



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Theory turns to reality for nonlinear optical metamaterials](#)

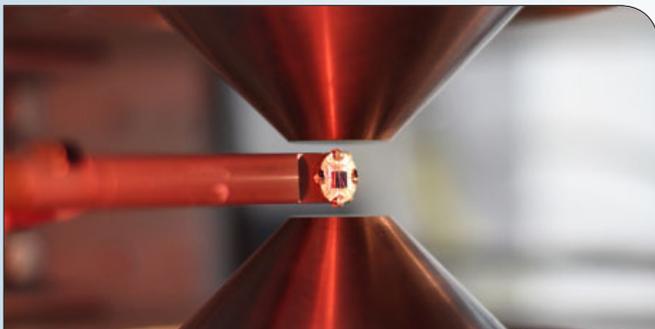
[PhysOrg.com, 16JUN2015](#)

A team of researchers in the US (Georgia Institute of Technology, Stanford University) has realized one of the long-standing theoretical predictions in nonlinear optical metamaterials: creation of a nonlinear material that has opposite refractive indices at the fundamental and harmonic frequencies of light. The discovery may prompt a re-evaluation of the fundamental rules governing nonlinear optics. [TECHNICAL ARTICLE](#)

Tags: Breakthrough technology, Advanced materials, Featured Article

[A new and game-changing magneto-resistance](#)

[Nanowerk, 15JUN2015](#)



A sample between the poles of an electromagnet. (Photo: Avci, Mendil and Gambardella / ETH Zurich)

The magneto-resistance of a conductive material normally remains the same when an electric current changes direction. However, a new magneto-resistive effect that researchers in Switzerland discovered changed when the electron flow was reversed. The discovery may lead to the production of customised materials in which the new magneto-resistance could be used. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T Switzerland, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[New honeycomb-inspired design delivers superior protection from impact](#)

[Science Daily, 15JUN2015](#)

Negative stiffness (NS) honeycomb, a technology developed by researchers at the University of Texas at Austin, is capable of elastic buckling, giving NS honeycomb structures the resilience to recover their energy-absorbing shape and properties after impact. NS honeycombs can be made from a variety of materials to suit distinct applications. They can be integrated into car bumpers, military and athletic helmets and other protective hardware. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Visible-frequency hyperbolic metasurface](#)

[Nature Letter, 11JUN2015](#)

A team of researchers in the US (Harvard University, MIT) report the experimental realization of a visible-frequency hyperbolic metasurface using single-crystal silver nanostructures defined by lithographic and etching techniques. They exhibit strong, dispersion-dependent spin-orbit coupling, enabling polarization- and wavelength-dependent routing of surface plasmon polaritons and two-dimensional chiral optical components. This research opens the door to realizing integrated optical meta-circuits, with wide-ranging applications in areas from imaging and sensing to quantum optics and quantum information science.

Tags: Advanced materials, Materials science

AUTONOMOUS SYSTEMS & ROBOTICS

[Centimeter-long origami robot](#)

[MIT News, 12JUN2015](#)

At the recent International Conference on Robotics and Automation, MIT researchers presented a printable origami robot that folds itself up from a flat sheet of plastic when heated and measures about a centimeter from front to back. Weighing only a third of a gram, the robot can swim, climb an incline, traverse rough

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terrain, and carry a load twice its weight. Other than the self-folding plastic sheet, the robot's only component is a permanent magnet affixed to its back. Its motions are controlled by external magnetic fields.

Tags: Autonomous systems & robotics

Video Friday: PR2 With Nailgun, Snake Bot Tango, and Robot vs Sword Master

[IEEE Spectrum](#), 12JUN2015

ESA is sending a robot to Mars with a big drill in 2016, with the hope of finding some trace of life.

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

First full genome of a living organism sequenced and assembled using technology the size of smartphone

[Science Daily](#), 15JUN2015

An international team of researchers (Canada, UK) has sequenced and assembled the full genome of the bacteria *Escherichia Coli*, using Oxford Nanopore's MinION™ device. While standard sequencing platforms can either generate vast amounts of data, or read long enough stretches of the genome to allow complete reconstruction, the Nanopore device has the potential to achieve both goals. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Biology, S&T Canada

Mimicking the body on a chip for new drug testing

[PhysOrg.com](#), 10JUN2015

Researchers in the EU working on Body-on-a-Chip (BOC), an EU supported project, replaced the 2D cell culture conventionally used for drugs testing with a multi-tissue device that better mimics real-life conditions in the body by combining several organ-specific 3D cultures into a single chip. Researchers used BOC to assess the toxicological risk of new candidate compounds and their effectiveness prior to formal clinical testing.

