Volume 4, Issue 42 ■ 17OCT2014

# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS



## FEATURE ARTICLES

### Tailored flexible illusion coatings hide objects from detection

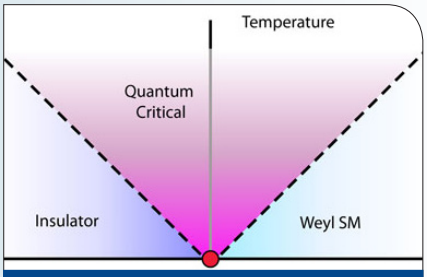
Science Daily, 13OCT2014

Researchers at Penn State developed a metamaterial "illusion coatings" made up of a thin flexible substrate with copper patterns designed to create the desired result. They can take a practical size metal antenna or sensor, coat it with the patterned film and when the device is probed by a radio frequency source, the scattering signature of the enclosed object will appear to be that of a prescribed dielectric material like silicon or Teflon. The coating could be used to enhance the way radio frequency ID tags work, redistribute energy in different, controlled patterns making things more visible rather than less visible, and shield any type of equipment from stray or intentional electromagnetic interference. TECHNICAL ARTICLE

*Tags: Advanced materials, Featured Article*

### A critical point for the materials of tomorrow

Nanowerk, 10OCT2014




*The critical point (red circle) between an insulator and the Weyl semimetal (SM) near absolute zero could provide a playground for unusual physics never seen before in conventional materials.*

Through an investigation of the quantum phase transition between the Weyl semimetal and an insulator near absolute zero temperature, researchers in Japan discovered a novel quantum criticality at the boundary between the two quantum states. The investigation provides a more complete understanding of the electron–electron interactions and opens the door to new material physics. TECHNICAL ARTICLE

*Tags: Quantum science, Materials science, S&T Japan, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### DNA nano-foundries cast custom-shaped metal nanoparticles

Science Daily, 09OCT2014

Researchers at Harvard University have unveiled a new method to form tiny 3-D metal nanoparticles in prescribed shapes and dimensions using DNA as a construction mold. This is a significant breakthrough that has the potential to advance laser technology, microscopy, solar cells, electronics, environmental testing, disease detection and more. TECHNICAL ARTICLE

*Tags: Advanced manufacturing, Advanced materials*

#### Emerging nanotechnologies for manufacturing

Nanowerk, 09OCT2014

In the second edition of "Emerging Nanotechnologies for Manufacturing, Second Edition (Micro and Nano Technologies)," an unrivaled team of international experts explores existing and emerging nanotechnologies as they transform large-scale manufacturing contexts in key sectors such as medicine, advanced materials, energy, and electronics.

*Tags: Advanced manufacturing*

### ADVANCED MATERIALS

#### Scientists create new protein-based material with some nerve

UC Berkeley News, 14OCT2014

Researchers at UC Berkeley have taken proteins from nerve cells and used them to create a "smart" material that is extremely sensitive to its environment. This marriage of materials science and biology could give birth to a flexible, sensitive coating that is easy and cheap to manufacture in large quantities. TECHNICAL ARTICLE

*Tags: Advanced materials*

*continued...*

BACK TO TOP

### Magnetic superconductor: Strange bedfellows

Science Daily, 13OCT2014

Researchers in Germany have synthesized a ferromagnetic superconducting compound that is made up of stacks of alternating superconducting iron selenide (FeSe) and ferromagnetic lithium-iron hydroxide (Li,Fe)OH layers. When the material is cooled, electrical resistivity drops to zero in the iron selenide layer at temperatures below -230°C, and superconductivity emerges. TECHNICAL ARTICLE

*Tags: Advanced materials, S&T Germany*

### Dissolvable silicon circuits and sensors

Science Daily, 09OCT2014

Researchers at the University of Illinois at Urbana-Champaign demonstrate the entire complement of building blocks for integrated circuits, along with various sensors and actuators with relevance to clinical medicine. The advances suggest a new era of devices that range from green consumer electronics to 'electroceutical' therapies, to biomedical sensor systems that do their work and then disappear.

