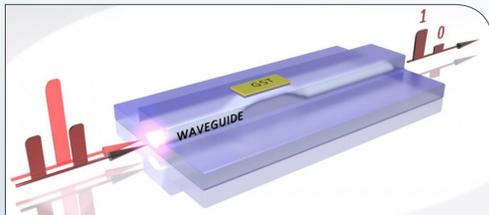


[Advanced manufacturing \(2\)](#)[Advanced materials \(4\)](#)[Cyber security \(1\)](#)[Energy \(2\)](#)[Environmental science \(3\)](#)[Forecasting \(1\)](#)[Imaging technology \(2\)](#)[Information technology \(1\)](#)[Materials science \(4\)](#)[Microelectronics \(1\)](#)[Neuroscience \(1\)](#)[Photonics \(2\)](#)[Quantum science \(2\)](#)[S&T policy \(1\)](#)[Science without borders \(1\)](#)[Sensors \(4\)](#)

## FEATURE ARTICLES

### [Permanent data storage with light](#)

[Science Daily, 22SEP2015](#)

All-optical data memory: ultra-short light pulses make the GST material change from crystalline to amorphous and back. Weak light pulses read out the data.  
Credit: C. Rios/Oxford University

Phase change materials that change their optical properties depending on the arrangement of the atoms allow for the storage of several bits

in a single cell. All-optical permanent on-chip memory, developed by an international team of researchers (UK, Germany), can store data for decades even when the power is removed. They might considerably increase future performance of computers and reduce their energy consumption. Together with all-optical connections, they might reduce latencies. Energy-intensive conversion of optical signals into electronic signals and vice versa would no longer be required. [TECHNICAL ARTICLE](#)

*Tags: Information technology, Communications technology, Featured Article*

### [A thermal invisibility cloak actively redirects heat](#)

[Nanowerk, 21SEP2015](#)

Researchers in Singapore have developed a thermal cloak that can render an object thermally invisible by actively redirecting incident heat. The system has the potential to fine-tune temperature distribution and heat flow in electronic and semiconductor systems. Their thermal cloaking was not limited by the shape of the object being hidden. When applied to a rectangular air hole, the thermoelectric devices redistributed heat just as effectively as in the circular one. It has application in devices with high requirements for efficient dissipation and homogenous thermal expansion, such as high-power engines, MRI instruments, and thermal sensors. [TECHNICAL ARTICLE](#)

*Tags: Sensors, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### [4-D technology allows self-folding of complex objects](#)

[Science Daily, 21SEP2015](#)

Using components made from smart shape-memory materials with slightly different responses to heat, an international team of researchers (USA - Georgia Institute of Technology, Singapore) has demonstrated a four-dimensional printing technology that allowed creation of complex self-folding structures. The team envisions a broad range of applications for their technology. For example, an unmanned air vehicle might change shape from one designed for a cruise mission to one designed for a dive, 3-D components designed to fold flat or be rolled up into tubes so they could be easily transported. [TECHNICAL ARTICLE](#)

*Tags: Advanced manufacturing, Materials science*

#### [Printing lightweight, flexible, and functional materials](#)

[Science Daily, 21SEP2015](#)

Researchers at Harvard University have designed new multimaterial printheads that mix and print concentrated viscoelastic inks that allow for the simultaneous control of composition and geometry during printing. Using active mixing and fast-switching nozzles, these novel printheads change material composition on the fly and could pave the way for entirely 3-D printed wearable devices, soft robots, and electronics. [TECHNICAL ARTICLE](#)

*Tags: Advanced manufacturing*

### ADVANCED MATERIALS

#### [Researchers produce first 2D perovskite hybrid sheets](#)

[Nanowerk, 25SEP2015](#)

An international team of researchers (USA - UC Berkeley, Lawrence Berkeley Laboratory, China) has successfully grown atomically thin 2D sheets of organic-inorganic hybrid perovskites from solution.

