



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Acoustic Structure Could Evade Sonar](#)

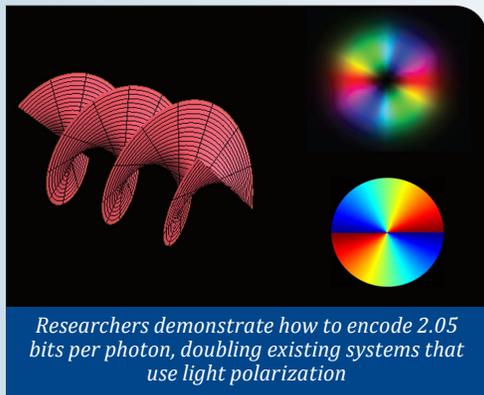
[American Physical Society Spotlight, 20MAR2015](#)

Topological insulators conduct electricity only along their surfaces and have a range of potential uses. Researchers in Singapore have proposed a structure that could do the same thing for sound waves, causing them to be guided in just one direction around the surface of a region and to ignore imperfections that would scatter the sound in an ordinary material. If it can be built, such a structure might find uses in acoustic technologies, such as soundproofing and sonar stealth systems. [TECHNICAL ARTICLE](#)

Tags: Sensors, Military technology, Featured Article

[New approach uses “twisted light” to increase the efficiency of quantum cryptography systems](#)

[University of Rochester, 20MAR2015](#)



Researchers demonstrate how to encode 2.05 bits per photon, doubling existing systems that use light polarization

An international team of researchers (USA, Austria, UK, Canada) developed a way to transfer 2.05 bits per photon by using “twisted light.” They used the orbital angular momentum of the photons to encode information, rather than the more commonly used polarization of light. The new approach doubles the 1 bit per photon that is possible with current systems that rely on light polarization. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications Technology, Featured Article

ADVANCED MATERIALS

[New processing technology converts used packing peanuts to battery components](#)

[Science Daily, 22MAR2015](#)

Researchers at Purdue University heated packing peanuts to between 500 and 900 degrees Celsius under inert atmosphere in the presence or absence of a transition metal salt catalyst and made anodes out of the resulting material. The anodes demonstrated a maximum specific capacity of 420 mAh/g (milliamp hours per gram), which is higher than the theoretical capacity of graphite (372 mAh/g). They were able to cycle it 300 times without significant capacity loss.

Tags: Advanced materials, Battery

AUTONOMOUS SYSTEMS & ROBOTICS

[Video Friday: Sneaky Humanoid, ROS Hexapod, and Beautiful RoboRavens](#)

[IEEE Spectrum, 20MAR2015](#)

This September, ESA astronauts will be controlling robotic rovers on Earth all the way from space.

Tags: Autonomous systems & robotics

CYBER SECURITY

[Images that fool computer vision raise security concerns](#)

[PhysOrg.com, 23MAR2015](#)

Computers are learning to recognize objects with near-human ability. But researchers at Cornell University have found that computers, like humans, can be fooled by an optical illusion, which raises security concerns and opens new avenues for research in computer vision.

Tags: Cyber security

[Stealing Data From Computers Using Heat](#)

[Wired, 23MAR2015](#)

Air-gapped systems, which are isolated from the Internet and are not connected to other systems that are connected to the Internet, are used in situations that

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demand high security because they make siphoning data from them difficult. Researchers in Israel have found a way to retrieve data from an air-gapped computer using only heat emissions and a computer's built-in thermal sensors. The method would allow attackers to surreptitiously siphon passwords, security keys, or send malicious commands.

Tags: Cyber security

China's shadowy cyber-warfare capabilities unmasked in official report

Digital Trends, 19MAR2015

In an unprecedented move, the People's Liberation Army has for the first time detailed the make-up of its digital military divisions, and they are more extensive than most would have imagined. In its latest publication of "The Science of Military Strategy" it has detailed three separate arms devoted to digital war making. This document which details China's military infrastructure is published once every few decades.

