



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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## FEATURE ARTICLES

### [Caltech announces discovery in fundamental physics](#)

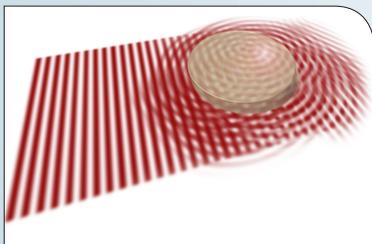
[PhysOrg.com, 10AUG2015](#)

Charge ordering in metals is a fundamental instability of the electron sea. What is difficult to parse, however, is whether the charge order originates among the itinerant electrons or whether it arises from the ionic lattice. An international team of researchers (USA-Argonne National Laboratory, University of Chicago, Caltech, the Netherlands, UK) found that there is a simple correlation between pressure and how the communal electrons organize themselves within the crystal. Materials with completely different types of crystal structures all behave similarly. This work should have applicability to new materials as well as to the kind of interactions that are useful to create magnetic states that are often the antecedents of superconductors.

**TECHNICAL ARTICLE**

*Tags: Breakthrough technology, Particle physics, Featured Article*

### [Novel material design for undistorted light waves](#)



*A wave penetrates a material: usually this leads to wave interference, to darker and brighter areas. Credit: Phys.org*

[PhysOrg.com, 10AUG2015](#)

An international team of researchers (Austria, USA - Princeton University, Florida State University, University of Central Florida) has shown that specially tailored high-tech materials, which can locally amplify or absorb

light allow new kinds of light waves, which have the same intensity everywhere inside the material, as if there was no wave interference at all. The light wave is not bent around the object as in metamaterials, but fully penetrates the high tech material. The way the material influences the wave is, however, fully cancelled by a carefully tuned interplay of amplification and absorption. **TECHNICAL ARTICLE**

*Tags: Photonics, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### [Team produces 3-D-printed objects with variable elasticity using single material](#)

[PhysOrg.com, 05AUG2015](#)

By using the printer to alter the small-scale structure of the material, researchers at Disney Research in Switzerland showed they could vary its elasticity dramatically within the same object. They developed families of compatible microstructures with varying elastic properties, enabling designers to select the properties desired for each region of an object.

*Tags: Advanced manufacturing, Materials science, S&T Switzerland*

### ADVANCED MATERIALS

#### [A sticky situation](#)

[Nanowerk, 06AUG2015](#)

Researchers at UC Santa Barbara improved upon a small molecule called the siderophore cyclic trichryso-bactin (CTC) that they had previously discovered. They modified the molecule and then tested its adhesive strength in aqueous environments. The result: a compound that rivals the staying power of mussel glue. There is real need in a lot of environments, including medicine, to be able to have glues that would work in an aqueous environment. **TECHNICAL ARTICLE**

*Tags: Advanced materials, Materials science*

#### [Flexible dielectric polymer can stand the heat](#)

[Science Daily, 06AUG2015](#)

Researchers at Pennsylvania State University developed a cross-linked polymer nanocomposite containing boron nitride nanosheets. This material has high-voltage capacity for energy storage at elevated temperatures, can be photo patterned and is flexible.

**TECHNICAL ARTICLE**

*Tags: Advanced materials, Materials science*

*continued...*

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## AUTONOMOUS SYSTEMS &amp; ROBOTICS

**[Video Friday: Tesla's Robot Tentacle, Subscale Robot Aircraft, and Virtual Humans Getting Dressed](#)**[IEEE Spectrum](#), 07AUG2015

Experts at NASA explain how a new robotic composite fiber placement system will be used to build large space structures for space vehicles. Lightweight composites have the potential to increase the amount of payload that can be carried by a rocket along with lowering its total production cost.

*Tags: Autonomous systems & robotics*

## BIOTECHNOLOGY

**[Researchers collaborate in development of brain-friendly interfaces](#)**[Science Daily](#), 07AUG2015

A team of researchers in the US (Georgia Institute of Technology, University of Pennsylvania) found that the extracellular matrix derived electrodes adapted to the mechanical properties of brain tissue and were capable of acquiring neural recordings from the brain cortex. Instead of using neural prosthetic devices, they developed a brain-friendly extracellular matrix environment of neuronal cells that contain very little foreign material. [TECHNICAL ARTICLE](#)

*Tags: Biotechnology*

## COMMUNICATIONS TECHNOLOGY

**[Army developing nine-language voice translator](#)**[Defense Systems](#), 07AUG2015

Made by a company in the US, the [SQ.410 Translation System](#) is currently programmed with nine languages and does not require a cell network or an Internet connection. The device, which is designed to be worn on the chest for hands-free operation, will repeat a soldier's spoken words in English and display them on the screen, so the soldier can be sure the voice recognition is accurate. The system then provides written and spoken translations in the other language, the Army said. It also can be used to record conversations.

