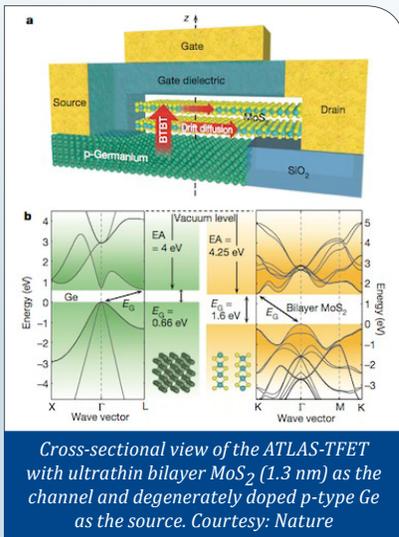


[Advanced materials \(5\)](#)[Energy \(3\)](#)[Microelectronics \(5\)](#)[S&T policy \(4\)](#)[Autonomous systems  
& robotics \(2\)](#)[Information technology \(1\)](#)[Neuroscience \(1\)](#)[Science without borders \(1\)](#)[Biotechnology \(1\)](#)[Materials science \(4\)](#)[Quantum science \(4\)](#)[Sensors \(1\)](#)

## FEATURE ARTICLES

## S&T NEWS ARTICLES

### Atom-thin transistor defies fundamental limits



Nanotechweb,  
02OCT2015

A team of researchers in the US (UC Santa Barbara, Rice University) has unveiled a new tunnel field-effect transistor (TFET) with an atomically thin current-carrying channel that operates at ultralow supply voltages. The new device, which is made from a 2D semiconducting

crystal and a bulk germanium substrate, can be switched on at just 0.1 V. It could be used in ultradense and lower-power integrated circuits and to make ultrasensitive bio- and gas sensors. [TECHNICAL ARTICLE](#)

Tags: [Microelectronics](#), [Featured Article](#)

### Breakthroughs need in-depth knowledge, not just cross-collaboration, study shows

Science Daily, 28SEP2015

Most high-impact innovation happens when knowledge and people from different fields are brought together to create something new, previous research has found. According to an international team of researchers (Canada, UK), new findings show that truly new, paradigm-busting ideas with long-term potential need profound knowledge in a narrow domain. Organizations that ignore that in favor of recombining what's already known will miss out on the greatest potential breakthroughs. Managers are going to have to design organizations for both deep-dive research and recombination. [TECHNICAL ARTICLE](#)

Tags: [S&T policy](#), [Science without borders](#), [Featured Article](#)

### ADVANCED MATERIALS

#### One-way sound tunnel offers novel way to control acoustic waves

PhysOrg.com, 30OCT2015

Researchers in China have designed and built an acoustic one-way tunnel that allows sound to pass through in one direction while blocking it from passing through in the opposite direction due to acoustic metamaterials placed on the sides of the tunnel. The tunnel is completely open to light and heat, which can pass through in both directions. The tunnel has potential applications for anti-noise windows and vent ducts, as well as medical ultrasound. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [S&T China](#)

#### Graphene as a front contact for silicon-perovskite tandem solar cells

Science Daily, 02OCT2015

A particularly effective complement to conventional silicon is perovskite. However, it is very difficult to provide the perovskite layer with a transparent front contact. Researchers in Germany have developed a process to cover the perovskite layer evenly with graphene that is highly conductive and highly transparent. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [S&T Germany](#)

#### Printable electronics thanks to contactless liquid deposition

Nanowerk, 02OCT2015

An international team of researchers (the Netherlands, Germany) has developed a contactless deposition method with the atomic force microscopy nano-fountain pen probe which ensures reliable and quick deposition of liquids on a 50 nanometre scale. By applying a voltage, the liquids inside the tip are charged. The difference with the charge of the surface causes the liquid to be pulled out of the probe. As the pulse duration increases, the volume of the liquid deposition will grow too. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#)

*continued...*

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## **Scientists grow organic semiconductor crystals vertically for first time**

PhysOrg.com, 02OCT2015

An international team of researchers (USA - UCLA, University of Illinois at Urbana-Champaign, Japan) has created an improved structure for one type of organic semiconductor, a building block of a conductive polymer called tetraaniline. They showed for the first time that tetraaniline crystals could be grown vertically. The advance could reshape solar cells. Scientists could potentially create “light antennas”—thin, pole-like devices that could absorb light from all directions, which would be an improvement over today’s wide, flat panels. **TECHNICAL ARTICLE**

*Tags: Advanced materials, Solar energy*

## **A material able to repair itself**

Science Daily, 01OCT2015

Researchers in Spain have developed a flexible polymeric material, a type of transparent resin, which has the property of healing itself; for example, when it is cut with scissors in half and put back in contact, it rejoins itself within 10-15 seconds without using any external source. The material’s lack of chemical reaction prevents its alteration and turns it into a biocompatible mass. It has applications in the medical field.

