



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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## FEATURE ARTICLES

### Physicists create lightning in the race to develop quantum technology microchip

[PhysOrg.com](#),  
07APR2014

Researchers in the UK

have been able to create a new microchip design that is capable of hosting a lattice of individually charged atoms that are held by electric fields emitted from the surface of the microchip. This may be the key for developing next-generation, super-fast quantum computers.

**TECHNICAL ARTICLE**

*Tags: Microelectronics, Quantum science, S&T UK, Featured Article*

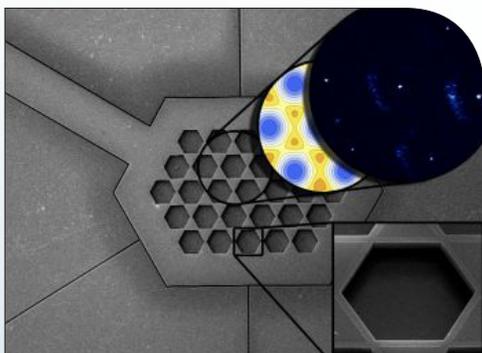
### Quantum melting

[PhysOrg.com](#), 07APR2014

An international team of researchers (Switzerland, Britain, France, China) has specifically altered the magnetic structure of the material  $TlCuCl_3$  by exposing it to a varying external pressure at different temperatures. By performing neutron-scattering measurements, they could observe what happens during a quantum phase transition, and compare the “quantum melting” of the magnetic structure with the classical “thermal melting” phase transition. Quantum-mechanical phase transitions are the key to many of the most exotic phenomena in solid-state physics, including high-temperature superconductivity.

**TECHNICAL ARTICLE**

*Tags: Quantum science, Featured Article*



Picture of the microchip with a close-up view in the right bottom inset. A two-dimensional chessboard lattice of individual charged atoms levitates just above the surface of the chip (shown in the top right inset).

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### 3-D printing trials of unmanned aircraft broaden possibilities for this emergent technology

[Science Daily](#), 08APR2014

Engineers in the UK have successfully printed a 1.5m-wide prototype UAV for a research project looking at 3D printing of complex designs. The engineers said the polymer craft could form the basis of cheap and potentially disposable UAVs that could be built and deployed in remote situations potentially within as little as 24 hours.

*Tags: Advanced manufacturing, S&T UK*

#### Chinese company prints parts for ten houses and builds them all in one day

[PhysOrg.com](#), 07APR2014

A company in China prints basic parts using concrete as ink. The parts dry quickly and can then be used to assemble a complete 2,100 square foot house at a cost of approximately \$4,800 per house. It uses a giant printer—it’s 490 feet long by 33 feet wide and 20 feet deep—and unlike other companies, plans to use its printer to start printing parts for real houses for sale to consumers.

*Tags: Advanced manufacturing, S&T China*

### ADVANCED MATERIALS

#### Recent Advances in Nanomaterial Fabrication – Review article

[IOP Science](#), 06APR2014

As nanostructures with well-controlled dimension, composition, and crystallinity are expected to be a new class of intriguing system for investigating structure-property relations, this review article provides a comprehensive review of researches of these materials and related applications.

*Tags: Advanced materials, Nanotechnology*

*continued...*

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## **Self-assembled silver superlattices create molecular machines with hydrogen-bond 'hinges' and moving 'gears'**

Science Daily, 06APR2014

Researches at the Georgia Institute of Technology have shown that self-assembled silver-based structures known as superlattices have an unusual and unexpected behavior: arrays of gear-like molecular-scale machines that rotate in unison when pressure is applied to them. Materials containing the gear-like nanoparticles—each composed of nearly 500 atoms—might be useful for molecular-scale switching, sensing and even energy absorption. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials*

## **Materials, electronics that dissolve when triggered being developed**

Science Daily, 04APR2014

Researchers at Iowa State University are developing “transient materials” and “transient electronics” that can quickly and completely melt away when a trigger is activated. One day you could send out a signal to destroy a lost credit card, or when soldiers are wounded, their electronic devices could be remotely triggered to melt away, securing sensitive military information. The field of study is very new, but progress is being made. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials*