*continued...*

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The ultrathin sheets are of high quality, large in area, and square-shaped. They also exhibited efficient photoluminescence, color-tunability, and a unique structural relaxation not found in covalent semiconductor sheets.

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Government S&T*

### [Ultrathin lens could revolutionise next-gen devices](#)

[PhysOrg.com, 23SEP2015](#)

Researchers in Australia have developed an ultrathin, flat, ultra-lightweight graphene oxide optical lens with unprecedented flexibility. It has a 3D subwavelength capability that is 30 times more efficient, able to tightly focus broadband light from the visible to the near infrared, and offers a simple and low-cost manufacturing method. Potential applications include on-chip nanophotonics, non-invasive 3D biomedical imaging photonic chips, aerospace photonics, micromachines, and laser tweezing. [TECHNICAL ARTICLE](#)

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

### [Characterizing the forces that hold everything together](#)

[Nanowerk, 22SEP2015](#)

A team of researchers in the US (UMass Amherst, Case Western Reserve University, University of Missouri) has developed Gecko Hamaker, an open-source computational and modeling tool with a full-spectral optical web-service. Researchers can use the software to calculate van der Waals forces between molecules and meso/nanoscale units, predict molecular organization and evaluate whether new combinations of materials will stick together, thereby facilitating the design of meso/nanoscale self-assembly. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

### [Fatigue-free, stretchable conductor created](#)

[Science Daily, 21SEP2015](#)

A team of researchers in the US (University of Houston, Harvard University) has discovered a new stretchable, transparent conductor that can be folded or stretched and released, resulting in a large curvature or a significant strain, at least 10,000 times without showing signs of fatigue. They found that if they stretched the substrate before placing the gold nanomesh on it, the material showed no sign of fatigue when cyclically stretched to a strain of more than 50 percent. The gold nanomesh also proved conducive to cell growth, indicating it is a good material for implantable medical devices. [TECHNICAL ARTICLE](#)

[ARTICLE](#)

*Tags: Advanced materials, Biotechnology*

## CYBER SECURITY

### [Scientists stop and search malware hidden in shortened urls on Twitter](#)

[Science Daily, 25SEP2015](#)

Researchers in the UK collected tweets containing URLs during the 2015 Superbowl and cricket world cup finals and used system activity such as bytes and packets exchanged between device and remote endpoint, processor use and network adapter status to train a machine classifier to recognise predictive signals that can distinguish between malicious and benign URLs. The team identified potential cyber-attacks within five seconds with up to 83% accuracy and within 30 seconds with up to 98% accuracy, when a user clicked on a URL posted on Twitter and malware began to infect the device.

*Tags: Cyber security*

## ENERGY

### [Small-scale nuclear fusion may be a new energy source](#)

[Science Daily, 25SEP2015](#)

An international team of researchers (Sweden, Iceland) is studying a new type of nuclear fusion process which produces almost no neutrons but instead fast, heavy electrons (muons), since it is based on nuclear reactions in ultra-dense heavy hydrogen (deuterium). The new fusion process can take place in relatively small laser-fired fusion reactors fueled by heavy hydrogen (deuterium). It has already been shown to produce more energy than that needed to start it. Heavy hydrogen is found in large quantities in ordinary water and is easy to extract.

[TECHNICAL ARTICLE 1, 2, 3](#)

*Tags: Energy, Nuclear energy*

### [Supercapacitors from scrap tires](#)

[Nanowerk, 25SEP2015](#)

By employing proprietary pretreatment and processing, a team of researchers in the US (Drexel University, Oak Ridge National Laboratory, University of Tennessee) has created flexible polymer carbon composite films as electrodes for supercapacitors. These devices are useful in applications for cars, buses and forklifts that require rapid charge and discharge cycles with high power and high energy density. Supercapacitors with this technology in electrodes saw just a 2 percent drop after 10,000 charge/discharge cycles.

