



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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## FEATURE ARTICLES

### [Researchers invent 'meta mirror' to help advance nonlinear optical systems](#)

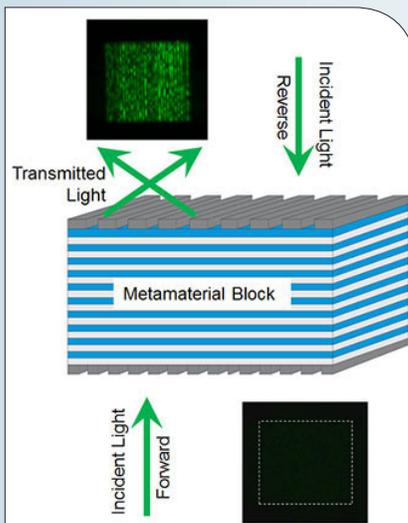
[Science Daily, 02JUL2014](#)

Researchers at UT Austin created thin-film metamaterials and demonstrated its strong nonlinear optical response by realizing a 400-nanometer-thick nonlinear mirror that reflects radiation at twice the input light frequency. [TECHNICAL ARTICLE](#)

*Tags: Photonics, Featured Article*

### [New metamaterial gives light a one-way ticket](#)

[Nanowerk, 01JUL2014](#)



*Schematic of NIST's one-way metamaterial. Forward travelling green light (left) or red light passes through the multilayered block and comes out at an angle due to diffraction off of grates on the surface of the material. Light travelling in the opposite direction (right) is almost completely filtered by the metamaterial and can't pass through. (Image: Xu/NIST)*

Researchers at NIST have built a silver, glass and chromium nanostructure that can all but stop visible light cold in one direction while giving it a pass in the other. The device could someday play a role in optical information processing and in novel biosensing devices. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials,*

*Government S&T, Photonics, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MATERIALS

#### [Nanotechnology that will impact the Security and Defense sectors to be discussed at NanoSD2014](#)

[Nanowerk, 08JUL2014](#)

[NanoSD2014](#) will be held in Avila, Spain (September 23-26, 2014). A broad range of defense and security technologies and applications, such as nanostructures, nanosensors, nano energy sources, and nanoelectronics will be discussed. [Speakers](#)

*Tags: Advanced materials*

#### [A solitary superconductor emerges under pressure](#)

[PhysOrg.com, 04JUL2014](#)

Researchers in Japan have now realized a crucial goal in the search for metal-like organic molecules by uncovering the first molecular superconductor containing only one component. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, S&T Japan*

#### [Researchers observe tunable quantum behavior in bilayer graphene](#)

[Nanowerk, 03JUL2014](#)

Researchers at Columbia University demonstrated the existence of the fractional quantum Hall effect in bilayer graphene and show evidence of a controllable phase transition by application of electric fields. The discovery provides a completely new way to manipulate the fractional quantum Hall States. In particular, theory predicts that it should be possible to create exotic 'non-abelian' states that could be used for quantum computation. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Quantum science*

### **With ‘ribbons’ of graphene, width matters: A narrow enough ribbon will transform a high-performance conductor into a semiconductor**

Science Daily, 03JUL2014

Researchers at the University of Wisconsin have found a novel way to “tune” graphene causing the extremely efficient conductor of electricity to act as a semiconductor. Their method could be used to produce nano-devices.

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

### **Inspired by nature, researchers create tougher metal materials**

Science Daily, 02JUL2014

Researchers at North Carolina State University have found that by gradually changing the internal structure of metals they can make stronger, tougher materials that can be customized for a wide variety of applications—from body armor to automobile parts. [TECHNICAL ARTICLE 1, 2](#)

*Tags: Advanced materials, Materials science*

### **Making graphene from plastic**

Science Daily, 02JUL2014

Researchers in South Korea have developed a carbon material without artificial defects commonly found during the production process of graphene while retaining its original characteristics. The new material can be used as a substitute for graphene in solar cells and semiconductor chips. The process is based on the continuous and mass-produced process of carbon fiber, making it much easier for full-scale commercialization.