## **Researchers probe the next generation of 2-D materials**

Science Daily, 03APR2014

A group of researchers in the US are studying molybdenum disulfide (MoS<sub>2</sub>), which is part of a wider group of materials known as transition metal dichalcogenides, as a potential building block for the next generation of low-cost electrical devices. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials*

## **AUTONOMOUS SYSTEMS & ROBOTICS**

### **A bird? A plane? Or both? Bio-inspired unmanned aircraft capable of soaring like birds**

Science Daily, 07APR2014

The long-term goal of the Australian team of researchers is to design an unmanned aircraft that could autonomously predict airflows in its surrounding environment and—by using this information—minimise its energy consumption, maximise its endurance and avoid areas of high turbulence.

Tags: *Autonomous systems & robotics, S&T Australia*

### **Darpa's Robots Could Soon Assemble Satellites in Space**

Wired , 04APR2014

Under its new Phoenix program, which recently completed Phase 1 testing, Darpa is totally rethinking how the U.S. builds and maintains its satellite fleet. The idea is for

robots to assemble modular satellite architecture, called satlets, that weigh about 15 pounds and contain the satellite functionality such as the power supply, controls and sensors. All of this is delivered on the Payload Orbital Delivery (POD) system, which is meant to be easily and quickly deployable.

Tags: *Autonomous systems & robotics, Government S&T, Satellite technology, Space technology*

## **BIOTECHNOLOGY**

### **Army's injectable bandage can stop heavy bleeding during 'the golden hour'**

Defense Systems, 07APR2014

XSTAT, developed by the US Army, looks like a large syringe and contains small cellulose sponges that, once injected, expand to fill a wound. Designed for use against large, deep injuries, it is intended to be used on wounds around joints such as the shoulder or groin, where medics couldn't apply a tourniquet, or wounds that are too deep for a dressing.

Tags: *Biotechnology, Government S&T, Military technology*

### **Forget Smart Watches, 'Smart Skin' May Be the Next Big Thing in Wearable Computers**

Science Magazine, 03APR2014

Although these recent innovations solve some of the problems facing wearable electronics, some key components such as batteries and processors do not yet have a flexible form suitable for skin patches. Researchers in South Korea are working on a method of using the wireless antennas in smartphones to transmit power over short distances with the potential to recharge or even replace batteries in wearable electronics.

Tags: *Biotechnology, Flexible electronics*

## **COMMUNICATIONS TECHNOLOGY**

### **Remote Troops Closer to Having High-Speed Wireless Networks Mounted on UAVs**

DARPA News, 07APR2014

DARPA's Mobile Hotspots program aims to develop a reliable, on-demand capability for establishing long-range, high-capacity reachback that is organic to tactical units. The program is building and demonstrating a scalable, mobile millimeter-wave communications backhaul network mounted on UAVs and providing a 1 Gb/s capacity.

Tags: *Communications Technology, Government S&T*

### **Quantum cryptography for mobile phones**

Science Daily, 03APR2014

The scheme designed by researchers in the UK relies on a protocol which allows robust exchange of quantum information through an unstable environment. The system uses photons as the information carrier and the scheme relies on integrated quantum circuits. [TECHNICAL ARTICLE](#)

Tags: *Communications Technology, Quantum science, S&T UK*

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“Science is simply common sense at its best, that is, rigidly accurate in observation, and merciless to fallacy in logic.”

THOMAS HENRY HUXLEY

### **Smart Node Pods for battlefield communications pass first test**

Defense Systems, 03APR2014

The Smart Node Pod is Northrop's solution for increasing communications capabilities on the front lines. The aircraft-mounted pod is designed to extend line-of-sight and beyond-line-of-sight, tactical data link and IP-based communications in the Joint Aerial Layer Network (JALN).

*Tags: Communications Technology, Military technology*

### **'Unbreakable' security codes inspired by nature**

Science Daily, 03APR2014

A revolutionary new method of encrypting confidential information has been patented by scientists in the UK inspired by their discoveries from human biology, which model how the heart and lungs coordinate their rhythms by passing information between each other. [TECHNICAL ARTICLE](#)

*Tags: Communications Technology, Cryptology, S&T UK*

## CYBER SECURITY

### **Scramble to fix huge 'heartbleed' security bug** bbc, 08APR2014

A bug in software used by millions of web servers could have exposed anyone visiting sites they hosted to spying and eavesdropping, say researchers. The bug is in a software library used in servers, operating systems and email and instant messaging systems. Called OpenSSL, the software is supposed to protect sensitive data as it travels back and forth. It is not clear how widespread exploitation of the bug has been because attacks leave no trace.

