



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

[Advanced materials \(2\)](#)

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

[Big data \(1\)](#)

[Biotechnology \(1\)](#)

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

[Communications technology \(3\)](#)

[Energy \(3\)](#)

[Imaging technology \(3\)](#)

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

[Microelectronics \(3\)](#)

[Photonics \(1\)](#)

[Quantum science \(2\)](#)

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

[Sensors \(5\)](#)

FEATURE ARTICLES

[Researchers build first working memcomputer prototype](#)

[PhysOrg.com](#), 06JUL2015

To create their prototype, an international team of researchers (USA, Italy) had to come up with a completely new computer design based on memprocessors. The memprocessors have the ability to change their own properties—one of which is electrical resistance—depending on things such as how much energy is passing through. That allows the processors to store information in a new way, even as the processor continues processing. To prove that it can do actual work, the prototype is able to solve the NP-complete version of the subset sum problem. [TECHNICAL ARTICLE](#)

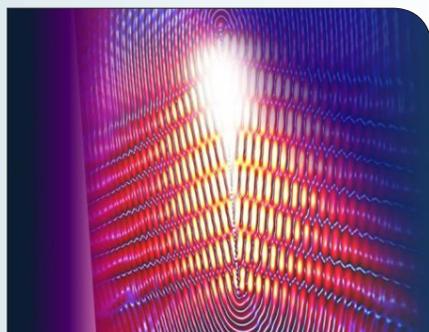
Tags: Breakthrough technology, Featured Article

[Surfing a wake of light](#)

[Science Daily](#), 06JUL2015

Researchers at Harvard University, with collaborators from Singapore and Italy, have created wakes of surface plasmons and demonstrated that they can be controlled and steered. The technique could lead to new types of plasmonic couplers and lenses that could create two-dimensional holograms or focus light at the nanoscale. This research addresses a particularly elegant and innovative problem in physics which connects different physical phenomena, from water wakes to sonic booms, and Cherenkov radiation. [TECHNICAL ARTICLE](#)

Tags: Photonics, Featured Article



This is an artistic rendition of the superluminal running wave of charge that excites the surface plasmon wakes. Credit: Daniel Wintz, Patrice Genevet, and Antonio Ambrosio.

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Transition from three to two dimensions increases conduction](#)

[PhysOrg.com](#), 07JUL2015

To investigate electron-phonon interaction changes in two-dimensional substances, an international team of researchers (USA, Russia) synthesized Nb_3SiTe_6 crystals. They developed a theory that predicts that electron-phonon interaction is suppressed due to dimensional effects in two-dimensional material. Through experiments they proved the theory. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Engineering the world's smallest nanocrystal with just 19 atoms](#)

[Nanowerk](#), 06JUL2015

Researchers in Japan have used an artificially designed protein to create a cadmium chloride nanocrystal—the smallest crystal reported so far, made up of just 19 atoms—sandwiched between two copies of the protein. The technique has applications in making a range of nanodevices such as biopharmaceuticals, biosensors, light-driven switches, and synthetic enzymes from the bottom up. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, S&T Japan

AUTONOMOUS SYSTEMS & ROBOTICS

[Google's Deep Learning Machine Learns to Synthesize Real World Images](#)

[MIT Technology Review](#), 06JUL2015

While Street View can show us what distant places look like, it does not show what the process of traveling or exploring would be like. Researchers at Google developed a computational movie machine that can turn more or less any sequence of images into smooth running film by interpolating the missing frames. DeepStereo, an algorithm they developed and trained, produces plausible outputs that are difficult to immediately distinguish from the original imagery. [TECHNICAL ARTICLE](#)

Tags: Autonomous systems & robotics, Artificial intelligence

continued...

[BACK TO TOP](#)

BIG DATA

Is big data still big news?

PhysOrg.com, 07JUL2015

Researchers in the UK explain that while many companies are already benefiting from big data, it also presents some tough challenges. To get value out of big data, however, organisations need to be able to capture, store, analyse, visualise and interpret it. None of which is straightforward.

TECHNICAL ARTICLETags: *Big data, S&T UK*

BIOTECHNOLOGY

Elastic gel to heal wounds

Science Daily, 02JUL2015

Researchers at Brigham and Women's Hospital in Boston have developed a new material known as a photocross-linkable elastin-like polypeptide-based (ELP) hydrogel that mimics many of the properties of elastic tissue. When exposed to light, strong bonds form between the molecules of the gel, providing mechanical stability without the need for any chemical modifiers to be added to the material.

