



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

[Advanced materials \(8\)](#)

[Breakthrough technology \(1\)](#)

[Information technology \(2\)](#)

[Quantum science \(1\)](#)

[Autonomous systems
& robotics \(1\)](#)

[Cyber security \(2\)](#)

[Materials science \(5\)](#)

[Science without borders \(3\)](#)

[Biotechnology \(1\)](#)

[Energy \(2\)](#)

[Microelectronics \(5\)](#)

[Sensors \(1\)](#)

FEATURE ARTICLES

[Existence of new quantum matter theoretically predicted](#)

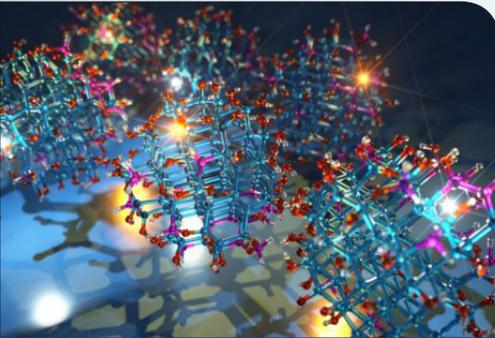
[Science Daily, 17JUN2015](#)

Researchers in Finland used the latest mathematical and physical models to predict the existence of a topological superconducting state on metallic superconducting surfaces and thin films. The results are important in the search for new quantum states and possible use in future electronics applications. [TECHNICAL ARTICLE](#)

Tags: Breakthrough technology, Advanced materials, S&T Finland, Featured Article

[What the blank makes quantum dots blink?](#)

[Science Daily, 15JUN2015](#)



In this illustration, silicon quantum dots are shown in various states of "blinking." The "on" crystals emit light (represented by a white dot) as an excited electron sheds excess energy as a photon. The "off" crystals are dark, because their electrons (yellow) are trapped in surface defects and siphon off energy through other paths, like heat or lattice vibrations. Credit: Illustration by Peter Allen, Institute for Molecular Engineering, University of Chicago

"Fluorescence intermittency" of quantum dots has put a damper on many potential applications. A team of researchers in the US (University of Chicago, UC Davis) offer new insights into the problem. Using ab initio calculations they predicted that Si

dangling bonds at the surface of oxidized nanoparticles introduce defect states which, depending on their charge and local stress conditions, may give rise to ON and OFF states responsible for exponential blinking statistics.

[TECHNICAL ARTICLE](#)

Tags: Quantum science, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Sweeping lasers snap together nanoscale geometric grids](#)

[Nanowerk, 23JUN2015](#)

Researchers at the DOE's Brookhaven National Laboratory have developed a new technique to rapidly create multi-layer nano-structured grids composed of different materials in virtually any geometric configuration with unprecedented versatility. By quickly and independently controlling the nanoscale structure and the composition, they can tailor the performance of these materials. The process can be easily adapted for large-scale applications. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T

[A magnetic-assisted, self-healing supercapacitor](#)

[Nanowerk, 19JUN2015](#)

Self-healing of a device includes materials self-healing plus alignment of electrodes, which is very difficult but essential. To realize this idea, researchers in China designed and fabricated an electrically and mechanically self-healable yarn-based supercapacitor by wrapping magnetic electrodes with a self-healing carboxylated polyurethane shell. The magnetic force assists the broken electrode's reconnection through magnetic alignment, which benefits the recovery of electrochemical performance after self-healing. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, S&T China

[First solar cell made of highly ordered molecular frameworks](#)

[Science Daily, 19JUN2015](#)

An international team of researchers (Germany, China, Japan) has produced MOFs based on porphyrines which have high efficiency in producing charge carriers, and high mobility. Computations made by the group suggest that the excellent properties of the solar cell result from the formation of indirect band gaps that play an

continued...

[BACK TO TOP](#)

important role in photovoltaics. The material is highly elastic and might also be used for the flexible coating of clothes and deformable components. [TECHNICAL ARTICLE](#)
Tags: Advanced materials, Solar energy

[NNI publishes workshop report and launches web portal on nanosensors](#)

EurekaAlert, 19JUN2015

The National Nanotechnology Coordination Office announced the launch of a workshop report and a web portal, "Nanotechnology for Sensors and Sensors for Nanotechnology: Improving and Protecting Health, Safety, and the Environment." Together, these resources help pave the path forward for the development and commercialization of nanotechnology-enabled sensors and sensors for nanotechnology.