Tags: Biotechnology, Medical technology, S&T EU

COMMUNICATIONS TECHNOLOGY

Researchers propose potential new way to maintain communication with hypersonic vehicles in flight

[PhysOrg.com](#), 16JUN2015

In order to overcome the communication blackout problem suffered by hypersonic vehicles, researchers in China have developed a technique which utilizes a double-positive material layer surrounding a hypersonic vehicle antenna to match with the plasma sheath enclosing the vehicle. Analytical analysis and numerical results indicate a resonance between the matched layer and the plasma sheath will form to mitigate the blackout problem in some conditions. [TECHNICAL ARTICLE](#)

Tags: Communications Technology, Military technology, S&T China

Airbus to build giant satellite network

[BBC News](#), 15JUN2015

Airbus has been contracted to build the world's largest satellite constellation. The company will produce 900 spacecraft for OneWeb that aims to broaden internet access to the underserved. The plan envisages 20 planes of satellites in the sky connecting to small user terminals on the ground. These terminals would then link out to local phone networks and web hubs. More than 600 satellites will initially be launched, with the rest held as spares.

Tags: Communications Technology, S&T EU, Satellite technology

First wireless network synchronized to a billionth of a second

[Science Daily](#), 10JUN2015

Researchers at the University of Southern California have developed a prototype, consisting of four nodes that synchronize to each other with an accuracy of approximately three nanoseconds. They also introduced a scalable protocol called the "Blink" algorithm which extends the same accuracy of the current small-size prototype to hundreds or even thousands of wireless devices. This technology could have applications in signal jamming, coordinated navigation, tracking, and distributed beam forming.

Tags: Communications Technology

CYBER SECURITY

Cyber-Espionage Nightmare

[MIT Technology Review](#), 10JUN2015

The first case the United States has brought against the perpetrators of alleged state-sponsored cyber-espionage has revealed computer-security holes that companies rarely acknowledge in public. Although the attackers apparently routed their activities through innocent people's computers and made other efforts to mask themselves, prosecutors traced the intrusions and outed individual intelligence agents.

Tags: Cyber security

ENERGY

Renewable energy from evaporating water

[Science Daily](#), 16JUN2015

Researchers at Columbia University built a floating, piston-driven engine that generates electricity causing a light to flash, and a rotary engine that drives a miniature car that derives power directly from evaporation. When evaporation energy is scaled up, the researchers predict, it could produce electricity from giant floating power generators that sit on bays or reservoirs. [TECHNICAL ARTICLE](#)

Tags: Energy

continued...

“If you are out to describe the truth, leave elegance to the tailor.”

ALBERT EINSTEIN

Working at the interface for future energy

Nanowerk, 12JUN2015

Researchers in Japan have demonstrated the importance of the interface between two organic materials in maximizing the generation of useful current, providing new insight that could help improve the efficiency of polymer solar cells. [TECHNICAL ARTICLE](#)

Tags: Energy, S&T Japan, Solar energy

IMAGING TECHNOLOGY

3D potential through laser annihilation

Nanowerk, 15JUN2015

Firing pulses of a trillion x-ray photons at molecular-sized samples in time scales on the order of million-billionths of a second, researchers at DOE's Argonne National Laboratory are aiming for the Holy Grail of ultra-fast X-ray Science—single-particle 3D imaging with atomic resolution.

Tags: Imaging technology, Government S&T, Particle physics

INFORMATION TECHNOLOGY

Researchers develop the first flexible phase-change random access memory

Nanowerk, 15JUN2015

An international team of researchers (South Korea, Japan) has developed the first flexible Phase change random access memory (PRAM) enabled by self-assembled block copolymer silica nanostructures with an ultralow current operation on plastic substrates. They successfully lowered the contact area by localizing the volume change of phase-change materials and thus resulted in significant power reduction. Reducing high operating current is an important issue in using PRAM for flexible devices.