*Tags: Cyber security*

### **Personal touch signature makes mobile devices more secure**

Science Daily, 07APR2014

Researchers at the Georgia Institute of Technology have developed a new security system that continuously monitors how a user taps and swipes a mobile device. If the movements don't match the owner's tendencies, the system recognizes the differences and can be programmed to lock the device.

*Tags: Cyber security*

## ENERGY

### **Battery offers 30-second phone charging** BBC News, 08APR2014

The bio-organic battery developed by a company in Israel utilises tiny self-assembling nano-crystals. The battery is

currently only a prototype and the firm predicts it will take three years to become a commercially viable product.

*Tags: Energy, Battery*

### **Tiny power generator runs on spit**

Science Daily, 03APR2014

Researchers at Penn State have developed saliva-powered micro-sized microbial fuel cells which can produce minute amounts of energy sufficient to run on-chip applications. Biomedical devices using micro-sized microbial fuel cells would be portable and have their energy source available anywhere.

*Tags: Energy*

## ENVIRONMENTAL SCIENCE

### **'Like a giant elevator to the stratosphere:' Newly discovered atmospheric layer may impact Earth's climate**

Science Daily, 04APR2014

An international team of researchers led by Germany has discovered that many chemical compounds emitted at the ground pass unfiltered through the so-called 'detergent layer' of the atmosphere, known as the 'OH shield.' The newly discovered phenomenon over the South Seas boosts ozone depletion in the polar regions and could have a significant influence on the future climate of the Earth.

*Tags: Environmental science, Climatology*

## IMAGING TECHNOLOGY

### **New algorithm aids in both robot navigation and scene understanding**

Science Daily, 04APR2014

While navigating in unfamiliar territory one may lose sight of landmarks. By identifying the major orientations in 3-D scenes, a new algorithm developed by MIT researchers makes it easier to re-identify the landmarks when they reappear. The algorithm is primarily intended to aid robots navigating unfamiliar buildings. The same algorithm could also simplify the problem of scene understanding, one of the central challenges in computer vision research.

*Tags: Imaging technology*

## INFORMATION TECHNOLOGY

### **Future computers that are normally off**

Science Daily, 08APR2014

Quick power-up of computers requires using volatile devices that continue to devour energy after the initial power up. Researchers in Japan figured out a way to eliminate this energy loss by using a nonvolatile function

*continued...*

of advanced spin-transfer torque magnetoresistive random access memory (STT-MRAM) technology to create a new type of computer: a “normally off” one. [TECHNICAL ARTICLE](#)

*Tags: Information Technology, Energy, S&T Japan*

## FEATURED RESOURCE

### [Physics Central Features](#)

With Physics Central, members of the American Physical Society communicate the excitement and importance of physics to everyone. [RSS](#)

## MATERIALS SCIENCE

### [A new twist makes for better steel, researchers find](#)

[EurekaAlert, 08APR2014](#)

Twisting motion deforms the outside more than the inside, deformation twins form only toward the surface of the cylinder. The core remains essentially untouched. Researchers at Brown University partitioned the material into a hardened part near the surface and a softer part near the core. This doubled the strength without sacrificing ductility. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

### [Expanding particles to engineer defects: Adding larger particle to crystalline system can create order rather than distortions](#)

[Science Daily, 08APR2014](#)

A new study by researchers at Northwestern University finds how defects affect two-dimensional crystalline structures. The results hold information for designing new materials. The defects restored order, creating a “screen,” or buffer, to protect the rest of the structure from the stress of the added impurity. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

## MICROELECTRONICS

### [Groundbreaking optical device could enhance optical information processing, computers](#)

[Science Daily, 06APR2014](#)

A team of researchers at Washington University, St Louis, have created an optical diode by coupling tiny doughnut shaped optical resonators on a silicon chip. The diode is capable of completely eliminating light transmission in one direction and greatly enhancing light transmission in the other nonreciprocal light transmission. The device may lead to new and more powerful computers that run faster and cooler. [TECHNICAL ARTICLE](#)