Tags: Cyber security, S&T China

ELECTRONIC WARFARE

New Army Tool Enhances Electronic Warfare Capabilities

Armed with Science, 22MAR2015

Army's Electronic Warfare Planning and Management Tool, or EWPMT, will allow for greater control and enhancement of EW capabilities. The tool will tightly integrate EW as a form of non-kinetic fires with existing kinetic capabilities. Once it is integrated into the mission command post, EWPMT will be able to quickly disseminate and receive information from other vital Department of Defense systems.

Tags: Electronic Warfare, Government S&T

ENERGY

Carbon-coated particles improve battery anode

Nanotechweb, 20MAR2015

A team of researchers in the US (Stanford University, SLAC National Accelerator Laboratory) reports that "non-filling" carbon-coated porous silicon microparticles might be used to make an ultrahigh performance lithium-ion battery anode material. As the microparticles prevent silicon from expanding during lithiation/delithiation, the electrode has a high reversible specific capacity of around 1500 mAh/g over 1000 cycles.

Tags: Energy, Battery

Lightweight Solar Power for Small Satellites

NASA STI, 20MAR2015

The novel solar cell array includes a thin and flexible photovoltaic cell applied to an inflatable structure to create a high surface area array for collecting solar energy in a lightweight, simple and deployable structure. The power density achievable in these small arrays is similar to that

of conventional high-power deployable/pointable arrays used on large satellites or space vehicles. NASA has built prototypes and tested functionality before and after inflation. **TECHNICAL ARTICLE**

Tags: Energy, Government S&T, NASA, Satellite technology

Putting batteries on stage spotlights performance at the nanoscale

Nanowerk, 20MAR2015

A team of researchers in the US (DOE's PNNL, Florida State University, UC Davis, Penn State) designed and implemented a small device, known as an operando electrochemical stage. Using this stage inside an aberration-corrected transmission electron microscope they can take nanoscale-resolution pictures of lithium ions as they are deposited on or dissolve off of an electrode while the battery runs. This information is vital to control performance- and safety-limiting processes. **TECHNICAL ARTICLE**

Tags: Energy, Government S&T

Three Technologies for Harvesting Ambient Energy

IEEE Spectrum, 20MAR2015

According to IDTechEx's analysts, the energy-harvesting industry is projected to grow to US \$2.6 billion by 2024. The harvesting show, sponsored by IDTechEx, was built around three main sources of energy and the technology used to tap them: mechanical energy, heat, and electromagnetic emissions.

Tags: Energy

Uncovering a reaction's secrets

Science Daily, 19MAR2015

Through experimental analysis and computer simulations, researchers in Singapore reveal new insights into the process by which ethanol produced from waste biomass can be converted into hydrogen in the presence of a catalyst. These insights should aid the design of more efficient catalysts for hydrogen production. **TECHNICAL ARTICLE**

Tags: Energy

ENVIRONMENTAL SCIENCE

Geoengineering proposal may backfire: Ocean pipes 'not cool,' would end up warming climate

Science Daily, 09MAR2015

There are a variety of proposals that involve using vertical ocean pipes to move seawater to the surface from the depths in order to reap different potential climate benefits. A new study from a group of Carnegie scientists has determined that these types of pipes could actually increase global warming quite drastically. **TECHNICAL ARTICLE**

Tags: Environmental science, Climatology

continued...

“And the only way to do great work is to love what you do.

If you haven't found it yet, keep looking.” STEVE JOBS

IMAGING TECHNOLOGY

[Sharper nanoscopy: What happens when a quantum dot looks in a mirror?](#)

Science Daily, 19MAR2015

Scattering limits the spatial resolution of a conventional microscope to no better than about one-half the wavelength of the light being used. Researchers at the University of Maryland report that if quantum dots, which emit single photons of light, are used close enough to the object meant to be mapped or imaged, nanometer-scale features can be resolved. This type of microscopy, called “Super-resolution imaging,” surmounts the standard diffraction limit. [TECHNICAL ARTICLE](#)

Tags: *Imaging technology*

INFORMATION TECHNOLOGY

[System to automatically find a common type of programming bug significantly outperforms its predecessors](#)

PhysOrg.com, 23MAR2015

Integer overflows are one of the most common bugs in computer programs—not only causing programs to crash but, even worse, potentially offering points of attack for malicious hackers. A new algorithm developed by researchers at MIT was tested on five common open-source programs, in which previous analyses had found three bugs. The new algorithm found all three known bugs—and 11 new ones. It will be presented at an upcoming ACM conference.