[TECHNICAL ARTICLE](#)

*Tags: Energy, Government S&T*

## ENVIRONMENTAL SCIENCE

### [Shooting lightning out of the sky](#)

[Science Daily, 24SEP2015](#)

When a powerful laser beam shoots through the air, it ionizes the molecules, leaving a thin trail of hot, ionized

“But the real glory of science is that we can find a way of thinking such that the law is evident.” RICHARD FEYNMAN

particles in its wake. Because this stream of plasma conducts electricity, it could be used to channel away a potentially damaging lightning bolt. Researchers in Israel found ways to make the length of such a plasma channel reach more than 10 times longer—a necessary advance for using the channel to redirect a lightning strike. They will present their paper at the 2015 OSA annual meeting in October.

*Tags: Environmental science, Climatology*

### **Tiny carbon-capturing motors could help clean up carbon dioxide pollution in the oceans**

**Nanowerk, 23SEP2015**

Researchers at UC San Diego have designed enzyme-functionalized micromotors that rapidly zoom around in water, remove carbon dioxide and convert it into a usable solid form. The micromotors are essentially six-micrometer-long tubes which have an outer polymer surface that holds the enzyme carbonic anhydrase, which speeds up the reaction between carbon dioxide and water to form bicarbonate. Calcium chloride, which is added to the water solutions, helps convert bicarbonate to calcium carbonate. The proof of concept study represents a promising route to mitigate the buildup of carbon dioxide. [TECHNICAL](#)

[ARTICLE](#)

*Tags: Environmental science*

### **Vertically aligned carbon nanotubes can chemically trap, store greenhouse gases more effectively than typical materials**

**PhysOrg.com, 23SEP2015**

An international team of researchers (Germany, India) found that gas adsorption in vertically aligned carbon nanotubes (VACNT) can be influenced by adjusting the morphological parameters of the carbon nanotube thickness, the distance between nanotubes, and their height. [TECHNICAL ARTICLE](#)

*Tags: Environmental science, Advanced materials, CNT*

## FORECASTING

### **AI algorithm trained to predict what ISIL forces will do in different situations**

**PhysOrg.com, 21SEP2015**

Researchers at Arizona State University have developed an artificial intelligence algorithm that learned how to predict what Islamic State forces will do in different situations. They used 2,200 recorded incidents of ISIS activity in the last six months of 2014 to test their equation.

*Tags: Forecasting, Military technology*

## IMAGING TECHNOLOGY

### **Ten years on, invisibility cloaks are close to becoming a manufacturable reality**

**The Conversation, 23SEP2015**

So far, most invisibility cloaks are made from engineered materials that can bend light in a way that manipulates the eye – or another device such as a radar. However, these typically only work for tiny objects. A new experiment has created a cloak that can hide small objects of any shape completely from visible light. The cloak, which is thinner and more flexible than any of its predecessors, can also be scaled up to hide bigger objects—potentially transforming the science into something that can be manufactured and sold.

*Tags: Imaging technology, Materials science*

### **Acoustic imaging with outline detection**

**PhysOrg.com, 21SEP2015**

Researchers in Switzerland have developed a new type of acoustic imaging device which, rather than producing a photorealistic image of an entire object, shows only its contours and edges. According to the researchers, this type of measuring method delivers similar results to the edge detection filter in image-processing software, which allows the outline of prominent photo objects to be identified with the click of the mouse. The work is currently just a proof of concept. The method still needs to be refined before it can be applied in practice. [TECHNICAL ARTICLE](#)

*Tags: Imaging technology, Sensors*

## MATERIALS SCIENCE

### **Nanomechanical study offers new assessment of silicon for next-gen batteries**

**Nanowerk, 24SEP2015**

The brittleness of the material has discouraged efforts to use pure silicon in battery anodes, which must withstand dramatic volume changes during charge and discharge cycles. Using a combination of experimental and simulation techniques, a team of researchers in the US (Georgia Institute of Technology, University of Pittsburgh, University of Illinois at Urbana-Champaign, Sandia National Laboratory) has reported surprisingly high damage tolerance in electrochemically-lithiated silicon materials. The work suggests that all-silicon anodes may be commercially viable if battery charge levels are kept high enough to maintain the material in its ductile state. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Battery*

