTICLE](#)

*Tags: Photonics, S&T Japan*

**New route for switching magnets using light**

[PhysOrg.com, 16SEP2015](#)

An international team of researchers (UK, the Netherlands, Germany, China, Russia) has shown that light can excite electrons, which in turn can directly influence the strength of the exchange interaction and therefore change magnetisation. No heat is released in the process, which is good news for magnetic data storage applications as it means that the method requires little energy. [TECHNICAL ARTICLE](#)

*Tags: Photonics, Imaging technology*

**Tracking slow nanolight in natural hyperbolic metamaterial slabs**

[PhysOrg.com, 15SEP2015](#)

Researchers in Spain observed ultraslow pulse propagation and backward propagating waves in deep

subwavelength-scale thick slabs of boron nitride—a natural hyperbolic material for infrared light. The work lays the foundations for studying the precise manner in which light travels through complex optical systems at the subwavelength scale in extremely high levels of detail. Such a capability will be vital for verifying that future nanophotonic devices are functioning as expected. [TECHNICAL ARTICLE](#)

*Tags: Photonics, Materials science, S&T Japan*

## QUANTUM SCIENCE

**Nano-trapped molecules are potential path to quantum devices**

[EurekAlert, 17SEP2015](#)

Single atoms or molecules imprisoned by laser light in a doughnut-shaped metal cage could unlock the key to advanced storage devices, computers and high-resolution instruments. A team of researchers in the US (University of Tennessee, Oak Ridge National Laboratory) describes conceptually how physicists may be able to exploit a molecule’s energy to advance a number of fields. [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

**Ultrafast quantum-dot photodetector detects multiple electrons**

[Nanotechweb, 17SEP2015](#)

Researchers at the Los Alamos National Laboratory have developed the first ultrafast photodetector made from quantum dots that is capable of directly observing the extra electrons produced via “carrier multiplication”—the process by which multiple electrons are generated by a single photon. The result could help in the development of more efficient solar cells and new types of photo and radiation detectors. [TECHNICAL ARTICLE](#)

*Tags: Quantum science, Government S&T*

**Single photons could help make complex decisions**

[Nanotechweb, 16SEP2015](#)

Computer algorithms use probabilistic mechanisms to resolve the exploration–exploitation dilemma trade-off in decision-making. An international team of researchers (Japan, France) made the world’s first decision-maker based on single photons (produced by a nitrogen-vacancy centre in a nanodiamond). The device relies on the laws of quantum mechanics rather than algorithms to make complex decisions, and could make for a new kind of “photonic intelligence.” [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

**Automated Search for new Quantum Experiments**

[arXiv, 09SEP2015](#)

Quantum mechanics predicts a number of at first sight counterintuitive phenomena. An international team of researchers (Austria, Canada) has developed an algorithm

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called Melvin which is able to find new experimental implementations for the creation and manipulation of complex quantum states. Melvin autonomously learns from solutions for simpler systems, which significantly speeds up the discovery rate of more complex experiments. [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

## S&T POLICY

### [China launches new type of carrier rocket: state media](#)

[PhysOrg.com](#), 19SEP2015

China launched a new type of rocket that will be primarily used for carrying satellites aloft. The rocket is 29.3 metres (97 feet) high and uses fuel composed of liquid oxygen and kerosene, which is said to be free of toxicity and pollution, state media said.

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

### [A call to deal with the data deluge](#)

[Nature](#), 18SEP2015

As the number of biomedical research papers continues its relentless growth, the quality and credibility of science is buckling under the weight of all the data. That is the conclusion of researchers in the UK that triggered discussion online this week. The piece, which is based on interviews with 20 anonymous US senior scientists, suggests a radical rethinking of the peer-review system to deal with the 'overflow' of data. [TECHNICAL ARTICLE](#)

*Tags: S&T policy, Bibliometrics, Biology, S&T UK*

### [Synthetic biology needs robust safety mechanisms before real world application](#)

[Science Daily](#), 16SEP2015

In a review article, researchers at Harvard University argue one key challenge associated with synthetic biology is preventing transfer between the engineered genome and wild microbial genomes. Microbial sensors and drug delivery systems can be shown to work in the lab, but researchers are not yet sure how they will function in a human body or a large-scale bioreactor. Engineered organisms have huge potential, but they will only be useful if proven to be reliable, predictable, and cost effective. [TECHNICAL ARTICLE](#)

*Tags: S&T policy, Synthetic biology*

## SENSORS

### [Making 3-D objects disappear: Researchers create ultrathin invisibility cloak](#)

[PhysOrg.com](#), 17SEP2015

Working with brick-like blocks of gold nanoantennas, an international team of researchers (USA - UC Berkeley, Lawrence Berkeley National Laboratory, Saudi Arabia) fashioned a "skin cloak" barely 80 nanometers in thickness, that was wrapped around a three-dimensional object about the size of a few biological cells and arbitrarily shaped with multiple bumps and dents. The surface of the skin cloak was meta-engineered to reroute reflected light waves so that the object was rendered invisible to optical detection when the cloak is activated. Although this cloak is only microscopic in size, the principles behind the technology should enable it to be scaled-up to conceal macroscopic items as well. [TECHNICAL ARTICLE](#)

*Tags: Sensors*

### [Engineering professor brings antenna capabilities to military armor](#)

[PhysOrg.com](#), 15SEP2015

According to researchers at Villanova University the multi-function armor they have designed eliminates the need for multiple high-profile communications antenna structures on military vehicles and ships, making them less visible and identifiable in hostile situations. The armor-incased antennas also have jamming capability to block radio signals, such as those used to remotely trigger explosives, including improvised explosive devices.

*Tags: Sensors, Military technology ■*

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