Tags: Advanced materials, Nanotechnology, S&T Policy

[Novel nanosphere lithography to fabricate tunable plasmonic metasurfaces](#)

Nanowerk, 18JUN2015

Conventional NSL can only produce nanoparticles with simple shapes. An international team of researchers (Japan, USA) managed to circumvent the thermodynamical restriction by putting the monolayers in a confined environment and constructing the bilayers with sequential stacking, both of which are critical for the formation of the moire patterns. They were able to construct a variety of moire patterns from polystyrene nanosphere monolayers and subsequently employed the etched moire patterns as masks to fabricate various novel metasurfaces. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Hooked on phonons: Researchers measure graphene vibrations](#)

Nanowerk, 17JUN2015

To filter the phonons' signal from other distractions, an international team of researchers (USA, Taiwan, Japan) systematically altered the number of electrons moving through their graphene device. The unwanted signals also varied in energy, but the phonons remained fixed at their characteristic frequency. Using this technique the team was able to map all the graphene phonons. Understanding these vibrations is a critical step toward controlling future technologies based on graphene. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

[Hot nanostructures cool faster when they are physically close together](#)

Nanowerk, 17JUN2015

A team of researchers in the US (University of Colorado, Lawrence Berkeley National Laboratory) uncovered a new regime of thermal transport near nanoscale structures, where counterintuitively, nanoscale hot spots cool more

quickly when placed close together than when they are widely separated. This finding suggests new approaches for addressing the significant challenge of thermal management in nanosystems. [TECHNICAL ARTICLE](#)
Tags: Advanced materials, Materials science

[The super materials that could trump graphene](#)

Nature News, 17JUN2015

A wave of innovative flat materials is following in the wake of graphene but the most exciting applications could come from stacking them into 3D devices. Researchers in Switzerland showed that different combinations of the basic ingredients could produce transition-metal dichalcogenides (TMDCs) with a wide range of electronic and optical properties. Unlike graphene many TMDCs are semiconductors, meaning that they have the potential to be made into molecular-scale digital processors that are much more energy efficient than anything possible with silicon.

Tags: Advanced materials, S&T Switzerland

AUTONOMOUS SYSTEMS & ROBOTICS

[Video Friday: Small Bebionic Hand, RoboRaven at Night, and Pepper on Sale](#)

IEEE Spectrum, 19JUN2015

Quadcopters, built by researchers at the University of Maryland, perform synchronized aerial maneuvers using only basic onboard sensors and cameras rather than external motion-tracking cameras. The experimenters follow model-based systems engineering methods to create modular software that can autonomously launch, fly and land multiple aircraft. The methods also allow the quadcopters to respond to cues in the environment.

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

[Biomedical breakthrough: Carbon nanoparticles you can make at home](#)

EurekaAlert, 18JUN2015

Researchers at the University of Illinois-Urbana report that the new approach generates the particles in a few hours and uses only a handful of ingredients, including store-bought molasses. They scatter light in a manner that makes them easy to differentiate from human tissues, eliminating the need for added dyes or fluorescing molecules to help detect them in the body. The polymers can be loaded with drugs that are gradually released. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Advanced materials

“The scientist is not a person who gives the right answers, he is one who asks the right questions.” **CLAUDE LEVI-STRAUSS**

CYBER SECURITY

[This Radio Bug Can Steal Laptop Crypto Keys, Fits Inside a Pita](#)

Wired, 23JUN2015

The key-stealing device developed by researchers in Israel, which they call the Portable Instrument for Trace Acquisition, consists of a loop of wire to act as an antenna, a Rikomagic controller chip, a Funcube software defined radio, and batteries. It can be configured to either collect its cache of stolen data on an SD storage card or to transmit it via Wifi to a remote eavesdropper.

Tags: Cyber security

[New security technology for the ‘Internet of Things’](#)

EurekAlert, 18JUN2015

Researchers in Germany have developed “PHYSEC,” a technology based on a random number generator that grants two parties access to a synchronised sequence of random numbers. These keys are only shared by pairs of communication partners and not by all devices within the network. A mobile phone app will be available to include new devices into an already existing “Net of Things” secured by “PHYSEC.”

Tags: Cyber security, S&T Germany

ENERGY

[Toward tiny, solar-powered sensors](#)

MIT News, 22JUN2015

Researchers at MIT have developed a new power converter chip that can harvest more than 80 percent of the energy trickling into it. It can charge a battery and directly power a device. All of those operations also share a single inductor—the chip’s main electrical component—which saves on circuit board space but increases the circuit complexity even further. Nonetheless, the chip’s power consumption remains low.