*Tags: Advanced materials*

## AUTONOMOUS SYSTEMS & ROBOTICS

### Video Friday: Pico Quadrotor, iRobot Control, and Android Metamorphosis

IEEE Spectrum, 10OCT2014

The Ishikawa Watanabe Laboratory at the University of Tokyo is famous for combining high-speed vision and robotic manipulation. But now they're applying the same vision-based strategy to control a biped robot.

*Tags: Autonomous systems & robotics*

## BREAKTHROUGH TECHNOLOGY

### Discovery of new subatomic particle, type of meson, to 'transform' understanding of fundamental force of nature

Science Daily, 08OCT2014

Led by scientists from the UK, the discovery of the new particle will help provide greater understanding of the strong interaction, the fundamental force of nature found within the protons of an atom's nucleus. The new particle is bound together in a similar way to protons. Due to this similarity, scientists will be able to study the particle to further understand strong interactions. TECHNICAL ARTICLE 1, 2

*Tags: Breakthrough technology, Particle physics*

## COMMUNICATIONS TECHNOLOGY

### Dolphin-inspired sonar overcomes size-wavelength limitation

PhysOrg.com, 08OCT2014

An international team of researchers (USA, China) has designed and constructed a biomimetic sonar projector based on dolphin biosonar that achieves high directivity with a subwavelength sound source, overcoming the size-wavelength limitation. TECHNICAL ARTICLE

*Tags: Communications Technology, Biomimetics*

## ENERGY

### Ultra-fast charging batteries that can be 70% recharged in just two minutes

Science Daily, 13OCT2014

Researchers in Singapore replaced the traditional graphite used for the anode in lithium-ion batteries with a new gel material made from titanium dioxide. They developed a simple method to turn titanium dioxide particles into tiny nanotubes which help speed up the chemical reactions taking place in the new battery allowing for superfast charging. TECHNICAL ARTICLE

*Tags: Energy, Battery*

### Fusion reactor concept could be cheaper than coal

Science Daily, 08OCT2014

The reactor design, published by researchers at the University of Washington, builds on existing technology and creates a magnetic field within a closed space to hold plasma in place long enough for fusion to occur. This allows the hot plasma to react and burn. The reactor itself would be largely self-sustaining. Heat generated from the reactor would heat up a coolant that is used to spin a turbine and generate electricity, similar to how a typical power reactor works. TECHNICAL ARTICLE

*Tags: Energy, Nuclear energy*

## ENVIRONMENTAL SCIENCE

### Study of electrons in space could help weather forecasting

PhysOrg.com, 14OCT2014

Researchers in Finland report that during magnetic storms vast quantities of energetic electrons accelerate to high speeds and 'rain' into the atmosphere at the poles. The temporary, but frequent, ozone loss occurring as a result of these 'rains' may explain changes in wind patterns which affect regional winter temperatures in the Northern Hemisphere by a maximum of plus or minus 5 degrees centigrade.

*Tags: Environmental science, S&T Finland*

## IMAGING TECHNOLOGY

### Getting sharp images from dull detectors

Science Daily, 10OCT2014

Using incoherent light sent through a double-slit baffle, researchers at NIST and the University of New Mexico obtained an interference pattern with fringes as narrow as 30 nm. Achieving this kind of sharp interference pattern could be valuable for performing a variety of

*continued...*

"Every great advance in science has issued from a new audacity of imagination."

JOHN DEWEY

high-precision physics and astronomy measurements. TECHNICAL ARTICLE

*Tags: Imaging technology*

## INFORMATION TECHNOLOGY

### Programming computers in everyday language

Science Daily, 13OCT2014

Computer scientists are now working on software that directly translates natural language into machine-readable source texts. A new analysis tool developed by researchers in Germany serves to automatically order the commands in the way they are to be executed by the computer. They are working on software that installs a language interface for any type of program. Users are enabled not only to open, but also to operate their apps by spoken commands. TECHNICAL ARTICLE

