



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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

[Autonomous systems & robotics \(2\)](#)

[Biotechnology \(2\)](#)

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

[Counter WMD \(1\)](#)

[Cyber security \(1\)](#)

[Energy \(1\)](#)

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

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

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

[Microelectronics \(4\)](#)

[Photonics \(3\)](#)

[Quantum science \(3\)](#)

[S&T policy \(1\)](#)

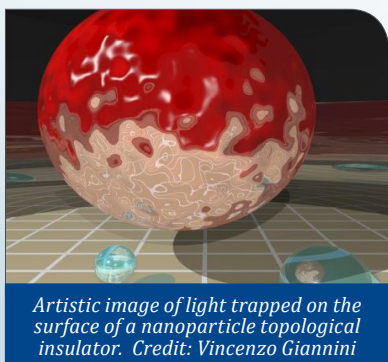
[Science without borders \(1\)](#)

[Sensors \(1\)](#)

FEATURE ARTICLES

[Scientists discover light could exist in a previously unknown form](#)

Science Daily, 05AUG2016



Artistic image of light trapped on the surface of a nanoparticle topological insulator. Credit: Vincenzo Giannini

In normal materials, light interacts with a whole host of electrons present on the surface and within the material. But by using theoretical physics to model the behaviour of light and topological insulators, researchers in the UK have found that it could interact

with just one electron on the surface. This would create a coupling that merges some of the properties of the light and the electron. Normally, light travels in a straight line, but when bound to the electron it would instead follow its path, tracing the surface of the material. [OPEN ACCESS](#)

[TECHNICAL ARTICLE](#)

Tags: Photonics, S&T UK, Featured Article

[Towards the T-1000: Liquid metals propel future electronics \(w/video\)](#)

Nanowerk, 04AUG2016

To work out how to enable liquid metal to move autonomously, an international team of researchers (Australia, Switzerland) immersed liquid metal droplets in water. Simply tweaking the water's chemistry made the liquid metal droplets move and change shape, without any need for external mechanical, electronic or optical stimulants. Using this discovery, they were able to create moving objects, switches and pumps that could operate autonomously, self-propelling liquid metals driven by the composition of the surrounding fluid. The research lays the foundation for being able to use "electronic" liquid metals to make 3D electronic displays and components on demand, and create makeshift and floating electronics. [OPEN ACCESS](#) [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Five nanotechnology research projects that could deliver big results](#)

Nanowerk, 05AUG2016

Researchers at UC Berkeley are using the new and exciting properties that emerge at the nanoscale to help solve big challenges. The article highlights five projects which promise big results from the smallest of building blocks.

Tags: Advanced materials

[Self-healing diamond-like carbon](#)

Science Daily, 05AUG2016

Researchers at Argonne National Laboratory show that multiple types of catalytically active nanocoatings interact with oil molecules to create the DLC film, which adheres to the metal surfaces. When the tribofilm is worn away, the catalyst in the coating is re-exposed to the oil, causing the catalysis to restart and develop new layers of tribofilm. The process is self-regulating, keeping the film at consistent thickness. The discovery could have profound implications for the efficiency and durability of future engines and other moving metal parts. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T

[Shape-changing metamaterial developed using Kirigami technique](#)

PhysOrg.com, 05AUG2016

By combining analytical models and numerical simulations, researchers in the UK have demonstrated how Kirigami cellular metamaterials can change their deformation characteristics. Kirigami can be applied to transform two-dimensional sheet materials into complex three-dimensional shapes with a broader choice of geometries than 'classical' origami. They have also shown the potential of using these classes of mechanical metamaterials for shape change applications like morphing structures. [OPEN ACCESS](#) [TECHNICAL ARTICLE](#)

Tags: Advanced materials, S&T UK

continued...