Tags: *Information Technology*

[Petaflops On Desktops: Ideas Wanted For Processing Paradigms That Accelerate Computer Simulations](#)

DARPA News, 19MAR2015

The standard computer cluster, equipped with multiple CPUs, each programmed to tackle a particular piece of a problem, is just not designed to solve the kinds of equations at the core of large-scale simulations, such as those describing complex fluid dynamics and plasmas. DARPA is interested in pursuing the somewhat counter-intuitive premise that “old fashioned” analog approaches may be part of the solution. [BAA](#)

Tags: *Information Technology, DARPA*

MATERIALS SCIENCE

[Landmark study proves that magnets can control heat and sound](#)

PhysOrg.com, 23MAR2015

Researchers at Ohio State University have shown that they can steer heat magnetically. With a strong enough magnetic field, it should be possible to steer sound waves too. The study is the first ever to prove that acoustic phonons have magnetic properties. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

[New transitory form of silica observed](#)

Science Daily, 20MAR2015

An international team of researchers (China, USA) demonstrated that under a range from 257,000 to 523,000 times normal atmospheric pressure a single crystal of coesite (high-temperature denser form of silica) transforms into four new, co-existing crystalline phases before finally recombining into a single phase that is denser than stishovite. This is the team's fifth newly discovered phase. The transition takes place at room temperature, rather than the extreme temperatures found deep in the earth.

[TECHNICAL ARTICLE](#)

Tags: *Materials science*

[High temp superconductivity: You can't play checkers with charge ordering](#)

Science Daily, 19MAR2015

Charge ordering creates instability in some metals at temperatures warmer than about -100 degrees Celsius, causing some electrons to reorganize into new periodical static patterns competing with superconductivity. An international team of researchers (Canada, Germany) found that it competes with superconductivity much more strongly along one direction than the other. The results are an important step in knowing what drives superconductivity and what may hinder it. [TECHNICAL ARTICLE](#)

Tags: *Materials science, S&T Canada*

[Metal oxidation controlled by atomic surface steps](#)

PhysOrg.com, 19MAR2015

A stepped structure composed of a series of flat terraces at different heights is common to all crystal surfaces. The steps are one atom high, but they can have a significant effect on material properties. A team of researchers in the US (State University of New York, Biola University, DOE's Brookhaven National Laboratory) demonstrated that atomic-height steps can play a key role in limiting

the onset of oxidation. This points to new avenues for controlling metal oxidation in applications ranging from catalysis to corrosion protection and microelectronics.

TECHNICAL ARTICLE

Tags: Materials science, Government S&T

How to make droplets chase each other and self-assemble into devices

[Physics World, 12MAR2015](#)

Researchers at Stanford University have shown that droplets can be made to chase each other around a track and even self-assemble into devices, simply by mixing two everyday liquids. The discovery could be exploited to create optical components that assemble themselves and even clean surfaces. TECHNICAL ARTICLE

Tags: Materials science

FEATURED RESOURCE

MIT Video

Developed and maintained by the MIT News Office, MIT Video aggregates and curates videos produced by the Institute's offices, laboratories, centers and administration; includes feature and editorial videos, event recordings, academic content and more.

MEDICAL SCIENCES

New test to revolutionise disease detection in people, crops and stock

[PhysOrg.com, 20MAR2015](#)

A single-drop DNA test invented by researchers in Australia works in a similar way to a pH test for swimming pools and gives a result in 90 minutes. It has already proved accurate in detecting human diseases such as HIV, malaria, tuberculosis, the H1N1 influenza virus, as well as E. coli in water, bovine herpes virus in cattle, and fusarium fungus in crops. TECHNICAL ARTICLE

Tags: Medical Sciences, S&T Australia

MICROELECTRONICS

New optical materials break digital connectivity barriers

[Science Daily, 18MAR2015](#)

Researchers in Israel report that nonlinear metamaterials which possess physical capabilities not found in nature may be the building blocks that allow moving from electronic to optical computing. They are currently exploring how to make the nonlinear interaction more efficient by using multilayered metamaterial structures and by examining different metamaterial building blocks. TECHNICAL ARTICLE

