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## FEATURE ARTICLES

### [Protecting GPS From Spoofers Is Critical to the Future of Navigation](#)



Illustration: Brian Stauffer

[IEEE Spectrum](#), 29JUL2016

According to researchers at Cornell University there are three main ways to protect against GPS spoofing: cryptography, signal-distortion detection, and direction-of-arrival sensing. No single method can stop every spoof, but they have found combining strategies that can provide a reasonably secure countermeasure that could be commercially deployed.

[OPEN ACCESS TECHNICAL ARTICLES 1, 2, 3](#)

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

### [Quantum leap in quest for digital speed and security](#)

[PhysOrg.com](#), 28JUL2016

An international team of researchers (Australia, USA - MIT) has discovered some of the brightest quantum emitters ever recorded—in hexagonal boron nitride, an alternating array of boron and nitrogen atoms. The research has yielded the identification of ultra-bright emitters in silicon carbide which can enable breakthroughs in both computation power and information security. [TECHNICAL ARTICLE 1](#), [OPEN ACCESS 2](#).

Tags: [Quantum science](#), [Cyber security](#), [Information technology](#), [Featured article](#)

### [Vortex laser offers hope for Moore's Law](#)

[PhysOrg.com](#), 28JUL2016

An international team of researchers (USA - State University of New York at Buffalo, Italy) is pushing laser technology forward using orbital angular momentum, which distributes the laser in a corkscrew pattern with

a vortex at the center. They were able to shrink the vortex laser to the point where it is compatible with computer chips. Because the laser beam travels in a corkscrew pattern, encoding information into different vortex twists, it is able to carry 10 times or more the amount of information than that of conventional lasers, which move linearly. [TECHNICAL ARTICLE](#)

Tags: [Photonics](#), [Microelectronics](#), [Featured article](#)

## S&T NEWS ARTICLES

### ADVANCED MATERIALS

#### [Hybrid perovskites: Super-ion building blocks](#)

[Science Daily](#), 30JUL2016

Researchers at Virginia Commonwealth University identified how to control different properties and stability in hybrid perovskites solar cell materials using lead-free preparation. These new design principles identified super-ion building blocks, clusters of atoms that carry the same charge as the ions that they replace. Hybrid perovskites can be tailored to improve stability and other desired traits. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Solar energy](#)

#### [Materials scientists make breakthrough in biomimetic coatings](#)

[Nanowerk](#), 29JUL2016

A team of researchers in the US (Pacific Northwest National Laboratory, Lawrence Berkeley National Laboratory, University of Washington) achieved self-assembly of peptoids into networks of hexagonally patterned nanoribbons on mineral surfaces in a highly ordered way to create materials similar to hard tissue surfaces, like bones or sea shells. The technique could potentially lead to the development of biomimetic coating materials for a variety of applications. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Biomimetics](#), [Biotechnology](#), [Materials science](#)

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## [Research into hollow sphere-based electrodes for high performance supercapacitors progresses](#)

[Nanotechweb](#), 29JUL2016

Researchers in China reviewed the recent progress in hollow sphere-based electrodes for high performance supercapacitors. Hollow spheres with various morphologies made using different fabrication processes are discussed. The review also covers symmetric and asymmetric supercapacitor devices based on hollow spheres, as well as research perspectives of the hollow sphere-based electrode materials. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, S&T China*

## [Research team develops ultrathin, transparent oxide thin-film transistors for wearable display](#)

[PhysOrg.com](#), 29JUL2016

Previous flexible transparent displays suffer from poor transparency and low electrical performance. Researchers in South Korea have developed ultrathin transparent oxide thin-film transistors for an active-matrix backplane of a flexible display by using the inorganic-based laser lift-off method. The new material showed high optical transparency of 83% and mobility of  $40 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$  even under several cycles of severe bending tests. According to the researchers, the oxide semiconductor can be easily transferred onto skin-like or any flexible substrate for wearable application. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

## [Novel porous materials made from flexible 'spaghetti-like' molecules](#)

[Nanowerk](#), 28JUL2016

A team of researchers in the US (UC San Diego, University of Florida) heated polymer chains with metal ions to allow ordering and assembly into a hybrid MOF material. The polymers end up bound to the metal ions. This coordination creates a porous scaffolding in the hybrid MOF. The MOF can be tuned by changing the chemistry of the polymer, the length of its molecular chain, or the processing temperature. The hybrid MOFs can be used for gas separation and storage. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

## [Self-healing textiles not only repair themselves, but can neutralize chemicals](#)

[PhysOrg.com](#), 25JUL2016

Researchers at Pennsylvania State University dipped the material to be coated in a series of liquids to create layers of material to form a self-healing, polyelectrolyte layer-by-layer coating made up of positively and negatively charged polymers. During the layering, enzymes can be incorporated into the coating matched to the chemical being targeted.