*Tags: Advanced materials*

### **Superconducting-silicon qubits: Using a bottom-up approach to make hybrid quantum devices**

Science Daily, 02JUL2014

Researchers at the University of Maryland have shown how superconducting qubits and devices can be constructed out of silicon. Doing so can potentially combine the good quantum properties of silicon and the ubiquity of semiconductor technology with the flexibility of superconducting devices. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

### **Super-Slick Material Stops Ice from Forming**

MIT Technology Review, 02JUL2014

While the pitcher plant uses water to form a slick surface, researchers at Harvard University use a variety of lubricants. The lubricant clings to the nanostructures and forms an extremely thin liquid film on the surfaces that is perfectly smooth, far more so than any solid surface could be. What’s more, if the material is scratched, the liquid flows over the scratch and the material maintains its slipperiness.

*Tags: Advanced materials*

## AUTONOMOUS SYSTEMS & ROBOTICS

### **Muscle-powered bio-bots walk on command**

Science Daily, 01JUL2014

Researchers at the University of Illinois at Urbana-Champaign have demonstrated a class of walking ‘bio-bots’ powered by muscle cells and controlled with electrical pulses, giving researchers unprecedented command over their function. [TECHNICAL ARTICLE](#)

*Tags: Autonomous systems & robotics*

## BIG DATA

### **‘Deep learning’ makes search for exotic particles easier: New computing techniques could aid hunt for Higgs bosons**

Science Daily, 02JUL2014

Currently, physicists devise by hand mathematical formulas that they apply to the data to derive the features they’re looking for, which are then fed to machine learning programs. By employing recent advances in deep learning, in which computers learn automatically at multiple processing levels, the UC Irvine researchers eliminated the need for the time-consuming manual creation of those formulas. [TECHNICAL ARTICLE](#)

*Tags: Big data*

## COMMUNICATIONS TECHNOLOGY

### **Oulu team explores magnetic communication for smartphones**

PhysOrg.com, 06JUL2014

Researchers in Finland built a test electromagnet system that communicated with Android phones. They encoded data in a varying magnetic field and transmitted items such as a web address and MIDI music sequence from the electromagnet to the phone. [TECHNICAL ARTICLE](#)

*Tags: Communications Technology, S&T Finland*

### **Smarter Pulse Shaping for Fiber Optics**

American Physical Society Spotlight, 01JUL2014

Researchers in the UK modeled the passage of light through an optical fiber using the nonlinear Schrödinger equation and found a set of signal waveforms that behave like sinusoidal waves in a fiber with no nonlinearities. As a proof of concept they simulated the transmission and sent a sequence of signals along a 2000-kilometer fiber and showed that the signals arrived without distortion. [TECHNICAL ARTICLE](#)

*Tags: Communications Technology, S&T UK*

“The scientist is motivated primarily by curiosity and a desire for truth.”

IRVING LANGMUIR

## CYBER SECURITY

### **Censorship? Researchers develop ‘Encore’ to monitor Web access**

Science Daily, 02JUL2014

Researchers at Georgia Institute of Technology have developed a tool called Encore, which runs when a user visits a website where the code is installed and then discreetly collects data from potentially censored sites. The researchers hope the data they collect will allow them to determine the wheres, whens and hows of what’s blocked, as well as identify ways to get around restricted access.

More information

Tags: Cyber security

## ENERGY

### **Silicon sponge improves lithium-ion battery perform**

PhysOrg.com, 08JUL2014

Researchers from DOE’s Pacific Northwest Laboratory and UC San Diego replaced graphite used in the battery’s electrode with a porous sponge-like material. The porous material gives silicon the room to expand without breaking.