*Tags: Information Technology, S&T Germany*

## MATERIALS SCIENCE

### Giant spin-splitting on the surface of strontium titanate

PhysOrg.com, 14OCT2014

An international team of researchers (Switzerland, Italy, Germany) has now revealed that the surface's electrons come in two basic forms: electrons of a 2D character, which can move in two dimensions parallel to the surface, and electrons of a 3D character, which penetrate deeper into the material. The large amount of energy required to move the electrons from one band to the other came as a surprise. This property makes strontium titanate an important base material for applications in spintronics. TECHNICAL ARTICLE

*Tags: Materials science*

### Unique catalysts for hydrogen fuel cells synthesized in ordinary kitchen microwave oven

PhysOrg.com, 14OCT2014

An international team of researchers (Sweden, China) show how a unique nano-alloy composed of palladium nano-islands embedded in tungsten nanoparticles creates a new type of catalysts for highly efficient oxygen reduction, the most important reaction in hydrogen fuel cells. TECHNICAL ARTICLE

*Tags: Materials science*

### Solid nanoparticles can deform like a liquid

MIT News, 11OCT2014

Researchers have found a surprising phenomenon in metal nanoparticles: They appear, from the outside, to be liquid droplets, wobbling and readily changing shape, while their interiors retain a perfectly stable crystal configuration. The work could have important implications for the design of components in nanotechnology, such as metal contacts for molecular electronic circuits. TECHNICAL ARTICLE

*Tags: Materials science, Advanced materials*

### Unstoppable magnetoresistance

Science Daily, 09OCT2014

Researchers at Princeton University exposed WTe2 to a 60-tesla magnetic field and observed a magnetoresistance of 13 million percent. The material's magnetoresistance displayed unlimited growth, making it the only known material without a saturation point. TECHNICAL ARTICLE

*Tags: Materials science*

## NEUROSCIENCE

### Manipulating memory with light: Scientists erase specific memories in mice

Science Daily, 09OCT2014

Researchers at UC Davis have used light to erase a specific memory in mice, showing how the hippocampus and cortex work together to retrieve memories. TECHNICAL ARTICLE

*Tags: Neuroscience*

### Remotely controlling brain cells with nanoparticle-based radiogenetics

Nanowerk, 08OCT2014

A proposal by researchers at Rockefeller University to develop a new way to remotely control brain cells is among the first to receive funding from the BRAIN initiative. The project will make use of radiogenetics that combines the use of radio waves or magnetic fields with nanoparticles to turn neurons on or off.

*Tags: Neuroscience*

## PHOTONICS

### Revving up fluorescence for superfast LEDs: Researchers set speed record for molecular fluorescence

PhysOrg.com, 12OCT2014

Researchers at Duke University have made fluorescent molecules emit photons of light 1,000 times faster than normal—setting a speed record and making an important step toward realizing superfast LEDs and quantum cryptography. TECHNICAL ARTICLE

*Tags: Photonics*

*continued...*

## QUANTUM SCIENCE

### Quantum test strengthens support for EPR steering

PhysOrg.com, 14OCT2014

An international team of researchers (China, Singapore) have experimentally demonstrated EPR (Einstein-Podolsky-Rosen) steering using a new method that requires fewer measurements and provides a stronger validation of steering. The new technique is based on an "all-versus-nothing" (AVN) steering, which does not require inequalities. Using this criteria, the researchers could verify whether states are steerable or not. TECHNICAL ARTICLE

*Tags: Quantum science*

## Featured Resource

### Materials Project

**The Materials Project provides open web-based access to computed information on known and predicted materials as well as powerful analysis tools to inspire and design novel materials.**

### A novel platform for future spintronic technologies

PhysOrg.com, 12OCT2014

An international team of researchers (France, Switzerland) have discovered that a common insulating material behaves as a perfect spintronic conductor because it is not affected by background electron charge. In addition, the material's properties make it an ideal platform for directly observing a strange subatomic particle that could one day lead to a different, more stable type of quantum computer. TECHNICAL ARTICLE

*Tags: Quantum science*

### Australian teams set new records for silicon quantum computing (w/video)

Nanowerk, 12OCT2014

Researchers in Australia created two types of quantum qubits providing two parallel pathways for building a quantum computer in silicon with an accuracy above 99%. TECHNICAL ARTICLE 1, 2