[BACK TO TOP](#)

[One-dimensional Magnetic Atom Chain Forged](#) IEEE Spectrum, 04AUG2016

An international team of researchers (Germany, Austria) has successfully created a one-dimensional magnetic atom chain of transition metals (manganese, iron, cobalt and nickel) using oxygen to separate the metals from the substrate while maintaining their magnetic properties. Nickel takes on a non-magnetic state; cobalt maintains its ferromagnetic properties, while iron and manganese become antiferromagnetic. It is the alternating state of magnetism that each link possesses that is an unusual feature of the chain. This will prove to have a fundamental impact on magnetic data storage as well as chemistry in general. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Atomic blimp stretches a crystal](#) Science Daily, 03AUG2016

An international team of researchers (USA - Oak Ridge National Laboratory, University of Tennessee, Louisiana State University, China) implanted a few helium ions into a crystalline thin film and stretched the structure of the crystal film in one direction, while the other two directions were fixed by an underlying substrate. The research shows that implanting the helium atoms into the crystalline lattice lets scientists control the strain in the film, thereby tuning the magnetic and electronic properties of the oxide film, and is reversible by removing the helium. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T

[Carbon nanotube 'stitches' make stronger, lighter composites](#) Science Daily, 03AUG2016

An international team of researchers (USA - MIT, Sweden) embedded tiny "forests" of carbon nanotubes within a glue-like polymer matrix, and then pressed the matrix between layers of carbon fiber composites. In experiments, compared with existing composite materials, the stitched composites were 30 percent stronger withstanding greater forces before breaking apart. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Challenging the 'rigidity' for smart soft electronics](#) Nanowerk, 03AUG2016

Conducting polymers are a promising candidate for soft electronics devices because they are malleable, lightweight, and can conduct electricity, although their charge carrier mobility is intrinsically lower than that of inorganic materials. To improve charge transport, researchers in South Korea introduced monomers without side chains into the polymer and utilized unconventional localized aggregates as stepping-stones to expedite charge transport in the microstructure of the polymer. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Paving the way toward novel strong, conductive materials](#) Nanowerk, 03AUG2016

A team of researchers in the US (Duke University, Harvard University, Yale University) developed a database to simulate the hundreds of crystalline structures each alloy could potentially take. They created a program to analyze the various structures and compare the energy required to form them and experimentally verified their performance. Alloys that can form many different structures whose energy is similar are likely candidates to form a metallic glass. Metallic glasses are used in a wide array of applications: electronics, nuclear reactor engineering, medical industries, even golf clubs. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

[Cyborg stingray swims toward light, breaks new ground](#) PhysOrg.com, 08AUG2016

Researchers at Harvard University created a translucent, penny-sized ray with a gold skeleton and silicone fins layered with the heart muscle cells of a rat. It is remote-controlled, guided by a blinking blue flashlight. Each burst of blue sets off a cascade of signals through the cells, which have been genetically-engineered to respond to light. The contraction of the tissue creates a downward motion on the ray's body. When the tissue relaxes, the gold skeleton recoils mimicking the graceful swimming of a real ray or skate. The stingray shows a glimpse of autonomy.

Tags: Autonomous systems and robotics, Biotechnology, Synthetic biology

[Video Friday: Drone With Lidar, Robot Tai Chi, and Strange Android](#) IEEE Spectrum, 05AUG2016

Student teams design autonomous, robotic boats to navigate and race through an aquatic obstacle course. The behaviors demonstrated by these boats mimic tasks that are being developed for coastal surveillance, port security and other types of oceanographic operations.

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

[Sprinkling of neural dust opens door to electroceuticals](#) Science Daily, 03AUG2016

Researchers at UC Berkeley implanted 1 millimeter cube sensors that contain a piezoelectric crystal that converts ultrasound vibrations from outside the body into electricity to power a tiny, on-board transistor that is in contact with a nerve or muscle fiber. A voltage spike in the fiber alters the circuit and the vibration of the crystal, which changes the echo detected by the ultrasound receiver, typically the same

continued...