Tags: Energy, Sensors

[Study Finds a Way to Prevent Fires in Next-Generation Lithium Batteries](#)

SLAC National Accelerator Laboratory, 17JUN2015

A team of researchers in the US (Stanford University, MIT, SLAC National Accelerator Laboratory) demonstrate that the growth of lithium dendrites can be suppressed by exploiting the reaction between lithium and lithium polysulfide. They show that a stable and uniform solid

electrolyte interphase layer is formed due to a synergetic effect of both lithium polysulfide and lithium nitrate as additives in ether-based electrolyte, preventing dendrite growth and minimizing electrolyte decomposition.

TECHNICAL ARTICLE

Tags: Energy, Battery

INFORMATION TECHNOLOGY

[Data transfer technology that increases speed of remote file access](#)

PhysOrg.com, 23JUN2015

By using the software developed by Fujitsu Laboratories that relays communications between the client and server, the number of communications made has been significantly reduced, lowering the effects of network latency. In an internal experiment, file transfers were confirmed to be up to ten times faster when dealing with multiple small files. Transfers of large files can be up to twenty times faster when combined with the deduplication technology.

Tags: Information Technology

[Google DeepMind Teaches Artificial Intelligence Machines to Read](#)

MIT Technology Review, 17JUN2015

Researchers at Google DeepMind in London say the special way that the Daily Mail and CNN write online news articles allows them to be used by deep learning machines to learn their trade from these vast databases that are carefully annotated for the purpose. And the sheer volume of articles available online creates for the first time, a database that computers can use to learn and then answer related questions. TECHNICAL ARTICLE

Tags: Information Technology, Artificial intelligence

MATERIALS SCIENCE

[Can heat be controlled as waves?](#)

Science Daily, 23JUN2015

A growing interest in thermoelectric materials and pressure to improve heat transfer from increasingly powerful microelectronic devices have led to improved theoretical and experimental understanding of how heat is transported through nanometer-scale materials. In this article researchers at the Georgia Institute of Technology describe recent developments and predict future advances in phonon wave interference and thermal bandgap materials. TECHNICAL ARTICLE

Tags: Materials science

[Varying the sliding properties of atoms on a surface](#)

PhysOrg.com, 23JUN2015

Researchers in Italy used atoms of xenon bound to one another to form two-dimensional islands deposited on a copper surface. At low temperatures these aggregates slide with virtually no friction. When they increased the size of the islands by adding xenon atoms, and until the whole available surface was covered, the friction decreased gradually. When the available space ran out, the addition of atoms caused the islands to compress, and resulted in an exceptional increase in friction. [TECHNICAL ARTICLE](#)

Tags: *Materials science, S&T Italy*

[‘Crumpled’ filter has potential to slash energy consumption in industry](#)

Science Daily, 19JUN2015

Researchers in the UK created a membrane with nanoscale crumples and established that this provides an increased surface area for filtering substances that remains strong and does not buckle, even under extreme pressures. Approximately 30 per cent of the world’s energy is currently used by industry, with a substantial fraction of that being used in evaporation and distillation processes. These industries could potentially make major energy savings if they used the membranes, with consequent reductions in carbon dioxide emissions.

[TECHNICAL ARTICLE](#)

Tags: *Materials science*

FEATURED RESOURCE

[PQDT Open](#)

PQDT Open provides the full text of open access dissertations and theses free of charge. The database can be searched under author, title, keywords, institution and limited by publication date.

[A new way to image surfaces on the nanoscale](#)

Nanowerk, 17JUN2015

An international team of researchers (USA, Australia) has developed a new imaging technique that uses atomic resolution secondary electron images in a quantitative way to determine the arrangement of atoms on the surface. Many important processes take place at surfaces, ranging from the catalysis used to generate energy-dense fuels from sunlight and carbon dioxide to how bridges and airplanes corrode, or rust. To understand these processes and improve material performance, it is vital to know how the atoms are arranged on surfaces.

[TECHNICAL ARTICLE](#)

Tags: *Materials science*

[Nanoparticles naturally present left- and right-handed versions](#)

PhysOrg.com, 17JUN2015

An international team of researchers (Russia, Ireland) has demonstrated that standard nanocrystals (cadmium selenide quantum dots and quantum rods), make up a racemic (50:50) mixture of ‘right’ and ‘left’ chiral forms. The discovery of this fundamental property in nanocrystals opens new horizons in nano- and bio-technology and medicine. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

MICROELECTRONICS

[The brains behind the chip that works like a brain](#)

PhysOrg.com, 23JUN2015

The chip developed by researchers in Australia has the ability to learn autonomously, evolve and associate information and respond to stimuli like a brain. It’s a hardware only solution, there is no software to slow things down. It could be used in applications including robotics, voice recognition, driverless cars, drones and smartphones.