Tags: Microelectronics, Advanced materials

PHOTONICS

Scientists invent new way to control light, critical for next gen of super-fast computing

[Science Daily, 19MAR2015](#)

A team of researchers in the US (University of Central Florida, University of Texas, University of North Carolina) used direct laser writing, a kind of nanoscale 3D printing, to create the miniature lattices. The team then ran light beams through the lattices and confirmed that they could flow light without loss through turns that are twice as tight as any done previously. TECHNICAL ARTICLE

Tags: Photonics, Information technology

Diamond bull's-eye collects polarized photons at a rapid rate

[Physics World, 18MAR2015](#)

A team researchers in the US (MIT, Columbia University) has built a new optical grating shaped like a "bull's-eye" that is extremely efficient at collecting photons from diamond nitrogen vacancy (NV) centres. The device can collect nearly three million photons per second from a single NV, which is the highest value reported to date. The grating could find use in a number of emerging technologies including nanoscale sensors, single-photon sources and quantum memories. TECHNICAL ARTICLE

Tags: Photonics

QUANTUM SCIENCE

Opening a window on quantum gravity

[Technology Org, 23MAR2015](#)

Scientists know that friction plays an important part in producing classical behavior in macroscopic objects, but many suspect that gravity also suppresses quantum effects. To address this problem, researchers at Yale University will create a novel instrument that will enable a drop of liquid helium to exhibit quantum mechanical effects. The droplet will be five orders of magnitude more massive than any other object in which quantum effects have been observed; it will enable researchers to explore quantum behavior on unprecedentedly macroscopic scales.

Tags: Quantum science

Quantum correlation can imply causation (Update)

[PhysOrg.com, 23MAR2015](#)

An international team of researchers (Canada, Germany) reports that researchers measuring quantum variables can tell the difference between cause-effect and common cause in a system with only two variables, without making an active intervention on the first variable. It's too early to say how that may play out, but such quantum advantages underpin the promise of quantum technologies: quantum entanglement, for instance, underlies quantum cryptography, and quantum superposition underlies quantum computation. TECHNICAL ARTICLE

Tags: Quantum science

continued...

[Superfast computers a step closer as a silicon chip's quantum capabilities are improved](#)

Science Daily, 20MAR2015

An international team of researchers (UK, the Netherlands, Switzerland) has demonstrated laser control of quantum states in an ordinary silicon wafer and observation of these states via a conventional electrical measurement. They discovered that silicon provides a clean environment for the phosphorus atoms trapped inside where quantum information is being stored. The superposition state survives even when electrons are flying around the trapped atom while current was flowing through the chip. [TECHNICAL ARTICLE](#)

Tags: *Quantum science*

[Quantum dots 'breathe' in response to stress](#)

Science Daily, 19MAR2015

A team of researchers in the US (Stanford University, SLAC National Accelerator Laboratory, UC Berkeley) exposed spheres and nanowires made of cadmium sulfide and cadmium selenide to a burst of laser light. They were surprised to see the spheres and nanowires expand in width by about 1 percent and then quickly contract within femtoseconds. They also found that the nanowires don't expand in length. Knowing how materials change under strain can be used together with simulations to design new materials with novel properties. [TECHNICAL ARTICLE](#)

Tags: *Quantum science, Advanced materials*

SCIENCE WITHOUT BORDERS

[Flight control breakthrough could lead to safer air travel](#)

EurekAlert, 19MAR2015

Researchers at the University of Illinois at Urbana-Champaign tested Hovakimyan's L1 adaptive control technology on a manned aircraft—representing an important step toward the introduction of the technology into commercial aviation. In the presence of failures, the L1 controller was able to recover aircraft performance to a point where pilots were comfortable flying the jet.

Tags: *Science without borders*

SENSORS

[The welding system of the future is self-learning](#)

PhysOrg.com, 20MAR2015

The self-adjusting properties of the welding systems developed by researchers in Finland are based on a new kind of sensor system which is controlled by a neural network program. There are also monitoring sensors for the thermal profile and the weld form. The monitoring data is transferred from the sensors to the neural network, which is able to deduce and react to simultaneous changes in multiple variables.

Tags: *Sensors, S&T Finland* ■

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