“No amount of experimentation can ever prove me right;
a single experiment can prove me wrong.” ALBERT EINSTEIN

device that generates the vibrations. The slight change, called backscatter, allows them to determine the voltage. According to the researchers the long-term prospects for neural dust are not only within nerves and the brain, but much broader. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Biotechnology, Neuroscience

[IBM lab-on-a-chip breakthrough aims to help physicians detect cancer](#)

[PhysOrg.com](#), 02AUG2016

A team of researchers in the US (IBM, Princeton University, Icahn School of Medicine at Mount Sinai) has developed a new lab-on-a-chip technology that can separate biological particles at the nanoscale. Results show size-based separation of bioparticles down to 20 nm in diameter, a scale that gives access to important particles such as DNA, viruses and exosomes. Once separated, these particles can potentially be analyzed by physicians to reveal signs of disease even before patients experience any physical symptoms and when the outcome from treatment is most positive. Until now, the smallest bioparticle that could be separated by size with on-chip technologies was about 50 times or larger. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Medical technology, Sensors

COMMUNICATIONS TECHNOLOGY

[Chinese satellite is one giant step for the quantum internet](#)

[Nature News](#), 27JUL2016

An international team of researchers is poised to launch the world's first satellite designed to do quantum experiments and create a super-secure communications network, potentially linking people anywhere in the world. Groups from Canada, Japan, Italy, Singapore and UK also have plans for quantum space experiments.

Tags: Communications technology, Quantum science, S&T China

COUNTER WMD

[‘Second skin’ protects soldiers from biological and chemical agents](#)

[PhysOrg.com](#), 03AUG2016

Researchers at Lawrence Livermore National Laboratory fabricated flexible polymeric membranes with aligned carbon nanotube channels as moisture conductive pores. Nanopores are less than 5 nm wide. Biological threats like bacteria or viruses are much larger and typically more than 10-nm in size. In tests, CNT membranes repelled Dengue virus from aqueous solutions during filtration. The fabric will be able to block chemical agents such as sulfur mustard, GD and VX nerve agents, toxins such as

staphylococcal enterotoxin and biological spores such as anthrax. [TECHNICAL ARTICLE](#)

Tags: Counter WMD, Military technology

CYBER SECURITY

[Machine-Learning Algorithm Combs the Darknet for Zero Day Exploits, and Finds Them](#)

[MIT Technology Review](#), 05AUG2016

Researchers at the University of Rochester have developed a machine learning cyberthreat intelligence-gathering system that uses machine learning to study hacking forums and marketplaces in the dark web and deep net. The system hunts for clues about emerging vulnerabilities and detects relevant products and topics being discussed on these sites. Currently, this system collects on average 305 high-quality cyberthreat warnings each week. It is able to recall 92% of products in marketplaces and 80% of discussions on forums relating to malicious hacking with high precision. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Cyber security

ENERGY

[Scientists develop quick-destructing battery to power ‘transient’ devices](#)

[Nanowerk](#), 04AUG2016

A team of researchers in the US (Iowa State University, Ames National Laboratory) developed a transient battery which is made up of eight layers, including an anode, a cathode and the electrolyte separator, all wrapped up in two layers of a polyvinyl alcohol-based polymer. The battery is about 1 mm thick, 5 mm long and 6 mm wide. When dropped in water, the polymer casing swells, breaks apart the electrodes and dissolves away. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery, Government S&T

IMAGING TECHNOLOGY

[From unconventional laser beams to a more robust imaging wave](#)

[PhysOrg.com](#), 05AUG2016

Working with terahertz frequency that is capable of sensing and/or imaging objects behind barriers, researchers at the University of Rochester demonstrated that they can detect a THz wave at a distance of up to 100 feet. The THz wave created by the researchers is more than five times stronger than what is generated by more conventional means, leading them to believe that a THz wave—and the image of a hidden object—can be detected at much greater distances in the future.

Tags: Imaging technology, Sensors

continued...