*Tags: Advanced materials, Materials science*

## **AUTONOMOUS SYSTEMS & ROBOTICS**

### **Video Friday: Walking on Ceilings, Cat-Inspired Legs, and Robot Grasps Tofu**

IEEE Spectrum, 02OCT2015

The Tri-Wheel is a novel wheel-leg locomotion concept inspired by work with first responders. Through its two modes of operation—Driving Mode and Tumbling Mode—this mechanism is able to both drive quickly on smooth surfaces at roughly 1.7 times desired speed and climb objects as tall as 67% of the diameter of the mechanism.

*Tags: Autonomous systems & robotics*

### **More-flexible machine learning**

Science Daily, 01OCT2015

At the Annual Conference on Neural Information Processing Systems in December, MIT researchers will present a new way of doing machine learning that enables semantically related concepts to reinforce each other. The researchers believe that their paper is the first to use the Wasserstein distance as an error metric in supervised machine learning, where the system’s performance is gauged against human annotations. **TECHNICAL ARTICLE**

*Tags: Autonomous systems & robotics, Artificial intelligence*

## **BIOTECHNOLOGY**

### **Self-propelled powder designed to stop severe bleeding**

Science Daily, 02OCT2015

An international team of researchers (Canada, USA - University of Washington, Mass General Hospital, Harvard University) has developed gas-generating calcium carbonate micro-particles that can be applied in powder form to stop critical bleeding. The particles work by releasing carbon dioxide gas, like antacid tablets, to propel them toward the source of bleeding. **TECHNICAL ARTICLE**

*Tags: Biotechnology, Advanced materials, Medical sciences*

## **ENERGY**

### **Triboelectric nanogenerators power up**

Nanotechweb, 02OCT2015

Researchers in China are proposing new ways to increase the power output from triboelectric nanogenerators (TENGs). They analyzed the working behaviour of three types of TENG and developed a single mathematical formalism that describes it. Based on how the output power depends on charge and displacement, they have proposed three different ways for obtaining higher output power and better load resistance matching for a conductor-conductor TENG. **TECHNICAL ARTICLE**

*Tags: Energy, S&T China*

### **Radio frequency ‘harvesting’ tech unveiled in UK**

PhysOrg.com, 30SEP2015

The Freevolt technology, developed by researchers in the UK, has a multi-band antenna and rectifier and is “capable of absorbing energy from multiple radio frequency bands. Freevolt offers the ability to provide continuous power to Low Energy IoT devices. The technology might impact mobile phone signals, though the low level of harvesting used by Freevolt made this unlikely.

*Tags: Energy, S&T UK*

### **First optical rectenna—combined rectifier and antenna—converts light to DC current**

Science Daily, 28SEP2015

In the new devices, developed by researchers at the Georgia Institute of Technology, the carbon nanotubes act as antennas to capture light from the sun or other sources. As the waves of light hit the nanotube antennas, they create an oscillating charge that moves through rectifier devices attached to them. The rectifiers switch on and off at record high petahertz speeds, creating a small direct current. Optical rectennas could provide a new technology for photodetectors, energy harvesters, and solar energy. **TECHNICAL ARTICLE**

*Tags: Energy*

“The only way to do great work is to love what you do.”

STEVE JOBS

## INFORMATION TECHNOLOGY

### Smart coding technology to reduce video surveillance bandwidth and storage

PhysOrg.com, 02OCT2015

Smart Coding technology employs a variety of advanced noise reduction processes and algorithm advancements, including Frequency Divided Filter (FDF), 3-D Multi-Process Noise Reduction (3D-MNR) and Group of Picture (GOP) Control to achieve a lower bit rate for images without degrading the captured and transmitted video stream. Panasonic has released Smart Coding which enhances the encoding algorithm in standard H.264 video streams, yielding up to a 70 percent improvement in bandwidth reduction.