The ELP hydrogel can be digested overtime by naturally-occurring enzymes and does not appear to have toxic effects when tested with living cells in the lab. **TECHNICAL ARTICLE**

Tags: *Biotechnology, Advanced materials*

COMMUNICATIONS TECHNOLOGY

Graphene sheets enable ultrasound transmitters

PhysOrg.com, 07JUL2015

Researchers at UC Berkeley have used graphene to build lightweight ultrasonic loudspeakers and microphones which complement standard radio transmission using electromagnetic waves in areas where radio is impractical, such as underwater, but with far greater fidelity than current ultrasound or sonar devices. They can also be used to communicate through objects, such as steel, that electromagnetic waves can't penetrate. **TECHNICAL ARTICLE**

Tags: *Communications Technology***Say it with light: Using LEDs to move data faster**

PhysOrg.com, 03JUL2015

Researchers at the University of Virginia have devised a way of using light waves from light-emitting diode fixtures to carry signals to wireless devices at 300 megabits per second from each light. They developed a modulation algorithm that increases the throughput of data in visible light communications. More data is transmitted without using any additional energy. As more light fixtures get replaced with LED lights, there will be different access points to the same network.

Tags: *Communications Technology***New method of quantum entanglement vastly increases how much information can be carried in a photon**

PhysOrg.com, 30JUN2015

Researchers at UCLA demonstrated that they could slice up and entangle each photon pair into multiple dimensions using quantum properties such as the photons' energy and spin. This method, called hyperentanglement, allows each photon pair to carry much more data than was possible with previous methods. **TECHNICAL ARTICLE**

Tags: *Communications Technology*

ENERGY

Omnidirectional free space wireless charging of multiple wireless devices

Science Daily, 07JUL2015

Researchers in South Korea have developed a wireless-power transfer (WPT) technology that allows mobile devices to be charged at any location and in any direction, even if the devices are away from the power source, so long as mobile users stay in a designated area where the charging is available, e.g., the Wi-Power zone. The invention is based on Dipole Coil Resonance System (DCRS) which was developed by the team in 2014 for inductive power transfer over an extended distance.

Tags: *Energy***Tiny wires could provide a big energy boost**

Nanowerk, 07JUL2015

The new approach, developed by an international team of researchers (USA, Canada), uses yarns, made from nanowires of the element niobium, as the electrodes in tiny supercapacitors. It can store and release electrical power in bursts. The innovation is especially significant for small devices because other energy-storage technologies—such as fuel cells, batteries, and flywheels—tend to be less efficient, or simply too complex to be practical when reduced to very small sizes. **TECHNICAL ARTICLE**

Tags: *Energy***New lithium ion battery is safer, tougher, and more powerful**

Nanowerk, 03JUL2015

The battery developed by researchers in South Korea is built from pumpkin-shaped molecules called cucurbit[6]uril (CB[6]) which are organized in a honeycomb-like structure. The molecules have an incredibly thin 1D-channel, only averaging 7.5 Å [a single lithium ion is 0.76 Å, or .76 x 10⁻¹⁰ m] that runs through them. The physical structure of the porous CB[6] enables the lithium ions to diffuse more freely than in conventional LIBs and exist without the separators found in other batteries.

TECHNICAL ARTICLETags: *Energy, Battery*

“There is something irreversible about acquiring knowledge; and the simulation of the search for it differs in a most profound way from the reality.” J. ROBERT OPPENHEIMER

IMAGING TECHNOLOGY

'Ghost:' Technology that leaps out of the screen

Science Daily, 03JUL2015

Researchers working on an EU-supported research project have launched GHOST (Generic, Highly-Organic Shape-Changing Interfaces) designed to tap humans' ability to reason about and manipulate physical objects through the interfaces of computers and mobile devices. This breakthrough in user interaction with technology allows us to handle objects, and even data, in a completely new way.

Tags: *Imaging technology, Emerging technology, S&T EU*

Spectrometer made from quantum dots is compact and low cost

Physics World, 03JUL2015

An international team of researchers (China, USA) has developed a spectrometer which is an array of 195 different types of quantum dots with absorption spectral features that cover a wavelength range of 300 nm. The quantum dots were dispersed in solution as colloids. These mixtures were then used to coat individual pixels of the light-detecting array of a digital camera. Because it is compatible with existing camera technology the spectrometer could be mass-produced at a relatively low cost. [TECHNICAL ARTICLE](#)

Tags: *Imaging technology*

Radar guards against space debris

PhysOrg.com, 01JUL2015

Researchers in Germany are building transmission and reception components for a radar system called German Experimental Space Surveillance and Tracking Radar (GESTRA) to capture radar signals emitted by satellites and space debris in several cardinal directions simultaneously, in a fraction of a second. It can look in many directions at once and cover a very large area of the sky. It can follow the path of selected, individual objects. The computer-assisted, digital beamforming function allows the main beam to be set to a narrow width, enabling it to be focused on a single moving object.