INFORMATION TECHNOLOGY

Scientists imitate the functionality of neurons with a phase-change device

Nanowerk, 03AUG2016

Researchers in Germany have created randomly spiking neurons using phase-change materials to store and process data. This demonstration marks a significant step forward in the development of energy-efficient, ultra-dense integrated neuromorphic technologies for applications in cognitive computing. [TECHNICAL ARTICLE](#)

Tags: *Information technology, Neuroscience*

FEATURED RESOURCE

Chinese Academy of Sciences

The site provides links to many English language journals and contents; Chinese articles provide English abstracts.

MATERIALS SCIENCE

Scientists developed a film which harnesses energy from humidity

Technology Org, 05AUG2016

Researchers in Japan have developed a carbon nitride polymer film that curls up and straightens out autonomously when exposed to different levels of humidity and this difference can be extremely small. However, irradiation in ultraviolet light changes the film's ability to absorb moisture and it can even jump up to a centimetre high, producing energy. The film is very durable. Scientists made one film bend and straighten more than 10,000 times and could not detect any deterioration.

Tags: *Materials science, S&T Japan*

MICROELECTRONICS

Experiments point toward memory chips 1,000 times faster than today's

PhysOrg.com, 08AUG2016

An international team of researchers (USA - SLAC National Accelerator Laboratory, Stanford University, Argonne National Laboratory, Germany) shows that phase-change materials store data permanently while allowing certain operations to occur up to a thousand times faster than today's memory devices. The new approach may also be more energy efficient. They focused on the unimaginably brief interval when an amorphous structure began to switch to crystalline, when a digital zero became a digital one. This emerging technology

could store data many times faster than silicon RAM for tasks that require memory and processors to work together to perform computations. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Information technology*

Buckyball buffer helps conduct electricity in only one direction, vital for molecule-sized circuits

PhysOrg.com, 05AUG2016

An international team of researchers (UK, USA - Pennsylvania State University, Argonne National Laboratory) restructured the diode by separating the electron pipe region made of a single layer of pentacene, from the metallic electrodes. The buffer is a thin layer of buckyballs. The new diode is 1,000 times more effective at conducting current in one direction than the other. These findings open the possibility of engineering non-linear electrical behavior on a nanometer length-scale in organic optoelectronics and photovoltaics. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

Field effect improves quantum capacitors and vertical transistors

Nanotechweb, 01AUG2016

A team of international researchers (Switzerland, UK) has unveiled a new theoretical framework to quantify how transparent a 2D material is to an electrostatic field. The theory will help design better quantum capacitors and vertical transistors. The work could lead to improved optoelectronics that consume less power and dissipate less heat. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

PHOTONICS

Getting light in shape with metamaterials

Nanowerk, 03AUG2016

Converting light from one wavelength to a shorter wavelength is typically inefficient. A team of researchers in the US (Sandia National Laboratory, Princeton University) designed nano-cavities following metamaterials concepts, to have special "resonance" frequencies that force the laser light to obey the rules imposed by the electronic transitions, and fabricated the cavities on top of the semiconductor structure. When the resonance frequencies are made equal to the inter-sub band transition energy, second-harmonic is generated inside the quantum well. The studies can open doors for advanced lasers for optical communications, efficient manufacturing and also miniaturize optical components for high-speed computing, telecommunications, cameras, and quantum computing. [OPEN ACCESS TECHNICAL ARTICLE 1](#), [TECHNICAL ARTICLE 2](#)

Tags: *Photonics, Advanced materials*

Laser nudges may help destroy space debris threatening communications, navigation on Earth

Science Daily, 03AUG2016

Researchers in Germany note that in the weightlessness of space when part of an object is ablated using a laser beam, the recoil transfers momentum to the object. While other studies have targeted simple geometric shapes such as plates, cubes, spheres, and cylinders that are optimally oriented to the laser source, the current study transitions towards simulations of the real world scenario with arbitrarily shaped debris and limited laser pointing accuracy. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Photonics, S&T Germany, Satellite technology, Space technology