*Tags: Quantum science, S&T Australia*

### Rare 'baby rattle' molecules reveal new quantum properties of H2O and H2

Science Daily, 10OCT2014

Researchers in the UK inserted small molecules, such as water and hydrogen, into C-60 buckyballs to form rare compounds ideal for testing the predictions of quantum theory. Similar confinement techniques could open the door to new insights about the quantum properties of molecules by providing a unique testing ground for quantum theory. TECHNICAL ARTICLE

*Tags: Quantum science, S&T UK*

## S&T POLICY

### The Scientific Competitiveness of Nations

arXiv, 19SEP2014

Researchers in Italy used citation data of scientific articles produced by individual nations in different scientific domains to determine the structure and efficiency of national research systems. They found that technologically leading nations, beyond having the largest production of scientific papers and the largest number of citations, do not specialize in a few scientific domains, but diversify.

*Tags: S&T policy*

## SCIENCE WITHOUT BORDERS

### Hawking radiation mimicked in the lab

Nature News, 12OCT2014

Researchers in Israel used a collection of rubidium atoms chilled to less than 1-billionth of a degree above absolute zero, manipulated them to a stand-in for the gravitational event horizon. Pairs of sound waves pop in and out of existence in a laboratory vacuum, mimicking particle-antiparticle pairs in the vacuum of space. Those that form astride this sonic event horizon become the equivalent of Hawking radiation.

*Tags: Science without borders*

### Researchers develop small but powerful piezohydraulic actuator

PhysOrg.com, 09OCT2014

Researchers at Siemens have developed a small but powerful piezohydraulic actuator. Although it is only about nine centimeters long, it can apply a force of more than 150 newtons—equivalent to a weight of 15 kilograms. Such actuators are used to operate valves and flaps, for example, and can also be employed in robots.

*Tags: Science without borders*

### International collaborations produce more influential science, analysis finds

Science Daily, 08OCT2014

In a new analysis calculating the scientific impact of 1.25 million journal articles, researchers at the University of Chicago found that papers with authors from multiple countries are cited more often and more likely to both appear in prestigious journals. This analysis provides a new perspective on the changing global landscape of scientific influence. TECHNICAL ARTICLE

*Tags: Science without borders*

*continued...*

## SENSORS

### Sensor invented that uses radio waves to detect subtle changes in pressure

Science Daily, 10OCT2014

Researchers at Stanford University have developed a sensor made of a special rubber layer between two strips of copper that act like radio antennas. Radio waves beamed through the device change frequency as pressure changes, providing a way to gauge pressure wirelessly. The underlying technology could lead to prosthetic devices with an electronic sense of touch. TECHNICAL ARTICLE

*Tags: Sensors*

### Using Light Frequencies to Sniff Out Deadly Materials from a Distance

DARPA News, 08OCT2014

DARPA issued a solicitation for proposals responsive to its Spectral Combs from UV to THz (SCOUT) program, which seeks new capabilities for highly sensitive remote detection of multiple biological or chemical agents in liquid or gaseous forms.

*Tags: Sensors*

### Quantum probe enhances electric field measurements

Nanowerk, 07OCT2014

The new method, developed by researchers at NIST and the University of Michigan, could improve the sensitivity, precision and ease of tests and calibrations of antennas, sensors, biomedical and nano-electronic systems, measurements of frequencies above 100 GHZ, in the millimeter wave and sub-terahertz bands and facilitate the design of novel devices. TECHNICAL ARTICLE

*Tags: Sensors, Government S&T*

### Sensitive room-temperature terahertz detection via the photothermoelectric effect in graphene

Nature Nanotechnology, 14SEP2014

An international team of researchers (US, Australia) demonstrates a graphene thermoelectric terahertz photodetector with sensitivity exceeding 10 V W–1 (700 V W–1) at room temperature and noise-equivalent power less than 1,100 pW Hz–1/2 (20 pW Hz–1/2), referenced to the incident (absorbed) power. This implies a performance that is competitive with the best room-temperature terahertz detectors for an optimally coupled device.

*Tags: Sensors* ■

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