Tags: *Imaging technology, S&T Germany, Sensors, Space technology*

MATERIALS SCIENCE

Polymer mold makes perfect silicon nanostructures

Nanowerk, 02JUL2015

In a breakthrough for nanoscience, researchers at Cornell University have made a mold for nanostructures

that can shape liquid silicon out of an organic polymer material. This paves the way for perfect, 3-D, single crystal nanostructures. With the right chemistry, organic polymers self-assemble. The researchers used this special ability of polymers to make a mold dotted with precisely shaped and sized nano-pores.

Tags: *Materials science*

Soundproofing with quantum physics

Science Daily, 02JUL2015

Researchers in Germany have shown that the mathematical formulas describing the quantum properties of a topological insulator can be rearranged to look exactly like those of a well-known mechanical system -- an array of swinging pendulums. Such properties would be interesting in sound and vibration insulation. Moreover, one can imagine materials that convey sound in one direction only, or others that focus sound like a lens. [TECHNICAL ARTICLE](#)

Tags: *Materials science, S&T Germany*

Trapping vortices key to high-current superconductors

Nanowerk, 02JUL2015

A team of researchers in the US (Cornell University, Brookhaven National Laboratory) has found that irradiation of the material creates nanometer-sized defects that trap swirling eddies in the flow of electrons, keeping them out of the way so more current can flow. [TECHNICAL ARTICLE](#)

Tags: *Materials science, Government S&T*

How oversized atoms could help shrink

PhysOrg.com, 01JUL2015

An international team of researchers (UK, Malaysia, Spain) used a colloidal mix of spherical particles and polymer strands to understand how fluids behave in extremely small channels, such as a drop of water in a nano-fluidic chip device. By changing the size of the channels, they were able to reveal in detail how a fluid interacts with the boundaries encasing it. Channel size can be used to create very small liquid droplets, which in turn can be used for lab-on-a-chip applications. This can be used to potentially guide the self-assembly of specifically shaped particles, some sort of "colloidal bricks" that could be used to produce more complex structures such as micro robots. [TECHNICAL ARTICLE](#)

Tags: *Materials science, Microfluidics*

continued...

Substrates change nanoparticle reactivity

PhysOrg.com, 30JUN2015

An international team of researchers (UK, Spain) has demonstrated that the topology of the titanium dioxide (TiO₂) substrate affects Pd nanoparticle reactivity. This research has two important implications for nanoparticle-substrate interactions: it shows how substrate morphology plays a role in nanoparticle reactivity and may explain changes in reactivity. Changing the substrate morphology may be a way to tune nanoparticle reactivity.

TECHNICAL ARTICLE*Tags: Materials science***FEATURED RESOURCE****IOP Asia-Pacific**

Research highlights from Korea, India, Pakistan, Thailand, Taiwan, Japan, China, Vietnam, Australia and New Zealand. **RSS**

MICROELECTRONICS**Ferroelectric capacitor goes flexible**

Nanotechweb, 03JUL2015

Researchers in Saudi Arabia have developed a high-performance, flexible storage device based on lead zirconium titanate. The nonvolatile memory boasts the highest polarization, capacitance and endurance values ever reported for a flexible ferroelectric capacitor. The device might find applications in wearable electronics, health-monitoring systems and ultradense information-storage systems that mimic the structure of the brain.

TECHNICAL ARTICLE*Tags: Microelectronics***Influential interfaces lead to advances in organic spintronics**

PhysOrg.com, 01JUL2015

The interface between two different materials is very important in determining the performance and efficiency of electronic devices. By manipulating the interface between cobalt and an organic semiconductor Alq₃, a team of researchers in the US (NIST, SUNY) showed that the spin polarization can be enhanced at the interface by simple interface engineering. This is helpful in efficient injection of the spin-polarized charge carrier from ferromagnetic materials to organic materials.