[TECHNICAL ARTICLE](#)

Tags: Information Technology, Flexible electronics

MATERIALS SCIENCE

All-star nanocrystals

Science Daily, 12JUN2015

A team of researchers in the US (Iowa State University, The Ames Laboratory, Los Alamos National Laboratory) synthesized a series of perovskite nanocrystals with different morphologies. Characterization studies of photoluminescence found that the rods and wires showed higher photoluminescence with longer lifetimes compared to other shapes. This work highlights the potential of low-dimensional organometal halide perovskite semiconductors in constructing new porous and nanostructured

solar cell architectures, as well as in applying these materials to other fields such as light-emitting devices and single particle imaging and tracking. [TECHNICAL ARTICLE](#)

Tags: Materials science, Government S&T

Surfaces get smooth or bumpy on demand

MIT News, 11JUN2015

The process developed by a team of researchers in the US (MIT, Columbia University) involves a material that is composed of two different polymers with different degrees of stiffness: More rigid particles are embedded within a matrix of a more flexible polymer. When squeezed, the material's surface changes from smooth to a pattern determined by the spacing and shapes of the implanted harder particles; when released, it reverts back to the original form. Surface textures that can then be modified at will to be perfectly smooth, or ridged or bumpy, or even to have complex patterns that could be used to guide fluids. It can have applications in optics and tribology. [TECHNICAL ARTICLE](#)

Tags: Materials science

At near absolute zero, molecules may start to exhibit exotic states of matter

PhysOrg.com, 10JUN2015

Researchers at MIT cooled molecules in a gas of sodium potassium to a temperature of 500 nanokelvins and found that the ultracold molecules were relatively long-lived and stable, resisting reactive collisions with other molecules and exhibited very strong dipole moments. These molecules move as quantum mechanical matter waves. They expect to get a huge variety of different states of matter, like superfluid crystals. [TECHNICAL ARTICLE](#)

Tags: Materials science, Science without borders

Buckling on demand: selective buckling in a novel metamaterial (w/video)

Nanowerk, 10JUN2015

Researchers in the Netherlands created a 3D-printed working prototype of a novel metamaterial that displays selective and tunable buckling on demand. Small structural variations in the material single out regions that buckle selectively under external stress, whereas other regions remain unchanged. The buckling behaviour can be tuned without changing other physical properties such as electromagnetic or heat conduction. A typical application of this property would be in shape-memory materials. [TECHNICAL ARTICLE](#)

Tags: Materials science

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[Scientists levitate wood on structured surfaces captured by high speed photography](#)

[PhysOrg.com](#), 10JUN2015

Using high speed photography, researchers at the University of Minnesota have demonstrated a particle of cellulosic biomass floating above a surface by aggressive generation of gases. The surprising new property can enhance biofuel production and has implications for cooking, tobacco use and forest fire suppression.

[TECHNICAL ARTICLE](#)

Tags: Materials science

FEATURED RESOURCE

[OSTI](#)

OSTI is the DOE office that collects, preserves, and disseminates DOE-sponsored R&D results that are the outcomes of R&D projects or other funded activities at DOE labs and facilities nationwide. [RSS](#)

MICROELECTRONICS

[Physicists blow magnetic bubbles](#)

[Physics World](#), 11JUN2015

The capacity of computer memory could be boosted by exploiting skyrmions which are topologically stable. To exploit this property, a team of researchers in the USA (Argonne National Laboratory, UCLA, Northwestern University, University of Chicago) has made individual skyrmion “bubbles” at room temperature by pushing magnetic domains through a narrow gap in a thin ferromagnetic-metal film. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Information technology

[Researchers decode interface switching effects in ferroelectric memories](#)

[PhysOrg.com](#), 11JUN2015

The circuitry for reading information stored in the polarization of ferroelectric materials has prohibited its adaptation to extremely small scales. An international team of researchers (USA, France, Germany, Japan) developed a new technique that provides key information for an alternative decoding method, where better understanding will help to fully harness the properties of these devices. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Advanced materials, Communications technology

[Liquid droplets create logic circuits](#)