Tags: Information technology

## MATERIALS SCIENCE

### High-speed march through a layer of graphene

Nanowerk, 05OCT2015

An international team of researchers (USA - Georgia State University, Germany) has made simulations of the processes that happen when a layer of carbon atoms is irradiated with strong laser light. The simulations have revealed complex relations between the excitation of valence electrons by light and their subsequent ultrafast motion inside and between the carbon atoms in the graphene layer. A better understanding of the underlying physical processes could lead to light-wave driven electronics that would operate at light frequencies, which is a hundred thousand times faster than state-of-the-art technologies. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

### Molecular nanoribbons as electronic highways

Science Daily, 05OCT2015

An international team of researchers (Sweden, USA - UC Berkeley, Lawrence Berkeley National Laboratory) has developed a method to synthesise a unique and novel type of material which resembles graphene nanoribbons, but in this material each carbon atom is 'replaced' by a molecule. The material could be important for the further development of organic solar cells. The study opens up possibilities to investigate important physical properties of molecular materials with nanoscale dimensions. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

### Proposed diamond maser could operate at room temperature

PhysOrg.com, 05OCT2015

An international team of researchers (China, Germany) has proposed a concept for a diamond maser that can operate at room temperature. With the potential to achieve a coherence time of a few minutes, the maser could pave the way for widespread applications. If a maser can be realized as proposed, it could have a variety of applications for microwave technologies, including radar and high-precision clocks. Portable, room-temperature masers could be used for ultrasensitive magnetic resonance spectroscopy to study minerals. The maser could also be used as a low-noise amplifier for space communication. TECHNICAL ARTICLE

Tags: Materials science

### Two years of tests confound two decades of assumptions on lithium-ion battery design

PhysOrg.com, 02OCT2015

While lithium-ion batteries needed carbon black in order to function, the precise amount of that material had not been considered crucial to overall performance. A team of researchers in the US (Stanford University, Lawrence Berkeley National Laboratory, SLAC National Accelerator Laboratory) found that the rate at which a cathode particle charges depends on how well it is connected to carbon black particles, something that varies a great deal within a battery. By upping the percentage of carbon black – as high as 20 percent in some experiments—they found that the cathode particles charged more quickly because they had more uniform carbon connectivity. TECHNICAL ARTICLE

Tags: Materials science, Battery

## MICROELECTRONICS

### Liquid cooling moves onto the chip for denser electronics

PhysOrg.com, 05OCT2015

To make their liquid cooling system, researchers at Georgia Institute of Technology removed the heat sink and heat-spreading materials from the backs of chips. They etched cooling passages into the silicon, incorporating silicon cylinders approximately 100 microns in diameter to improve heat transmission into the liquid. A silicon layer was then placed over the flow passages, and ports were attached for the connection of water tubes. They believe they have eliminated one of the major barriers to building high-performance systems.

Tags: Microelectronics

*continued...*

## [Nanoscale photodetector shows promise to improve the capacity of photonic circuits](#)

Nanowerk, 05OCT2015

Researchers at the University of Rochester developed a nanoscale photodetector that uses molybdenum disulfide to detect optical plasmons. They demonstrated that light can drive a current using a silver nanowire. Future work for the group includes reducing potential contamination in device assembly by transitioning to a complete dry transfer of wires and MoS<sub>2</sub> onto prefabricated electrodes, and gaining better control of the MoS<sub>2</sub> doping process to add additional charge carriers and improve the device's efficiency. They will present their work at the OSA's 2015 annual meeting.

Tags: *Microelectronics, Photonics*

## FEATURED RESOURCE

### [Tech Xplore](#)

Tech Xplore covers the latest engineering, electronics and technology advances. It is a part of the Science X suite of services. [RSS](#)

## [Breakthrough paves way for post-silicon future with carbon nanotube electronics](#)

PhysOrg.com, 02OCT2015

Researchers at IBM, New York, demonstrated a new way to shrink transistor contacts without reducing performance of carbon nanotube devices, opening a pathway to dramatically faster, smaller and more powerful computer chips beyond the capabilities of traditional semiconductors. Carbon nanotube chips could greatly improve the capabilities of high performance computers, enabling Big Data to be analyzed faster, increasing the power and battery life of mobile devices and the Internet of Things, and allowing cloud data centers to deliver services more efficiently and economically. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Materials science*

## [Scientists' discovery could have powerful effect on electronics](#)

PhysOrg.com, 01OCT2015

An international team of researchers (USA - Pennsylvania State University, UT Dallas, Taiwan, Saudi Arabia) has shown how grown and stacked, atomically thin materials can exhibit a unique transport effect, called negative differential resistance, or NDR, at room temperature. The discovery could have major implications for the development of nano-electronic circuits and devices.

[TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

## NEUROSCIENCE

### [Thought-controlled computer cursor takes a leap forward](#)

Medical Express, 28SEP2015

A team of researchers in the US (Stanford University, Brown University, Mass General Hospital, UC San Diego) said they have made a range of improvements, including filtering out electrical interference that can weaken signals from the brain. The test subjects control the prosthesis via an array of electrodes implanted onto their motor cortices—the part of the brain that controls body movement. The 96 tiny electrodes pick up the signals from nearby neurons and send them to a computer that translates them into action.