*Tags: Advanced materials*

## [Spiders spin unique phonetic material](#)

[PhysOrg.com](#), 25JUL2016

An international team of researchers (Germany, Singapore, Greece, USA - Rice University) has shown that spider silk has a phonon band gap. That means it can block phonon waves in certain frequencies in the same way as an electronic band gap—the basic property of semiconducting materials. New discoveries could inspire novel materials to manipulate sound and heat in the same way semiconducting circuits manipulate electrons. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

## [Integration of novel materials with silicon chips makes new 'smart' devices possible](#)

[PhysOrg.com](#), 21JUL2016

A team of researchers in the US (North Carolina State University, Army Research Laboratory, UT El Paso) developed a technique to integrate multiferroic materials, topological insulators and novel ferroelectric materials onto a silicon chip, allowing them to incorporate their functions into electronic devices. The exact combination of thin films varies, depending on which novel materials are being used.

[OPEN ACCESS TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

## ['Nanoantenna-reactor' catalysts offer best of both worlds](#)

[Nanowerk](#), 18JUL2016

A team of researchers in the US (Rice University, Princeton University) has demonstrated an antenna-reactor concept by showing that plasmonic aluminum nanocrystal antennas decorated with small catalytic palladium reactor particles exhibit dramatically increased photocatalytic activity over their individual components. The modularity of this approach provides for independent control of chemical and light-harvesting properties and paves the way for the rational, predictive design of efficient plasmonic photocatalysts. [OPEN ACCESS TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

## [Scientists develop way to upsize nanostructures into light, flexible 3-D printed materials](#)

[PhysOrg.com](#), 18JUL2016

A team of researchers in the US (Virginia Tech, Lawrence Livermore National Laboratory, MIT) describes a new process to create lightweight, strong and super elastic 3-D printed metallic nanostructured materials with unprecedented scalability, a full seven orders of magnitude control of arbitrary 3-D architectures and 400 percent increase of tensile elasticity over conventional lightweight metals and ceramic foams. They have applications in flexible armors, lightweight vehicles and batteries, aerospace, military and automotive industries. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*



“Imagination is more important than knowledge. It is, strictly speaking, a real factor in scientific research.” ALBERT EINSTEIN

## AUTONOMOUS SYSTEMS & ROBOTICS

### [Video Friday: Artificial Evolution, Legged Machines, and Delivery Robots in Silicon Valley](#)

IEEE Spectrum, 29JUL2016

Researchers in Canada present a distributed iterative learning control (ILC) approach where the same task is repeated several times. Each vehicle learns from the experience of its own and its neighbors' previous task repetitions and adapts its feedforward input to improve performance. [TECHNICAL ARTICLE](#)

Tags: *Autonomous systems & robotics*

## BIOTECHNOLOGY

### [Flexible building blocks of the future](#)

Science Daily, 29JUL2016

An international team of researchers (the Netherlands, Israel) has developed a new approach to manufacturing mechanical “metamaterials” that can be programmed to deform in a uniquely complex manner. The breakthrough may have future applications in soft robotics and wearable technologies—and may lead to more close-fitting, comfortable and user-friendly prosthetics. [TECHNICAL ARTICLE](#)

Tags: *Biotechnology, Advanced materials*

### [Portable device produces biopharmaceuticals on demand](#)

MIT News, 29JUL2016

A team of researchers in the US (MIT, Harvard, industry partner) developed a system based on a programmable strain of yeast, altering the yeast so it could be more easily genetically modified and include more than one therapeutic in its repertoire. The system can be used to produce a single dose of treatment from a compact device containing a small droplet of cells in a liquid. It could ultimately be carried onto the battlefield and used to produce treatments at the point of care or manufacture a vaccine to prevent a disease outbreak in a remote village.

[OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Biotechnology, Synthetic biology*

### [Microswimmer robot chains can decouple and reconnect in magnetic field \(w/video\)](#)

PhysOrg.com, 28JUL2016

Using a rotating magnetic field, an international team of researchers (USA - Drexel University, University of Nevada, Southern Methodist University, University of Utah, South Korea) shows how multiple chains of microscopic magnetic bead-based robots can link up to reach impressive speeds swimming through in a microfluidic environment. They are able to navigate in many different biological environments,

such as the blood stream and the microenvironment inside a tumor hence one day they could be used to carry out medical procedures and deliver more direct treatments to affected areas inside the body. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Biotechnology, Medical technology*

## COMMUNICATIONS TECHNOLOGY

### [Ultra-long lasers challenge conventional knowledge about laser technology](#)

PhysOrg.com, 28JUL2016

The EU project [ULTRALASER](#) is focusing on the development of ultra-long lasers, or lasers with a cavity formed by a long (up to hundreds of kilometres) span of optical fibre transformed into amplifying medium by the Raman effect. According to the researchers, when such optical fibre is used, the laser can function not only as a source of coherent light, but also as a transmission medium.

Tags: *Communications technology, S&T EU*

## CYBER SECURITY

### [Cyber Grand Challenge Seeks Automation Revolution in Computer Security](#)

DARPA News, 29JUL2016

On August 4, in Las Vegas, the Defense Advanced Research Projects Agency (DARPA) will host the world's first, all-machine hacking tournament. This Cyber Grand Challenge will mark the culmination of an ambitious three-year effort to develop advanced, autonomous systems that can detect, evaluate, and patch software vulnerabilities before adversaries have a chance to exploit them. The event will be livestreamed at [www.cybergrandchallenge.com](#).

Tags: *Cyber security*

## ENERGY

### [A new leaf: Scientists turn carbon dioxide back into fuel](#)

Science Daily, 30JUL2016

Trees and plants use enzymes to capture carbon dioxide from the atmosphere and convert it to sugars that store energy. An international team of researchers (USA - University of Illinois Chicago, University of New Mexico, University of Illinois at Urbana-Champaign, University of Louisville, South Korea) fashioned tungsten diselenide to convert carbon dioxide to carbon monoxide. Although carbon monoxide is also a greenhouse gas, it is much more reactive than carbon dioxide and scientists already have ways of converting carbon monoxide into usable fuel, such

*continued...*

as methanol. The study showed that the reaction occurs with minimal lost energy. [TECHNICAL ARTICLE](#)

*Tags: Energy, Government S&T*

## IMAGING TECHNOLOGY

### [Improving computer graphics with quantum mechanics](#)

[PhysOrg.com](#), 28JUL2016

An international team of researchers (USA - Caltech, Germany) has developed a new way to simulate large-scale motion numerically using the mathematics that governs the universe at the quantum level. The technique allows computers to more accurately simulate vorticity. They hope their work will have an impact on computer-generated graphics, and may also be used to model real-world phenomena, such as the curling motion of a hurricane. [TECHNICAL ARTICLE](#)

*Tags: Imaging technology, Quantum science, Simulation and modeling*

## FEATURED RESOURCE

### [Research News: Editors' Choice](#)

A monthly recap of papers selected by the Physics editors. American Physical Society Physics provides daily online-only news and commentary about a selection of papers from the APS journal collection. [RSS](#)

## INFORMATION TECHNOLOGY

### [A research project helps reduce the cost of parallel computing](#)

[PhysOrg.com](#), 29JUL2016

An international team of researchers (Switzerland, Spain, Italy, Germany, industry partners) working on an EU project, Reengineering and Enabling Performance and power of Applications, aims to make energy and performance benefits by source code "refactoring", a technique used in software engineering to improve the internal structure of a program without altering its observable behavior. The technique can be applied to the health, transportation and robotics sectors.

*Tags: Information technology*

### [More efficient way to write data into non-volatile memory devices improves performance](#)

[Science Daily](#), 27JUL2016

Researchers in Singapore adapted a version of B+ tree architecture for organizing memory data for use in Non-volatile memory (NVM). The data are separated into critical data and reconstructable data which can be derived from the critical data. Therefore, the priority

during the writing process is to ensure the consistency of the critical data. The new NV tree data structure can be up to 96 per cent more efficient in the operation of NVM, moving this technology closer to applications. [TECHNICAL ARTICLE](#)