*Tags: Communications technology*

## CYBER SECURITY

**[How to Damage a Chemical Plant over the Internet](#)**[MIT Technology Review](#), 07AUG2015

A researcher who works on industrial security at a company says that many refineries and plants are still vulnerable. An attacker who evades the systems that detect and prevent digital incursions would most likely

have free rein to tinker with the equipment inside. But he says that defending them is not an impossible task. Accessing a plant over the Internet takes a long period of probing and experimental tinkering with its pumps and valves to understand how some unexpected physics might be set off, he says. That should provide plenty of opportunity to detect an intrusion.

*Tags: Cyber security*

## ENERGY

**[A small, modular, efficient fusion plant](#)**[MIT News](#), 10AUG2015

According to researchers at MIT using the new commercially available superconductors, rare-earth barium copper oxide (REBCO) superconducting tapes, to produce high-magnetic field coils just ripples through the whole design. The stronger magnetic field makes it possible to produce the required magnetic confinement of the superhot plasma, the working material of a fusion reaction. The smaller than previously envisioned size of the device makes the whole system less expensive and faster to build. The new reactor is designed for basic research on fusion and also as a potential prototype power plant that could produce significant power. [TECHNICAL ARTICLE](#)

*Tags: Energy, Nuclear energy*

**[Heart-shaped Li-ion battery printed on a cup shows batteries can be printed almost anywhere](#)**[PhysOrg.com](#), 07AUG2015

Researchers in South Korea have developed a new battery manufacturing method which does not require either liquid-electrolyte injection or separator membranes. Instead, the electrolyte is made of a paste, the electrodes are made of slurry, and they are consecutively printed onto a surface and then cured with ultraviolet light. Researchers envision their technique which eventually removes pre-designated battery space with fixed dimension and shape holds a great deal of promise for use in wearable electronics and Internet of Things. [TECHNICAL ARTICLE](#)

*Tags: Energy, Battery*

**[Plans to develop 3D-printed graphene batteries](#)**[Nanowerk](#), 07AUG2015

Researchers in the UK, working under a government sponsored project [Additive Manufacturing Next Generation Supergen Energy Storage Devices](#), are developing a desktop printer to create batteries, supercapacitors and energy storage devices for phones or tablets, and solar, wind and wave power storage. They are analysing new techniques for rapid 3D printing with conductive graphene ink to create the batteries.

*Tags: Energy, Battery, S&T UK*

“The next major explosion is going to be when genetics and computers come together. I’m talking about an organic computer - about biological substances that can function like a semiconductor.” ALVIN TOFFLER

## ENVIRONMENTAL SCIENCE

### Capturing and converting CO2 in a single step

PhysOrg.com, 11AUG2015

A team of researchers in the US (University of Pittsburgh, DOE’s National Energy Technology Laboratory) computationally derived a metal-free catalyst that captures and converts carbon dioxide into formic acid. The catalyst allows the conversion to happen without the need for expensive, extreme conditions. [TECHNICAL ARTICLE](#)

Tags: Environmental science

### Don’t Count on Geoengineering the Oceans

MIT Technology Review, 11AUG2015

The authors of a new study examined various scenarios and found that in all scenarios, past emissions “leave a substantial legacy in the marine environment,” especially in the deep ocean. These effects last for centuries. Some researchers are beginning to discuss potential geoengineering schemes aimed directly at reversing ocean acidification. According to a recent report from the National Research Council, there is no evidence that adding alkalinity to ocean waters would have “deleterious effects”.

Tags: Environmental science, Climatology

### Copper clusters capture and convert carbon dioxide to make fuel

Nanowerk, 07AUG2015

The activation of CO<sub>2</sub> and its hydrogenation to methanol are of much interest as a way to utilize captured CO<sub>2</sub>. An international team of researchers (USA - Argonne National Laboratory, Yale University, University of Chicago, Germany) investigated the use of size-selected Cu<sub>4</sub> clusters supported on Al<sub>2</sub>O<sub>3</sub> thin films for CO<sub>2</sub> reduction in the presence of hydrogen. The results indicate that size-selected Cu<sub>4</sub> clusters are the most active low-pressure catalyst for catalytic CO<sub>2</sub> conversion to CH<sub>3</sub>OH. [TECHNICAL ARTICLE](#)

Tags: Environmental science, Climatology, Materials science

## FORECASTING

### Millennium Project releases '2015-16 State of the Future' report

KurzweilAI, 03AUG2015

The Millennium Project has released its annual 2015-16 State of the Future report, listing global trends on 28 indicators of progress and regress, new insights into 15 Global Challenges, and impacts of artificial intelligence, synthetic biology, nanotechnology and other advanced technologies on employment over the next 35 years. The 300-page report distills research from UN organizations, national governments, think tanks, and thought leaders around the world.