## [Extreme density—approaching a poorly understood state of matter](#)

PhysOrg.com, 23SEP2015

Researchers in Germany have developed a new simulation technique which overcomes the inaccuracies of existing theoretical models in describing this state of matter. Exact knowledge about warm dense matter is the key to answering many astrophysical questions, technological applications such as inertial confinement fusion or for understanding how materials behave under extreme pressure. [TECHNICAL ARTICLE](#)

Tags: *Materials science, S&T Germany*

## FEATURED RESOURCE

### [Science Daily RSS Newsfeeds](#)

Science Daily offers more than 400 specific RSS feeds in a variety of topics. Each item contained in a feed includes the story's headline, summary, and link back to the full-text version on the Science Daily web site. Feeds are updated with new stories as frequently as every hour.

## [Frustrated magnets point towards new memory](#)

Science Daily, 23SEP2015

So far skyrmions are only produced in special materials called chiral magnets. To advance the field, new classes of materials are needed. Researchers in the Netherlands have discovered that so-called 'frustrated magnets' can produce skyrmions. They found that magnetic moments inside the "frustrated" skyrmions can rotate. The rotation is coupled to the electric dipole moment of the skyrmion, which can be used to store extra information. This discovery opens up a new class of materials for scientists working on 'skyrmonics,' which aims to build memory and logic devices based on skyrmions. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

## [Antiferromagnetic spintronics](#)

arXiv, 17SEP2015

In this review article, an international team of researchers (Czech Republic, UK) gives an overview of recent works addressing the outstanding question "how to efficiently manipulate and detect the magnetic state of antiferromagnets". They also review studies looking at merits of antiferromagnetic spintronics from a more general perspective of spin-transport, magnetization dynamics, and materials research, and give a brief outlook of future research and applications of antiferromagnetic spintronics. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

## MICROELECTRONICS

### [Darwin on a chip: New electronic circuits mimic natural networks like the human brain](#)

Science Daily, 21SEP2015

Researchers in the Netherlands have demonstrated working electronic circuits that have been produced in a radically new way, using methods that resemble Darwinian evolution. The size of these circuits is comparable to the size of their conventional counterparts, but they are much closer to natural networks like the human brain. The findings promise a new generation of powerful, energy-efficient electronics. [TECHNOLOGY ARTICLE](#)

Tags: *Microelectronics*

## NEUROSCIENCE

### [One more step along the long road towards brain-to-brain interfaces](#)

Medical Express, 25SEP2015

Researchers at the University of Washington expand on previous research to demonstrate that BBIs can actually be used to solve problems, albeit in the narrow sense of the experimental laboratory. The closest that scientists have come to establishing direct communication between brains involves an extremely convoluted apparatus and would take hours to transmit the amount of information you typically exchange in a 2-minute conversation. [TECHNICAL ARTICLE](#)

Tags: *Neuroscience*

## PHOTONICS

### [First circularly polarized light detector on a silicon chip](#)

Science Daily, 23SEP2015

A team of researchers in the US (Vanderbilt University, Ohio State University) report on an ultracompact circularly polarized light detector that combines large engineered chirality. They demonstrated the detector's ability to distinguish between left and right hand circularly polarized light without the use of additional optical elements. Implementation of this photodetector could lead to enhanced security in fibre and free-space communication, and imaging and sensing applications for circularly polarized light using a highly integrated photonic platform. [TECHNICAL ARTICLE](#)

Tags: *Photonics*

### [Pushing the limits of lensless imaging](#)

Science Daily, 21SEP2015

Researchers in Germany used a special, custom-built ultrafast laser that fires extreme ultraviolet photons a hundred times faster than conventional table-top machines. With more photons, at a wavelength of 33 nanometers, they were able to make an image with a resolution of 26 nanometers—almost the theoretical limit. The new approach could be used to study everything from semiconductor chips to cancer cells.