QUANTUM SCIENCE

Quantum computing researchers reduce quantum information processing errors

Army Scitech, 05AUG2016

Quantum computers are highly sensitive to errors of different kinds. Researchers at the University of Southern California have developed a new method which they call “nested quantum annealing correction”, to suppress heating errors. They showed that by coupling several qubits together on a D-Wave Two TM quantum optimizer, without changing the hardware of the device, the qubits act effectively as one qubit that experiences a lower temperature. The more qubits are coupled, the lower the temperature experienced. The nesting scheme is implementable on other future quantum optimization devices with different hardware architectures. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Quantum science

Tags: Quantum science

Record-breaking logic gate ‘another important milestone’ on road to quantum computers

PhysOrg.com, 05AUG2016

Using qubits stored in hyperfine ground states of calcium-43 ions held in a room-temperature trap, researchers in the UK demonstrated laser-driven two-qubit and single-qubit logic gates with respective fidelities 99.9(1)% and 99.9934(3)%, significantly above the $\approx 99\%$ minimum threshold level required for fault-tolerant quantum computation. They developed a theoretical error model which is consistent with the data and which allows identification of the principal technical sources of infidelity. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T UK

Ion-trap quantum computer is programmable and reconfigurable

Physics World, 03AUG2016

Researchers at the University of Maryland demonstrated a five-qubit trapped-ion quantum computer, which is programmable and reconfigurable. The computing architecture is such that the researchers, can programme multiple algorithms into their trapped-ion processor, which is a first. According to the researchers, although the computer is relatively small at five qubits and the algorithms they process fairly simple, there are a variety of ways to scale up this architecture to build a functional quantum computer in the future. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Information technology

S&T POLICY

China: Standardize R&D costing

Nature, 03AUG2016

Before comparing gross expenditure on research and development with that in developed countries, China’s official statistics first need bringing into line with international standards for collecting and reporting R&D costs. China’s R&D statistics exclude salaries for university faculty members and postdocs, capital spending on big facilities and their operation budgets. Based on such considerations, China probably spent about double the official figure of 4.7% of its total R&D budget on basic research in 2013 which is still significantly less than Japan or the United States.

Tags: S&T policy, S&T China

SCIENCE WITHOUT BORDERS

‘Kudos’ promises to help scientists promote their papers to new audiences

Nature News, 01AUG2016

A free site called [Kudos](#) makes it easier for mid-to-late-career academics, who often are wary of social media, to engage on those platforms and maximize the reach and impact of their papers on social media, and measure the effects of their efforts. By encouraging researchers to do outreach, the site also indirectly builds the profile of their institution or their journal. Publishers and institutions can build up valuable intelligence from the Kudos database about the effects of different kinds of outreach. The site has established partnerships with some 65 publishers so far.

Tags: Science without borders, Bibliometrics

SENSORS

Researchers invent acoustic prism

[PhysOrg.com](#), 08AUG2016

Researchers in Switzerland have invented an acoustic prism that splits sound into its constituent frequencies using physical properties alone. It looks like a rectangular tube made of aluminum, with ten, perfectly aligned holes along one side. Each hole leads to an air-filled cavity inside the tube, and a membrane is placed between two consecutive cavities. The membranes are key, since they vibrate and transmit the sound to the neighboring cavities with a delay that depends on frequency. The delayed sound then leaks through the holes and towards the exterior, dispersing the sound. The acoustic prism can be used as an antenna to locate the direction of a distant sound by simply measuring its frequency. [OPEN ACCESS](#)

TECHNICAL ARTICLE

Tags: Sensors, S&T Switzerland ■

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 asdre-st-bulletin-reply@sainc.com. This publication is authored and distributed by:

Ryan Zelnio, Ph.D., Associate Director - Tech Watch / Horizon Scans, Office of Net Technical Assessments, OSD AT&L/OASD(R&E)

Ms. Hema Viswanath, TW/HS, ONTA Corporate Librarian