TECHNICAL ARTICLE*Tags: Microelectronics, Government S&T, Quantum science***Taking the heat off silicon optical devices**

Nanotechweb, 01JUL2015

Right now, computer speeds are limited by how fast signals on the chip travel, and one way around this problem is to bring light onto a computer chip. Researchers in Canada have demonstrated that by exploiting surface- instead of bulk-diffusion processes, pulsed laser deposition could produce silicon nanocrystals in one step, at much lower temperatures of around 550°C. Silicon can produce light when in the form of nanocrystals.

TECHNICAL ARTICLE*Tags: Microelectronics, S&T Canada***QUANTUM SCIENCE****Good quantum states and bad quantum states**

PhysOrg.com, 06JUL2015

An international team of researchers (Austria, Germany) present a quantum tomography method, which makes it possible to measure and describe the state of a large quantum system very precisely with just a few measurements. The basic idea behind this new technique is simple: even though the system can be in one of unimaginably many quantum states, it is a very good approximation to ignore most of them. The new method does not only open up new possibilities for many-body quantum physics. It could also lead the way to new quantum simulators.

TECHNICAL ARTICLE*Tags: Quantum science***Quantum teleportation? Producing spin-entangled electrons**

Science Daily, 01JUL2015

Researchers in Japan have successfully produced pairs of spin-entangled electrons and demonstrated that these electrons remain entangled even when they are separated from one another on a chip. This research could contribute to the creation of futuristic quantum networks operating using quantum teleportation. This could allow information contained in qubits to be shared between many elements on chip, a key requirement to scale up the power of a quantum computer.

TECHNICAL ARTICLE*Tags: Quantum science, Communications Technology, S&T Japan***SCIENCE WITHOUT BORDERS****The future of artificial intelligence**

PhysOrg.com, 07JUL2015

This week, Microsoft will host a panel of experts to discuss progress in artificial intelligence: myths, realities and aspirations. According to the researchers at Microsoft despite the recent breakthroughs in artificial intelligence research, many experts believe some of the biggest advances in artificial intelligence are years, if not decades, away. As these systems improve, researchers are creating safeguards to ensure that AI systems will perform safely even in unforeseen situations.

*Tags: Science without borders, Artificial intelligence**continued...*

SENSORS

Optical ‘dog’s nose’ may hold key to breath analysis

PhysOrg.com, 07JUL2015

Researchers in Australia developed an instrument which uses an optical frequency comb that sends up to a million different light frequencies through the sample in parallel to measure the molecular content of a sample of gas. They use optical spectroscopy to detect the light-absorption patterns of different molecules, with high levels of accuracy and speed.

Tags: Sensors, S&T Australia

Faster detection of hidden objects by terahertz sensor

Science Daily, 06JUL2015

Researchers in the UK have developed a sensor called ‘Q-Eye’, that senses radiation in the Terahertz region of the spectrum. It works by detecting the rise in temperature produced when electromagnetic radiation emitted by an object is absorbed by the Q-Eye sensor, even down to the level of very small packets of quantum energy. The device may prove useful in discovering concealed goods for non-destructive monitoring, astronomical and climate science observations and medical diagnosis.

Tags: Sensors, S&T UK

Researchers develop world’s most sensitive test to detect infectious disease, superbugs

Science Daily, 06JUL2015

Researchers in Canada have developed a molecular device made of DNA that can be switched ‘on’ by a specific molecule of their choice--such as a certain type of disease indicator or DNA molecule representing a genome of a virus—an action that leads to a massive, amplified signal which can be easily spotted. It can detect the smallest traces of metabolites, proteins or fragments of DNA. The test has the best sensitivity ever reported for a detection system of this kind—it is as much as 10,000 times more sensitive than other detection systems. **TECHNICAL ARTICLE**

Tags: Sensors, Biotechnology, S&T Canada

Photonic crystal fibre: a multi-purpose sensor

Nanowerk, 03JUL2015

Researchers in Germany sent a tiny glass bead which can literally sense different physical quantities such as electric field, temperature or vibrations through the inside of a hollow-core photonic crystal fibre. The flying particle detects the quantities to be measured over long distances with a high spatial resolution, even under harsh conditions like those in an aggressive chemical substance or inside an oil pipeline. **TECHNICAL ARTICLE**

Tags: Sensors, S&T Germany

Invisibility cloak aspirations inspire new metasurface material

PhysOrg.com, 01JUL2015

Based on the concept of cloaking with quasi-two-dimensional materials engineered to exhibit exotic electromagnetic behaviors, researchers at Penn State University created a cloaking metasurface for optimal antenna communication. They were able to put these coatings around antennas to isolate or cloak them from other antennas, essentially making them invisible in order to maintain or restore the desired intrinsic radiation properties.

Tags: Sensors ■

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