Tags: *Photonics, Imaging technology, S&T Germany*

*continued...*

## QUANTUM SCIENCE

### [A new study predicts a quantum Goldilocks effect](#)

Science Daily, 23SEP2015

By studying a system that couples matter and light together, researchers at the University of Miami have found that crossing a quantum phase transition at intermediate speeds generates the richest, most complex structure. Such structure resembles ‘defects’ in an otherwise smooth and empty space. The study sheds new light on how to generate, control, and manipulate quantum entanglement, since the defects contain clusters of quantum entanglement of all sizes, ultrafast quantum computing, ultrasafe quantum cryptography, high-precision quantum metrology, and even the quantum teleportation of information.

Tags: Quantum science

### [Quantum teleportation: World record of 100 kilometers](#)

Science Daily, 22SEP2015

An international team of researchers (Japan, USA - NIST) has “teleported” quantum information carried in light particles over 100 km of optical fiber, four times farther than the previous record. The experiment confirmed that quantum communication is feasible over long distances in fiber. Other research groups have teleported quantum information over longer distances in free space, but the ability to do so over conventional fiber-optic lines offers more flexibility for network design.

TECHNICAL ARTICLE

Tags: Quantum science, Communications technology, Government S&T

## S&T POLICY

### [China will have two 100 petaflop supercomputers in 2016 and they will use domestic chips](#)

Next Big Future, 18SEP2015

Information in the public domain suggested that China is developing a 100 Petaflop machine that will use its own CPU, designed in China. The computer is expected to start operating before the middle of next year.

Tags: S&T policy, S&T China

## SCIENCE WITHOUT BORDERS

### [Social network launches bid to get academics chattering about papers online](#)

Nature News, 25SEP2015

Academia.edu, a social-networking site for researchers, has announced an effort to get scores of academics to talk about research manuscripts together online before submitting them to journals through a feature on their site called “Sessions”. The goal of Sessions is to solicit feedback from Academia’s network of 25 million users. If you’re a site user, you will see new Sessions through your news feed of social activity.

Tags: Science without borders

## SENSORS

### [Ultrafast detector spies on multiple electrons in quantum dots](#)

Physics World, 24SEP2015

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 in a process called “carrier multiplication”. This process has the potential to boost the efficiency of solar cells and understanding how it occurs could lead to the development of new types of light and radiation detectors. TECHNICAL ARTICLE

Tags: Sensors, Government S&T

### [Gigahertz Antenna-on-a-Chip Theory Is Questioned](#)

IEEE Spectrum, 22SEP2015

In order for an antenna to transmit sufficient power it needs it to be comparable in size to the wavelength it is sending. That’s hard when you’re constrained by the size of a smartphone or smaller gadget. Researchers in the UK created a small antenna made from a dielectric material that can fit on a chip. But now researchers in Finland claim that it can’t work. TECHNICAL ARTICLE

Tags: Sensors

### [DeXpression: Deep Convolutional Neural Network for Expression Recognition](#)

arXiv, 17SEP2015

A convolutional neural network (CNN) architecture for facial expression recognition, proposed by researchers in Germany, is independent of any hand-crafted feature extraction and performs better than the earlier proposed convolutional neural network based approaches. Standard datasets, i.e. Extended Cohn-Kanade (CKP) and MMI Facial Expression Database are used for the quantitative evaluation. The proposed architecture achieves 99.6% for CKP and 98.63% for MMI. Automatic facial expression recognition has a broad spectrum of applications such as human-computer interaction and safety systems.

TECHNICAL ARTICLE

Tags: Sensors, Pattern recognition ■

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