Tags: Forecasting

## IMAGING TECHNOLOGY

### New video camera released featuring ultra-high-speed CMOS image sensor

Science Daily, 07AUG2015

Researchers in Japan have developed an ultra-high-speed CMOS image sensor FTCMOS2 that offers 10 million frames per second with ISO 16,000 photosensitivity. The higher sensitivity of the ultra-high-speed video camera is expected to be widely used for advanced scientific research in life-sciences and engineering.

Tags: Imaging technology, S&T Japan

## MATERIALS SCIENCE

### Foldable glass

Nanowerk, 11AUG2015

Researchers in South Korea have demonstrated substrate platforms of glass and plastics, which can be reversibly and repeatedly folded at pre designed location(s) without any mechanical failure or deterioration in device performances. The use of ultrathin substrates (usually with a thickness of 1-2 microns) is especially suitable for conformable, patch-like skin sensors or devices.

[TECHNICAL ARTICLE](#)

Tags: Materials science

### A new look at superfluidity

MIT News, 10AUG2015

For the first time, researchers at MIT have created a superfluid gas, the so-called Bose-Einstein condensate, in an extremely high magnetic field. The magnetic field is a synthetic magnetic field, generated using laser beams, and is 100 times stronger than that of the world’s strongest magnets. Within this magnetic field, the researchers could keep a gas superfluid for a tenth of a second. [TECHNICAL ARTICLE](#)

[ARTICLE](#)

Tags: Materials science

### Eliminating entanglements

Science Daily, 10AUG2015

In order to fabricate a soft elastomer, researchers at Harvard University needed to eliminate the entanglements from the beginning by developing a new type of polymer that was fatter and less prone to entanglement than linear polymers. The polymers, nicknamed bottlebrushes, are easily synthesized by mixing three types of commercially available linear silicone polymers. The softness of the elastomers can be precisely controlled by adjusting the amount of cross-linked polymers to mimic everything from soft brain tissue and relatively stiff cells. [TECHNICAL ARTICLE](#)

[ARTICLE](#)

Tags: Materials science, Biotechnology

continued...

## [Charge density, optical properties of multicomponent crystals](#)

Science Daily, 07AUG2015

Researchers in Poland present design strategies for optical materials based on selected active pharmaceutical ingredients (APIs). They experimentally confirmed the theoretically predicted optical properties and bulk effects. The study is just a first step in the design of novel optical materials based on push-pull molecules and APIs.

[TECHNICAL ARTICLE](#)

*Tags: Materials science, Advanced materials*

## FEATURED RESOURCE

### [RIKEN Research \(Japan\)](#)

RIKEN is one of Japan's largest research organizations with institutes and centers throughout Japan. It highlights articles published by RIKEN researchers across a broad spectrum of disciplines in science and technology. [RSS](#)

## [Molecular trick alters rules of attraction for non-magnetic metals](#)

Science Daily, 05AUG2015

An international team of researchers (UK, Switzerland, USA - Brookhaven National Laboratory) has demonstrated how to generate magnetism in metals that aren't naturally magnetic, which could end our reliance on some rare and toxic elements currently used. Researchers detail a way of altering the quantum interactions of matter in order to 'fiddle the numbers' in a mathematical equation that determines whether elements are magnetic, called the Stoner Criterion. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

## [Two spin liquids square off in an iron-based superconductor](#)

Science Daily, 05AUG2015

A new study by a team of researchers in the US (Brookhaven National Laboratory, Oak Ridge National Laboratory) describes how iron-telluride develops superconductivity with no long-range electronic or magnetic order. In fact, the material displays a liquid-like magnetic state consisting of two coexisting and competing disordered magnetic phases. The results challenge a number of widely accepted paradigms into how unconventional superconductors work. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Government S&T*

## MICROELECTRONICS

### [New Nanoscale Programmable Switches Promise Faster, More Versatile Chip-scale Devices](#)

DARPA News, 06AUG2015

Under a DARPA supported program, researchers at UMass Amherst have devised ultratiny, electronic switches with reprogrammable features resembling those at play in inter-neuron communication. These highly adaptable nanoscale switches can toggle on and off fast with low loss. They could become the basis of not only computer and memory devices but also multi-function RF chips, which can be programmed to behave like a cell-phone's signal emitter, a collision-avoidance radar component or a local radio jammer.