*Tags: Information technology*

## MATERIALS SCIENCE

### [Acquiring graphene-like films from salts to boost nanoelectronics](#)

[Nanowerk](#), 29JUL2016

Films with a cubic structure and ionic bonding could spontaneously convert to a layered hexagonal graphitic structure in what is known as graphitisation. An international team of researchers (Russia, USA - Rice University) used computer simulations to find how thin a slab of salt has to be in order for it to break up into graphene-like layers. They derived the equation for the number of layers in a crystal that will produce ultrathin films with applications in nanoelectronics. They believe that ultrathin films of different composition might also undergo spontaneous graphitisation, yielding new layered structures with properties that are even more intriguing than graphene. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Advanced materials*

## MICROELECTRONICS

### [Chemical etching method helps transistors stand tall](#)

[Nanowerk](#), 25JUL2016

Researchers at the University of Illinois at Urbana-Champaign have developed a technique, called metal-assisted chemical etching or MacEtch, to etch very tall, narrow finFETs, a type of transistor that forms a tall semiconductor "fin" for the current to travel over. MacEtch is a liquid-based method where a metal template is applied to the surface, and then a chemical bath etches away the areas around the template, leaving the sides of the fins vertical and smooth. The technique could apply to many types of devices or applications that use 3-D semiconductor structures, such as computing memory, batteries, solar cells and LEDs.

[TECHNICAL ARTICLE](#)

*Tags: Microelectronics*

## PHOTONICS

### [Getting light in shape with metamaterials](#)

[Nanowerk](#), 28JUL2016

A team of researchers in the US (Sandia National Laboratory, Princeton University) has made a system that effectively couples light into and out of the semiconductor quantum wells. The system creates intense light inside the quantum wells and can be designed to control the outgoing laser beam's characteristics. This allows for new capabilities to control optical beams, creating new functionality. [OPEN ACCESS](#) [TECHNICAL ARTICLE 1, 2](#)

*Tags: Photonics, Advanced materials*

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## S&amp;T POLICY

**White paper highlights federal vision for nanotechnology-inspired Grand Challenge for future computing**

Nanowerk, 29JUL2016

Federal agencies participating in the National Nanotechnology Initiative (NNI) released a white paper describing the collective Federal vision for the emerging and innovative solutions needed to realize the Nanotechnology-Inspired Grand Challenge for Future Computing. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: S&T policy

**Expanding Strategic Defense in Space - China's Missile Interceptors and Satellite Killers**

Defense Update, 28JUL2016

SC-19 missiles carrying the interceptor and its derivatives were successfully used in a number of exo-atmospheric ballistic missile defense intercepts between 2003 and 2015. In addition to its BMD role, the weapon could possibly be used against hypersonic glide vehicles surfing in the upper atmosphere. In addition to the development of indigenous missile defense capability, China is also pursuing means to kill or disable adversary satellites.

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

## SCIENCE WITHOUT BORDERS

**Research News: Editors' Choice**

American Physical Society, 29JUL2016

Monthly recap of Physics papers.

Tags: Science without borders

**2nd International Conference on Complexity, Future Information Systems and Risk - COMPLEXIS 2017, 24-26 April, 2017, Portugal**

Physics World, 28JUL2016

The conference aims at becoming a yearly meeting place for presenting and discussing innovative views on all aspects of Complex Information Systems, in different areas such as Informatics, Telecommunications, Computational Intelligence, Biology, Biomedical Engineering and Social Sciences.

Tags: Science without borders

**Seven Questions about Technology You Aren't Even Allowed to Ask**

MIT Technology Review, 28JUL2016

At [Forbidden Research](#), a conference held last week at the MIT Media Lab, researchers discussed technologies and questions about technology that are just too hot to handle. Each question is morally or legally fraught and sets up a clash of ethics between individual technologists in search of solutions and institutions that see possible harm. [VIDEO](#)

Tags: Science without borders

## SENSORS

**Optical spring detects single molecules**

PhysOrg.com, 28JUL2016

An international team of researchers (Canada, USA - University of Rochester) discovered that when an individual particle or biomolecule lands on the surface of quivering microcavity, the optical spring force changes the vibration in a particular and measurable way. They propose and demonstrate an approach that utilizes the optical spring effect in a high-Q coherent optomechanical oscillator to dramatically enhance the sensing resolution by orders of magnitude compared with conventional approaches. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Sensors ■

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**Ryan Zelnio, Ph.D.**, Associate Director - Tech Watch / Horizon Scans, Office of Net Technical Assessments, OSD AT&L/OASD(R&E)

**Ms. Hema Viswanath**, TW/HS, ONTA Corporate Librarian