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## FEATURE ARTICLES

### [Mimicking brain cells to boost computer memory power](#)

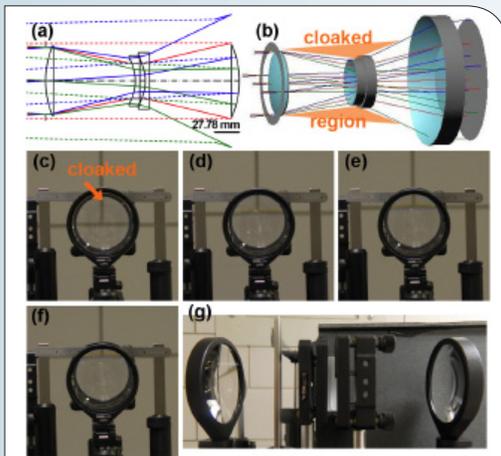
[Science Daily, 29SEP2014](#)

Researchers in Australia created a nanometer-thin stacked structure using thin film, a functional oxide material. The film is specifically designed to have defects in its chemistry to demonstrate a ‘memristive’ effect—where the memory element’s behaviour is dependent on its past experiences. [TECHNICAL ARTICLE](#)

*Tags: Microelectronics, S&T Australia, Featured Article*

### [‘Cloaking’ device uses ordinary lenses to hide objects across range of angles](#)

[PhysOrg.com, 27SEP2014](#)



*A symmetric three lens cloak. Two diverging lenses are combined into one diverging lens, and placed in the center of two converging lenses.*

Researchers at the University of Rochester developed a combination of four standard lenses that keeps the object hidden as the viewer moves up to several degrees away from the optimal viewing position. The cloak can be scaled up as large as the size of the lenses and it works for the whole visible spectrum of light, rather than only for specific frequencies. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Featured Article*

## ADVANCED MATERIALS

### [New transparent nanoscintillators for radiation detection developed](#)

[Science Daily, 29SEP2014](#)

Researchers at UT Arlington describe a new method to fabricate transparent nanoscintillators by heating nanoparticles composed of lanthanum, yttrium and oxygen until a transparent ceramic is formed. The resulting “nanostructured polycrystalline scintillators” have better energy resolution than currently used materials and have a fast luminescence decay time. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

### [‘Pixel’ engineered electronics have growth potential](#)

[PhysOrg.com, 29SEP2014](#)

Researchers in the US report that when you stack 2-D materials by transferring layers, there’s no way to control their orientation to one another. That impacts their electronic properties. They demonstrate that in a certain window they can get a particular stacking order during growth, with a particular orientation. The new materials could be used for vertically stacked field-effect transistors as well as electronic devices only a few atoms thick. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Microelectronics*

### [The perfect solar cell](#)

[Nanowerk, 29SEP2014](#)

The material created by researchers at MIT is a two-dimensional metallic dielectric photonic crystal absorbing sunlight from a wide range of angles and withstanding extremely high temperatures. It works as part of a solar-thermophotovoltaic (STPV) device. The sunlight’s energy is first converted to heat, which then causes the material to glow, emitting light that can, in turn, be converted to an electric current. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Energy*

## S&T NEWS ARTICLES

### **New discovery could pave way for spin-based computing: Novel oxide-based magnetism follows electrical commands**

Science Daily, 25SEP2014

Researchers at the University of Pittsburgh and their colleagues at the University of Wisconsin-Madison discovered that the interface between strontium titanate and lanthanum aluminate can exhibit magnetic behavior that is stable at room temperature. The work may lead to a new type of magnetic storage. **TECHNICAL ARTICLE**

Tags: *Advanced materials, Materials science*

### **New organic semiconductor material: Organic tin in polymers increases their light absorption**

Science Daily, 25SEP2014

Researchers in Germany successfully integrated organic tin into semiconducting polymers which can absorb light over a wide range of the solar spectrum. They used palladium as a reaction catalyst. The material can be processed easily into thin films and their application in solar cells can be tested. **TECHNICAL ARTICLE**

Tags: *Advanced materials, S&T Germany, Semiconductors*

### **World's smallest reference material is big plus for nanotechnology**

Science Daily, 25SEP2014

NIST recently issued Reference Material (RM) 8027, the smallest known reference material ever created for validating measurements of these human-made, ultrafine particles between 1 and 100 nanometers in size. RM 8027 may be ordered from the NIST Standard Reference Materials Program.