*Tags: Microelectronics, Information technology*

### [Neuromorphic electronic circuits for building autonomous cognitive systems](#)

[arXiv, 25FEB2014](#)

The article reviews neuromorphic circuits for emulating neural and synaptic dynamics in real-time and discuss the role of biophysically realistic temporal dynamics in hardware neural processing architectures. The article also reviews the challenges of realizing spike-based plasticity mechanisms in real physical systems and present examples of analog electronic circuits that implement them.

*Tags: Microelectronics*

## NEUROSCIENCE

### [Social circuits that track how we like people, ideas](#)

[Science Daily, 07APR2014](#)

Researchers at the Cognitive Neuroscience Society in California report that we track people’s popularity largely through the brain region involved in anticipating rewards. They are working on forecasting which ideas will go viral and what kind of people and messages can best make that happen.

*Tags: Neuroscience*

### [Brain-on-a-chip](#)

[Nanowerk, 04APR2014](#)

Several research projects funded with millions of dollars are at work with the goal of developing brain-inspired computer architectures or virtual brains: DARPA’s SyNAPSE, the EU’s BrainScaleS (a successor to FACETS), and the Blue Brain project (one of the predecessors of the Human Brain Project) at Switzerland’s EPFL.

*Tags: Neuroscience*

## QUANTUM SCIENCE

### [Quantum computing: Quantum photon properties revealed in another particle – the plasmon](#)

[Science Daily, 04APR2014](#)

Results from a recent applied science study at Caltech support the idea that waveguides coupled with another quantum particle—the surface plasmon—could also become an important piece of the quantum computing puzzle. [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

### [Reflecting on an Alternative Quantum Theory](#) [American Physical Society Spotlight, 04APR2014](#)

Since 1998, physicists have explored a modified quantum theory based on spacetime reflections. This so-called PT symmetric theory makes certain predictions—such as time shortcuts in the evolution between two states—that conflict with conventional quantum mechanics, while still being compatible with observations. However, a new

assessment of this alternative model suggests that it is fundamentally flawed. [TECHNICAL ARTICLE](#)

*Tags: Quantum science*

## SCIENCE WITHOUT BORDERS

### [Thermodynamics Confronts Quantum Mechanics](#)

[American Physical Society Spotlight, 04APR2014](#)

Thermoelectric devices can potentially recapture useful energy from heat sources such as the hot exhaust gases of vehicles. If such devices are to remain relatively efficient while producing substantial power, they can't be any smaller than a minimum of perhaps a few millimeters across. This size limit is determined by the laws of quantum physics that govern the behavior of electrons, even though such quantum effects are usually associated with much smaller size scales. [TECHNICAL ARTICLE](#)

*Tags: Science without borders*

### [Fermi data tantalize with new clues to dark matter: Gamma rays from center of Milky Way galaxy](#)

[Science Daily, 03APR2014](#)

A team of researchers from the US (Fermilab, Harvard-Smithsonian, MIT, University of Chicago) have developed new maps showing that the galactic center produces more high-energy gamma rays than can be explained by known sources and that this excess emission is consistent with some forms of dark matter.

*Tags: Science without borders*

## SENSORS

### [Engineers design video game controller that can sense players' emotions \(w/ video\)](#)

[PhysOrg.com, 08APR2014](#)

Researchers at Stanford University have developed handheld game controllers that measure the player's physiology and alter the gameplay to make it more engaging. They replaced the controller in Xbox 360 with a 3-D printed plastic module packed with sensors. Sensors measure the user's heart rate, blood flow, and both the rate of breath and how deeply the user is breathing to alter the pace of game to better suit the player.

*Tags: Sensors*

### [Tiny wireless sensing device alerts users to telltale vapors remotely](#)

[Science Daily, 03APR2014](#)

Researchers at the Georgia Institute of Technology have developed a small electronic sensing device that can alert users wirelessly to the presence of chemical vapors in the atmosphere. The technology is aimed at myriad applications in military, commercial, environmental, healthcare and other areas.

*Tags: Sensors* ■

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