Tags: *Microelectronics, S&T Australia*

[New spin on ‘silicon valleytronics’ could revolutionise future technologies](#)

PhysOrg.com, 22JUN2015

An international team of researchers (France, UK, Japan) addresses the electrons’ spin alignment in a magnetic field in silicon-on-insulator quantum wells under valley polarization. In stark contrast to expectations from a non-interacting model, they show experimentally that less magnetic field is required to fully spin polarize a valley-polarized system than a valley-degenerate one. This work is expected to feed into the flurry of research into the development of valleytronics, which could be applied across technologies.

[TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

[Reducing the heat generated by the billions of transistors in computers](#)

KurzweilAI, 17JUN2015

A team of researchers in the US (Boston College, Northeastern University, Stanford University, Lawrence Berkeley National Laboratory) discovered that iridium oxide has 3-D negative electronic compressibility. They found that a gap between different groupings of energy bands in the sample material actually shrank as electrons were added, reducing the material’s stored energy level. In principle, using metal electrodes that have this property in the microscopic gates that regulate the flow of electrons in transistors could substantially enhance their efficiency and reduce heat buildup. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Materials science*

continued...

[BACK TO TOP](#) 4

Simple yet clever way to boost chip speeds

Science Daily, 17JUN2015

A team of researchers in the US (Stanford University, University of Wisconsin) demonstrates that graphene can help electrons scoot through tiny copper wires in chips more quickly. According to the researchers this modest fix, using graphene to wrap wires, could allow transistors to exchange data faster than is currently possible. And the advantages of using graphene would become greater in the future as transistors continue to shrink. They will present their research at the Symposium of VLSI Technology and Circuits in Japan.

Tags: *Microelectronics*

First flexible phase-change random access memory developed

Science Daily, 15JUN2015

Researchers in South Korea have developed the first flexible PRAM enabled by self-assembled block copolymer silica nanostructures with an ultralow current operation on plastic substrates. They demonstrated random access capability for flexible and wearable electronics. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Flexible electronics*

SCIENCE WITHOUT BORDERS**Could we one day control the path of lightning?**

Science Daily, 19JUN2015

An international team of researchers (Canada, UK, China, France, USA) has discovered a way to guide electric discharges--and even steer them around obstacles--through the clever use of lasers. Electric arcs have long been used in such technologies as combustion engines, pollution control applications, lighting, machining and micromachining. Potential applications could multiply with the ability to precisely control the path they take.

[TECHNICAL ARTICLE](#)

Tags: *Science without borders*

Scientists create computational algorithm for fact-checking

Science Daily, 17JUN2015

Researchers at Indiana University have developed a new computational method that can leverage any body of knowledge to aid in the complex human task of fact-checking that assigns "truth scores" to statements concerning history, geography and entertainment, as well as random statements drawn from the text of Wikipedia. In multiple experiments, the automated system consistently matched the assessment of human fact-checkers in terms of their certitude about the accuracy of these statements. [TECHNICAL ARTICLE](#)

Tags: *Science without borders*

Roadmap to fight reproducibility crisis

Science Daily, 16JUN2015

Researchers at Johns Hopkins University attribute the crisis to the explosion in the amount of data available to researchers and their comparative lack of analytical skills necessary to find meaning in the data. To improve the quality of data analysis in science, stakeholders need to go beyond the call for reproducibility and increase the number of trained data analysts in the scientific community and identify statistical software and tools proven to improve study reproducibility and replicability.

[TECHNICAL ARTICLE](#)

Tags: *Science without borders*

SENSORS**Detecting the undetectable: New chip identifies chemicals in ultratrace amounts**

EurekAlert, 18JUN2015

REDIchip (Resonance-Enhanced Desorption Ionization), a technology invented by researchers at George Washington University, can identify traces of chemicals at 10-19 moles. The REDIchip platform has potential applications in drug discovery; the analysis of tissues, cells and biofluids; discovery of natural products; and the identification of previously undetected environmental contaminants.

Tags: *Sensors, Biotechnology* ■

ABOUT THIS PUBLICATION

The appearance of external hyperlinks in this publication does not constitute endorsement by the United States Department of Defense (DoD) of the linked web sites, nor the information, products or services contained therein. In addition, the content featured does not necessarily reflect DoD's views or priorities.

To **SUBSCRIBE** or **UNSUBSCRIBE**, visit <https://tin-ly.sainc.com/ASDRE>. To provide feedback or ask questions, contact us at asdrest-bulletin-reply@sainc.com. This publication is authored and distributed by:

Kristopher Gardner
Director, Office of
Technical Intelligence (OTI)

Ms. Hema Viswanath
OTI Corporate Librarian