[TECHNICAL ARTICLE](#)

*Tags: Microelectronics, DARPA*

## PHOTONICS

### [Droplets levitate on a cushion of blue light](#)

PhysOrg.com, 11AUG2015

The floating effect is similar to Leidenfrost levitation—in which droplets dance on a hot vapor cushion. But by creating the vapor with a strong jolt of electricity instead of heat, researchers in France found they could ionize the gas into a plasma that glowed a soft blue light. The work may offer an inexpensive new way to generate a freely movable microplasma, as well as yield insights into fundamental physics questions. [TECHNICAL ARTICLE](#)

*Tags: Photonics, Materials science, S&T France*

## QUANTUM SCIENCE

### [Paving the way for a faster quantum computer](#)

PhysOrg.com, 11AUG2015

Researchers in Austria have demonstrated a new quantum computation scheme in which operations occur without a well-defined order. They used this effect to accomplish a task more efficiently than a standard quantum computer. These ideas could set the basis for a new form of quantum computing, potentially providing quantum computers with an even larger computational speed-up. [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

### ['Quantum dot finder' could help make high-performance nanophotonic devices](#)

Nanowerk, 11AUG2015

An international team of researchers (USA - NIST, University of Maryland, University of Rochester, UK) has developed a camera-based imaging technique which maps the location of the quantum dots first, and then uses that knowledge to build optimized light-control devices in the right place. Using this technique, the researchers demonstrated grating-based single photon sources in which they were able to collect 50 percent of the quantum dot's emitted photons. They also

demonstrated that more than 99 percent of the light produced from their source came out as single photons.

#### TECHNICAL ARTICLE

Tags: Quantum science, Government S&T

### **Integration of quantum dots and photonic crystals produce brighter, more efficient light**

Nanowerk, 07AUG2015

Researchers at the University of Illinois at Urbana-Champaign have developed a new method to extract more efficient and polarized light from quantum dots over a large-scale area. Their method, which combines QD and photonic crystal technology, could lead to brighter and more efficient and enhanced LED lighting. Since screens consume large amounts of energy in devices like laptops, phones, and tablets, their approach could have a huge impact on energy consumption and battery life. TECHNICAL ARTICLE

Tags: Quantum science, Advanced materials

## S&T POLICY

### **Three new Engineering Research Centers will advance U.S. resiliency and sustainability**

NSF News, 10AUG2015

The National Science Foundation has invested \$55.5 million in three new Engineering Research Centers (ERCs) to create novel technology platforms and transform industries. These three ERCs will address national challenges in energy, sustainability and infrastructure. Over the next five years, these flagship centers will generate knowledge and high-tech innovations while contributing to U.S. economic opportunities and the preparation of engineering graduates.

Tags: S&T policy, STEM

### **Move over, autonomous AI weapons, there's a new risk in town: 'gene drives'**

KurzweilAI, 06AUG2015

An international group of 26 experts, including prominent genetic engineers and fruit fly geneticists, has unanimously recommended a series of preemptive measures to safeguard gene drive research from accidental (or intentional) release from laboratories. RNA-guided gene drives are genetic elements that increase the chance of the gene they carry being passed on to all offspring. Researchers around the world are developing synthetic gene drives that could one day be leveraged by humans to purposefully alter the traits of wild populations of organisms to prevent disease transmission and eradicate invasive species. TECHNICAL ARTICLE

Tags: S&T policy, Biology

## SENSORS

### **Smart light, shadows used to track human posture**

Science Daily, 11AUG2015

A team of researchers at Dartmouth College have created the first light-sensing system that reconstructs human postures continuously and unobtrusively, furthering efforts to create smart spaces in which people control their environment with simple gestures. VIDEO

Tags: Sensors

### **Portable ultra-broadband lasers could be key to next-generation sensors**

Science Daily, 10AUG2015

Researchers at Northwestern University have developed a compact laser diode by integrating multiple wavelength emitters into a single device. Capable of emitting broadband wavelengths on demand, the device is smaller than a penny and works at room temperature. It can also emit light at frequencies within +/- 30 percent of the laser central frequency, which has never before been demonstrated in a single-laser diode. TECHNICAL ARTICLE

Tags: Sensors ■

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