TECHNICAL ARTICLE

Tags: Energy, Battery, Government S&T

### **Solar energy gets a boost: ‘Singlet fission’ can increase solar cell efficiency by as much as 30 percent**

Science Daily, 08JUL2014

Researchers at UC Riverside propose that “singlet fission,” a process in which a single photon generates a pair of excited states, has the potential to overcome the Shockley-Queisser Limit and boost solar cell efficiency by as much as 30 percent.

TECHNICAL ARTICLE

Tags: Energy, Breakthrough technology, Solar energy

### **Using sand to improve battery performance**

Science Daily, 08JUL2014

Researchers at UC Riverside have developed a better method to produce nanoscale silicon using sand with a high percentage of quartz. Improved performance could mean expanding the expected lifespan of silicon-based electric vehicle batteries up to 3 times or more.

TECHNICAL ARTICLE

Tags: Energy, Battery

### **Engineering researchers develop next-generation battery**

PhysOrg.com, 07JUL2014

Researchers in Canada used carbon nanomaterial to develop next-generation batteries capable of charging faster and lasting longer than today’s standard lithium-ion batteries. The new battery also performs better than two other future technologies: lithium-sulfur batteries, currently in the prototype stage, and lithium-air batteries, now under development.

TECHNICAL ARTICLE

Tags: Energy, Battery, S&T Canada

### **Solar cells – powered by nanoholes**

Nanowerk, 02JUL2014

Researchers in Singapore have improved the manufacturing of silicon ‘nanoholes’ that have enhanced mechanical and light-harvesting capabilities. Solar activity of the cells depends on nanohole depth. Nanoholes are particularly effective at capturing light because photons can ricochet many times inside these openings until absorption occurs.

TECHNICAL ARTICLE

Tags: Energy, Solar energy

## INFORMATION TECHNOLOGY

### **How An Intelligent Thimble Could Replace the Mouse In 3D Virtual Reality Worlds**

MIT Technology Review, 03JUL2014

Researchers at the University of Wyoming have created an intelligent thimble that can sense its position accurately in three-dimensions and respond to a set of preprogrammed gestures that allow the user to interact with objects in a virtual three-dimensional world.

TECHNICAL ARTICLE

Tags: Information Technology, Sensors

## MATERIALS SCIENCE

### **A room-temperature alternative to reducing the thermal conductivity of crystalline silicon**

Nanowerk, 07JUL2014

An international team of researchers (USA, Japan) shows that bulk single crystalline silicon, when subjected to intense plastic strain through high-pressure torsion processing, shows a reduction in thermal conductivity from its intrinsic single crystalline value by a factor of 20.

TECHNICAL ARTICLE

Tags: Materials science

**Solid-state physics: Consider the ‘anticrystal’**

Science Daily, 07JUL2014

Researchers at the University of Pennsylvania have evidence that a new concept should undergird our understanding of most materials: the anticroystal, a theoretical solid that is completely disordered. Their work suggests that, when trying to understand a real material’s mechanical properties, scientists would be better served in many cases by starting with the framework of the anticroystal and adding order, rather than starting with a perfect crystal and adding disorder. [TECHNICAL ARTICLE](#)

Tags: Materials science

**The quantum dance of oxygen: Proposal for a new phase of the element, when atoms dance in quartets**

Science Daily, 07JUL2014

Researchers in Italy report that under extremely high pressure conditions oxygen molecules group into quartets and give rise to a “dance of their magnetic moments”. This results in magnetic properties never previously observed in these conditions and in theory points to the existence of a new phase of the element, called epsilon 1. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&amp;T Italy

**FEATURED RESOURCE****e! Science News**

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**MICROELECTRONICS****Project at IBM looks to carbon nanotube future**

PhysOrg.com, 02JUL2014

IBM scientists are now examining the basic properties of carbon nanotubes and the feasibility of using them as the basis for a new class of nanoelectronic devices. Semiconductor industry experts say that soon after 2020, transistors must have features as small as five nanometers to keep up with the miniaturization of computer chips.