Tags: *Advanced materials, Government S&T*

### **Nanotechnology in defence, aerospace and national security**

Nanowerk, 24SEP2014

Nanotech Insights, a quarterly newsletter dedicated to the field of nanoscience and nanotechnology, has released a special double issue on nanotechnology-related Defence, Aerospace and National Security.

Tags: *Advanced materials*

### **Taking advantage of graphene defects: Security screening**

Science Daily, 24SEP2014

Researchers in Russia propose a new theoretical approach to describe graphene with defects in the form of artificial triangular holes. It could result in rectifying the electric current within the material. Specifically, the study provides an analytical and numerical theory of the so-called ratchet effect. **TECHNICAL ARTICLE**

Tags: *Advanced materials, S&T Russia*

## AUTONOMOUS SYSTEMS & ROBOTICS

### **Video Friday: Murata Cheerleaders, Soft Robotics, and ROSCon**

IEEE Spectrum, 26SEP2014

Northrop Grumman's MQ-4C Triton unmanned surveillance platform made its first cross country trip earlier this month.

Tags: *Autonomous systems & robotics*

## COMMUNICATIONS TECHNOLOGY

### **Future Smartphones Won't Need Cell Towers to Connect**

MIT Technology Review, 29SEP2014

LTE Direct has a range of up to 500 meters, far more than either Wi-Fi or Bluetooth. It is included in the update to the LTE standard slated for approval this year, and devices capable of LTE Direct could appear as soon as late 2015. Qualcomm, Facebook, and other tech companies are experimenting with it.

Tags: *Communications Technology*

### **Access to long-term optical memories using photon echoes retrieved from semiconductor spins**

Nature Photonics, 28SEP2014

An international team of researchers (Germany, Russia, Poland) present a new experimental approach to stimulated photon echoes by transferring the information contained in the optical field into a spin system, where it is decoupled from the optical vacuum field and may persist much longer. They demonstrate this for an n-doped CdTe/(Cd,Mg)Te quantum well, the storage time of which could be increased by more than three orders of magnitude, from the picosecond range up to tens of nanoseconds.

Tags: *Communications Technology*

### **Final proof for optimal encoding strategies in optical communication**

Science Daily, 24SEP2014

Researchers in Germany answer the question of what are the fundamental physical limits to the information transmission rate over optical links. They proved that Gaussian encoding achieves minimum out-put entropy and hence provides the ultimate capacity of an optical communication channel. **TECHNICAL ARTICLE**

Tags: *Communications Technology, S&T Germany*

## ENERGY

### **New imaging capability reveals possible key to extending battery lifetime, capacity**

Nanowerk, 26SEP2014

An international team of researchers (USA, Germany) mapped the three-dimensional strain in individual

“Mathematical reasoning may be regarded rather schematically as the exercise of a combination of two facilities, which we may call intuition and ingenuity.” ALAN TURING

nanoparticles within the electrodes of operating coin cell batteries and reported evidence that the history of charge cycles alters the patterns of strain in single particles of the electrode material. The insight could help to guide the design of economical batteries with longer useful lives.

[TECHNICAL ARTICLE](#)

*Tags: Energy, Battery*

### [New technology may lead to prolonged power in mobile devices](#)

[Science Daily, 26SEP2014](#)

Researchers at the University of Texas, Dallas, found that when a specific atomic thin film layer is added to a transistor, the layer acts as a filter for the energy that passed through it at room temperature. The signal that resulted from the device was six to seven times steeper than that of traditional devices. Steep devices use less voltage but still have a strong signal. [TECHNICAL ARTICLE](#)

*Tags: Energy*

### [Efficiently harvesting hydrogen fuel from Sun using Earth-abundant materials](#)

[Science Daily, 25SEP2014](#)

By combining a pair of solar cells made with perovskite and low cost electrodes, an international team of researchers (Switzerland, Singapore, South Korea) has obtained a 12.3 percent conversion efficiency from solar energy to hydrogen, a record using Earth-abundant materials as opposed to rare metals.