[Physics World](#), 08JUN2015

Researchers at Stanford University used multiple droplets of a magnetic fluid to create all of the fundamental logic circuits within a computer. The circuits are made by having the interacting droplets move through a matrix of interconnected tracks while under the influence of an applied magnetic field. The research could provide a new platform for creating lab-on-a-chip technologies, as well as provide insights into the fundamental physics of collective behaviour. [TECHNICAL ARTICLE](#)

Tags: Microelectronics

QUANTUM SCIENCE

[Miniscule mirrored cavities connect quantum memories](#)

[PhysOrg.com](#), 16JUN2015

Enhanced interactions between light and atoms and the extended spin-coherence times are essential steps toward realizing real-world quantum memories and quantum computing systems. A team of researchers in the US (MIT, Brookhaven National Laboratory, industry partner) has demonstrated a new process to construct diamond nanocavities in which memories are encoded inside the electronic spin states of an atomic system, with a memory time exceeding 200 microseconds. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Microelectronics

[Blind quantum computing method surpasses efficiency ‘limit’](#)

[PhysOrg.com](#), 12JUN2015

Blind quantum computing protocols will always require a certain minimum amount of resources which effectively limits the efficiency of the protocols. Researchers in Singapore have shown that this limit holds only in certain scenarios, and it can be overcome by using a technique called “iterated gate teleportation” where additional gate teleportation steps are repeatedly carried out to correct errors based on the results of the preceding teleportation steps. [TECHNICAL ARTICLE](#)

Tags: Quantum science

[World’s Fastest Quantum Random Number Generator Unveiled in China](#)

[MIT Technology Review](#), 11JUN2015

The best commercially available quantum random number generators produce them only at a rate of a million per second, far short of the many tens of billions per second that many applications require. Researchers in China report that they have built a quantum random number generator capable of producing 68 billion of them per second. [TECHNICAL ARTICLE](#)

Tags: Quantum science

Advances in Quantum Teleportation

arXiv, 28MAY2015

In this article, an international team of researchers (UK, Germany, Canada, Japan) review the basic theoretical ideas behind quantum teleportation and its variant protocols. They focus on the main experiments, together with the technical advantages and disadvantages associated with the use of the various technologies, from photonic qubits and optical modes to atomic ensembles, trapped atoms, and solid-state systems. Analysing the current state-of-the-art, they finish by discussing open issues, challenges and potential future implementations.

Tags: *Quantum science*

S&T POLICY**China building 42000 military drones over next eight years and many are copies of US designs**

Next Big Future, 13JUN2015

Some estimates indicate that China plans to produce upwards of 41,800 land- and seabased unmanned systems, worth about \$10.5 billion, between 2014 and 2023. During 2013, China began incorporating its UAVs into military exercises and conducted ISR over the East China Sea with the BZK-005 UAV. In 2013, China unveiled details of four UAVs under development. Three of them are designed to carry precision-strike capable weapons.

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

New initiative targets emerging models of technological innovation

NSF News, 09JUN2015

To identify the emerging models of technological innovation that will propel U.S. competitiveness in the coming decades, the Council on Competitiveness is beginning the Exploring Innovation Frontiers Initiative with support from NSF. In addition to exploring models of innovation, attendees will discuss tapping into the nation's innovation capacity, nurturing new talent and ideas, translating innovation into widespread prosperity, and growing national and regional economies.

Tags: *S&T policy*

SENSORS**Engineers create origami paper-based bacteria-powered battery**

Nanowerk, 10JUN2015

The battery, created by researchers at the State University of New York-Binghamton, generates power from microbial respiration, delivering enough energy to run a paper-based biosensor with nothing more than a drop of bacteria-containing liquid. It folds into a square the size of a matchbook and uses an inexpensive air-breathing cathode created with nickel sprayed onto one side of ordinary office paper. Total cost of this potentially game-changing device is five cents. [TECHNICAL ARTICLE](#)

Tags: *Sensors, Biotechnology*

STEM**NSF awards \$12 million to spur an engineering education revolution**

NSF News, 15JUN2015

NSF awarded \$12 million to engineering and computer science departments to enact groundbreaking, scalable and sustainable changes in undergraduate education. These five-year, \$2 million awards are part of NSF's multiyear effort to help universities substantially improve the professional formation of engineers and computer scientists. A key component is support for revolutionizing engineering departments, an NSF activity known as RED.

Tags: *STEM* ■

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