[TECHNICAL ARTICLE](#)

Tags: *Neuroscience*

## QUANTUM SCIENCE

### [Crucial hurdle overcome in quantum computing](#)

PhysOrg.com, 05OCT2015

An international team of researchers (Australia, Japan) has demonstrated a two-qubit logic gate in silicon. They have morphed silicon transistors into quantum bits by ensuring that each has only one electron associated with it. Because they use essentially the same device technology as existing computer chips, it will be much easier to manufacture a full-scale processor chip than for any of the leading designs.

[TECHNICAL ARTICLE](#)

Tags: *Quantum science*

### [How Much Power Will Quantum Computing Need?](#)

IEEE Spectrum, 05OCT2015

The ability to scale up a D-Wave machine's computing capabilities without increasing its power consumption may sound promising. Today's D-Wave machines perform about as well as a high-end PC on certain specific tasks, but they use far more power based on their extreme cooling requirements. Quantum computing's big advantages probably won't begin to emerge until engineers build machines with many thousands or possibly millions of qubits.

Tags: *Quantum science*

### [Scientists produce status check on quantum teleportation](#)

Science Daily, 30SEP2015

While theoretical proposals for a quantum Internet already exist, there is still debate over which of various technologies provides the most efficient and reliable teleportation system. None of the technologies alone provide a perfect solution. An international team of researchers (UK, Germany, Canada, Japan) concluded that a hybridisation of the various protocols and underlying structures would offer the most fruitful approach. [TECHNICAL ARTICLE](#)

Tags: *Quantum science*

## **Small entropy changes allow quantum measurements to be nearly reversed**

PhysOrg.com, 30SEP2015

A theorem that was developed by a Swedish physicist Göran Lindblad in 1975 is a foundational component of quantum information theory. An international team of researchers (Sweden, USA - Louisiana State University, University of Illinois at Urbana-Champaign, the Netherlands, Singapore, UK, Switzerland, Spain) has improved this theorem in a way that allows for understanding how quantum measurements can be approximately reversed under certain circumstances. The new results allow for understanding how quantum information that has been lost during a measurement can be nearly recovered, which has potential implications for a variety of quantum technologies. [TECHNICAL ARTICLE 1, 2, 3.](#)

*Tags: Quantum science*

## **S&T POLICY**

### **Big plans for small satellites—testing laser communications, formation flying**

PhysOrg.com, 02OCT2015

Under the Optical Communications and Sensor Demonstration (OCS D) project, NASA is preparing to launch a set of miniature satellites that push the boundaries of space-to-Earth communications for CubeSats, as well as testing the ability of two small spacecraft to fly in close proximity to each other. The OCS D effort includes two flight demonstrations: a single satellite in the first demonstration and two satellites in the second demonstration. Optical data rates achieved by OCS D spacecraft are expected to be a speedy 200 megabits per second (Mb/s) or higher—100 times faster than current high-end CubeSat communications systems.

*Tags: S&T policy, Communications technology, Government S&T, Satellite technology*

### **More than \$100 million in new BRAIN funds**

Science Magazine, 01OCT2015

The new funding, geared at providing stable support for high-risk, interdisciplinary research, exceeds the original commitment of \$40 million that the Kavli Foundation made to the national Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, when it was first launched by President Obama in 2013. The funds are also unrestricted, allowing each institute to determine which projects to pursue.

*Tags: S&T policy, Neuroscience*

## **Pentagon takes an analog approach to securing the Internet of Things**

Defense Systems, 29SEP2015

Protecting the computerized components of embedded systems isn't quite the same as protecting PCs, networks and mobile devices. DARPA has issued a solicitation for a program called Leveraging the Analog Domain for Security (LADS), which is seeking technology for monitoring electromagnetic and acoustic emissions, power fluctuations, thermal output variations and other indicators. Significantly, it wants the monitoring technology to operate separately from the embedded device being monitored.

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

## **SCIENCE WITHOUT BORDERS**

### **Meet the 2015 MacArthur Fellows**

MacArthur Foundation, 30SEP2015

These 24 delightfully diverse MacArthur Fellows are shedding light and making progress on critical issues, pushing the boundaries of their fields, and improving our world in imaginative, unexpected ways.

*Tags: Science without borders*

## **SENSORS**

### **A light touch: Embedded optical sensors could make robotic hands more dexterous**

Science Daily, 28SEP2015

Using fiber optics, researchers at Carnegie Mellon University were able to embed 14 strain sensors into each of the fingers in the robotic hand, giving it the ability to determine where its fingertips are in contact and to detect forces of less than a tenth of a newton. The new stretchable optical sensing material, not incorporated in this version of the hand, potentially could be used in a soft robotic skin to provide even more feedback.

*Tags: Sensors, Autonomous systems & robotics* ■

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