*Tags: Energy, Battery*

## ENVIRONMENTAL SCIENCE

### [Chemists observe key reaction for producing 'atmosphere's detergent'](#)

[PhysOrg.com, 26SEP2014](#)

Earth's atmosphere is a complicated dance of molecules. Researchers at the University of Pennsylvania have observed one of these rapid atmospheric reactions in the lab. They identify an important intermediate molecule and track its transformation to hydroxyl radicals called the "atmosphere's detergent."

*Tags: Environmental science*

### [On the road to artificial photosynthesis](#)

[Nanowerk, 25SEP2014](#)

Researchers at UC Berkeley used bimetallic nanoparticles of gold and copper as the catalyst for carbon dioxide reduction. Acting synergistically, the electronic and geometric effects dictate the binding strength for reaction intermediates and consequently the catalytic selectivity

and efficiency in the electrochemical reduction of carbon dioxide. [TECHNICAL ARTICLE](#)

*Tags: Environmental science*

## MATERIALS SCIENCE

### [Scientists make droplets move on their own](#)

[Science Daily, 29SEP2014](#)

Researchers in Denmark have shown that small droplets of alcohol in water can move through complex mazes when they sense salt in their environment. Salt is the stimulus that makes them move because the salt gradient provides a different energy landscape. The droplets can be led to certain targets, and therefore they may be used as a technology to physically move chemistry to a place where it is desired.

*Tags: Materials science*

### [Exploring the potential of 'valleytronics'](#)

[Nanowerk, 26SEP2014](#)

Researchers in Japan have discovered that ultrathin films of a semiconducting materials have properties that form the basis for a new kind of low-power electronics, termed 'valleytronics'. Valleytronics is based on the quantum behavior of electrons in terms of a material's electronic band structure. [TECHNICAL ARTICLE](#)

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

### [Solar cell compound probed under pressure](#)

[Science Daily, 25SEP2014](#)

An international team of researchers (China, USA) subjected "wurtzite" (hexagonal) gallium arsenide up to about 227,000 times normal atmospheric pressure. They discovered that around 207,000 times normal atmospheric pressure the "wurtzite" gallium arsenide nanowires underwent a structural change that induced a new phase called "orthorhombic," which may possibly have metallic electronic properties. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Advanced materials*

### [Layered semiconductors: thickness changes conductivity](#)

[Nanotechweb, 24SEP2014](#)

Researchers in Taiwan show that the conductivity is highly dependent on the thickness of MoSe<sub>2</sub>. It increases by more than two orders of magnitude from 4.6 to 1500 Ω<sup>-1</sup>cm<sup>-1</sup> with a decrease in thickness from 2700 to 6 nm. In addition, ohmic contact fabrication for this layer semiconductor without post annealing is also achieved using the focused-ion beam (FIB) technique. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

## [Interface surprises may motivate novel oxide electronic devices](#)

Science Daily, 23SEP2014

An international team of researchers (US, South Korea, Norway, Ukraine) observed the effect in ferroelectrics, materials that exhibit switchable electrical polarization, or asymmetric distribution of positive and negative electrical charges. Their major finding was that, depending on the charge, either purely electrical or combined electrical and chemical phenomena were at play. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

## [Unconventional Superconductivity](#)

arXiv, 15SEP2014

A brief review of unconventional superconductivity is given, stretching from the halcyon days of helium-3 to the modern world of Majorana fermions. Along the way, we will encounter such strange beasts as heavy fermion superconductors, cuprates, and their iron-based cousins. Emphasis will be put on the fact that in almost all cases, an accepted microscopic theory has yet to emerge.

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](#)

## NEUROSCIENCE

### [Five ways the superintelligence revolution might happen](#)

The Conversation, 25SEP2014

A survey of leading researchers in AI suggests that there is a 50% probability that human-level machine intelligence will have been attained by 2050. There are several paths of development that should get there eventually—Biological inspiration, Pure mathematics, Brute Force, Plagiarising nature, and Competent humans.