Tags: Microelectronics

**Toward a new way to keep electronics from overheating**

Science Daily, 02JUL2014

Researchers in Malaysia tested three nanofluids as coolants and found that all three performed better than water as coolants with the nanofluid mixture of copper oxide and water topping them all. [TECHNICAL ARTICLE](#)

Tags: Microelectronics

**NEUROSCIENCE****A Speech Synthesizer Direct to the Brain**

MIT Technology Review, 09JUL2014

Over the last five years, research effort at U.S. universities has proved that recording devices placed under the skull can capture brain activity associated with speaking. Furthering the effort, researchers at UC San Francisco are working toward building a wireless brain-machine interface that could translate brain signals directly into audible speech using a voice synthesizer.

Tags: Neuroscience

**New computer software corrects a wandering mind**

Science Alert (Australia), 06JUL2014

Researchers at the University of Notre Dame have developed an interface that’s intelligent enough to pick up on what looks like waning concentration. It will pause the session, send a notification to the user and highlight the missed content for them to read over again.

Tags: Neuroscience

**Do not disturb! How the brain filters out distractions**

Science Daily, 03JUL2014

Researchers in Germany have shown division of labor among different parts of the brain when it comes to using the working memory. Nerve cells in the parietal cortex simply suppress the distraction, while nerve cells in the prefrontal cortex allow themselves to be momentarily distracted—only to return immediately to the truly important memory content. [TECHNICAL ARTICLE](#)

Tags: Neuroscience, S&amp;T Germany

**PHOTONICS****Metamaterial mirrors in optoelectronic devices**

Nature, 03JUL2014

The phase reversal that occurs when light is reflected from a metallic mirror produces a standing wave with reduced intensity near the reflective surface. An international team of researchers (USA, the Netherlands) shows that this challenge can be circumvented by using a metamaterial mirror whose reflection phase is tunable from that of a perfect electric mirror ( $\varphi = \pi$ ) to that of a perfect magnetic mirror ( $\varphi = 0$ ).

Tags: Photonics

*continued...*

**Hollow optical fibers for UV light**

Science Daily, 02JUL2014

Researchers in Germany have tested a new type of optical fiber with a hollow core and have found that this type of optical fiber was able to guide UV laser light without being damaged and with acceptable loss. Among other applications the discovery could be useful for researchers who are developing quantum computers. [TECHNICAL ARTICLE](#)

Tags: *Photonics, Advanced materials*

**Overcoming light scattering: New optical system sees deeper inside tissue**

Science Daily, 02JUL2014

Researchers in Spain have developed a single-pixel optical system based on compressive sensing that can overcome the fundamental limitations imposed by scattering. [TECHNICAL ARTICLE](#)

Tags: *Photonics*

**QUANTUM SCIENCE****Remote quantum applications, teleportation enabled by calling long distance between superconducting qubits**

PhysOrg.com, 04JUL2014

Researchers in Australia have developed a way for superconducting quantum chips to talk to each other over large distances through an optical fibre, allowing quantum entanglement or teleportation—both key steps towards building a truly global quantum internet via a quantum repeater. [TECHNICAL ARTICLE](#)

Tags: *Quantum science, S&T Australia*

**S&T POLICY****Forecasting the development of breakthrough technologies to enable novel space missions**

Science Daily, 04JUL2014

European Science Foundation's report on breakthrough technologies in the non-space sector identifies five overwhelming drivers: 1. Reduce mass, maintain stiffness; 2. Build a spacecraft and missions that can last 50 years; 3. Deploy a 30m+ telescope into space; 4. Enable humans to stay in space for more than 2 years; 5. Autonomous geophysical survey of planets. [Technological Breakthroughs for Scientific Progress \(TECHBREAK\)](#).

Tags: *S&T policy, S&T EU* ■

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