Tags: *Neuroscience*

## PHOTONICS

### [Researchers create 'tractor beams' in the lab](#)

Nanowerk, 29SEP2014

Researchers in Israel returned to Stokes' experiments to observe the particles that move in very small waves of light. They discovered that a three-dimensional representation of the particles' path is predictable and can even

be planned out ahead of time. Using this insight, the scientists demonstrated the principle using two controlled fluid vortices. Between them a wave flowed "backward" to the point at which the oscillations that created it originated.

[TECHNICAL ARTICLE](#)

Tags: *Photonics*

### [Speed at its limit with this ultrafast plasmonic nanowire laser](#)

Nanowerk, 29SEP2014

While the fastest lasers typically need several nanoseconds for one cycle the semiconductor nano-laser developed by an international team of researchers (UK, Germany) only needs less than a picosecond and is therefore a thousand times faster. They combined the semiconductor with a metallic layer, leaving only a 10 nanometre thin gap layer between both in which the light field is constricted.

[TECHNICAL ARTICLE](#)

Tags: *Photonics*

### [Instabilities, breathers and rogue waves in optics](#)

Nature Photonics, 28SEP2014

This review by an international team of researchers (France, Ireland, New Zealand, Finland) provides an overview of the field, concentrating primarily on propagation in optical fibre systems that exhibit nonlinear breather and soliton dynamics, but also discussing other optical systems in which extreme events have been reported.

Tags: *Photonics*

## QUANTUM SCIENCE

### [Quantum bits get their first compression](#)

Nature News, 29SEP2014

Researchers in Canada have shown how to reduce the proliferation of qubits by exploiting the fact that most of the information encoded by such objects relates to their ordering, rather than to their quantum state. Because the qubits are identical, the extra information in the ordering can be simply discarded. The achievement could be useful for efficient quantum communications and information storage. [TECHNICAL ARTICLE](#)

Tags: *Quantum science, S&T Canada*

### [Self-organized indium arsenide quantum dots for solar cells](#)

Nanowerk, 25SEP2014

Researchers in Japan used molecular beam epitaxy to grow a layer of InAs QDs with a density of  $5 \times 10^{11} \text{ cm}^{-2}$  on GaAsSb/GaAs (100) substrates. Importantly, the breakthrough that yielded this high density of highly ordered QDs was the discovery that InAs growth at a relatively low substrate temperature of 470 degrees Celsius on Sb-irradiated GaAs layers suppressed coalescence or

*continued...*

'ripening' of InAs QDs that was observed at higher temperatures.

*Tags: Quantum science, S&T Japan*

**Are weak values quantum? Don't bet on it**  
**PhysOrg.com, 24SEP2014**

Researchers at the University of New Mexico show that a key technique used to probe quantum systems may not be so quantum after all. They outline a parallel process—the same pre-selection, post-selection, and weak measurement—to show that you can get the same odd result out of the world's simplest random system: a coin flip. **TECHNICAL ARTICLE**

*Tags: Quantum science*

## S&T POLICY

**Ultra-low consumption for the future of electronics**

**PhysOrg.com, 26SEP2014**

The mission of the EU project E2SWITCH will be to develop an ultra-low power electronic system based on Tunnel FET (TFET) heterostructures built on silicon substrates and exploiting a phenomenon of quantum mechanics for operating at voltages up to five times lower than those of the current standard mobile phone circuit.

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

## SCIENCE WITHOUT BORDERS

**Adding uncertainty to improve mathematical models**

**Science Daily, 29SEP2014**

Burgers' equation describes turbulence and shocks in fluid flows in "a very sterilized" way, meaning the flows are modeled in the absence of external influences. Researchers at Brown University showed that Burgers' equation can indeed be solved in the presence of an additional random term which produces a range of solutions that accounts for uncertain external conditions that could be acting on the model system. **TECHNICAL ARTICLE**

*Tags: Science without borders, Mathematics ■*

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