



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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

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

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

[Biotechnology \(1\)](#)

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

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

[Energy \(1\)](#)

[Forecasting \(3\)](#)

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

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

[Materials science \(4\)](#)

[Photonics \(2\)](#)

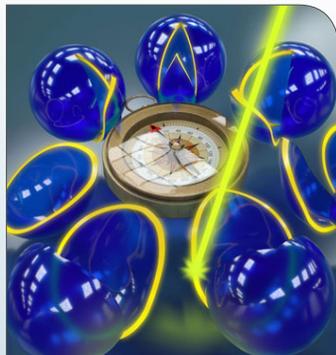
[Quantum science \(4\)](#)

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

[Science without borders \(4\)](#)

[Sensors \(2\)](#)

FEATURE ARTICLES



This artist's rendition shows a laser light guiding the evolution of an electronic spin within an atomic-scale defect in diamond. These light-driven loops give rise to a geometric phase, a quantum logic operation that shows remarkable resilience to noise. (Image: Peter Allen)

[Moving electrons around loops with light: A quantum device based on geometry](#)

[Nanowerk, 19FEB2016](#)

An international team of researchers (USA - University of Chicago, UC Santa Barbara; Germany) demonstrated the ability to generate a quantum logic operation that is intrinsically resilient to noise as well as to variations in the

strength or duration of the control. Their achievement is based on a geometric concept known as the Berry phase and is implemented through entirely optical means within a single electronic spin in diamond. This suggests a route toward robust and fault-tolerant quantum information processing. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Featured Article

[Researchers find the tipping point between resilience and collapse in complex systems](#)

[Science Daily, 17FEB2016](#)

Using statistical physics, an international team of researchers (USA - Northeastern University, Harvard University, Harvard Medical School; China) has developed a tool to identify the tipping point for everything from ecological systems such as bees and plants to technological systems such as power grids. The tool crunches down all the parameters and components of any complex system into a single crucial number. It opens the door to planning and implementing preventive measures before it is too late, as well as preparing for recovery after a disaster. [TECHNICAL ARTICLE](#)

Tags: Science without borders, Mathematics, Featured Article

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[Researchers use 3D printing to make ultrafast graphene supercapacitor](#)

[Nanowerk, 22FEB2016](#)

Using a 3D-printing process called direct-ink writing and a graphene-oxide composite ink, a team of researchers in the US (Lawrence Livermore National Laboratory, UC Santa Cruz) was able to print micro-architected electrodes and build supercapacitors with excellent performance characteristics. The technology opens the door to novel, unconstrained designs of highly efficient energy storage systems for smartphones, wearables, implantable devices, electric cars and wireless sensors. [TECHNICAL ARTICLE](#)

Tags: Advanced manufacturing, Government S&T

[Robotic drones to 'print' emergency shelters for those in need](#)

[University of Bath, 17FEB2016](#)

Researchers in the UK are developing drones that could fly to a disaster zone, scan and model the landscape using Building Information Management (BIM) systems, design temporary shelters, and print them on the spot using Additive Building Manufacturing (ABM). This would enable the robots to act as flying mini-factories.

Tags: Advanced manufacturing, Autonomous systems & robotics, S&T UK

ADVANCED MATERIALS

[New material to enhance battery life](#)

[EurekAlert, 20FEB2016](#)

An international team of researchers (Russia, Belgium) created a new high-power cathode material based on a fluoride-phosphate of vanadium and potassium for Li-ion batteries. They stabilized a unique crystal structure, which provides fast transport of lithium ions through spatial cavities and channels. The cathode material demonstrated high charge/discharge rates (down to 90 seconds) retaining more than 75% of the initial specific capacity. The results may promote the development of a new battery type where the role of a

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[BACK TO TOP](#)

mobile ion would be performed by potassium ions instead of lithium. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Battery

[Engineers discover a new kind of 2D semiconducting material for electronics](#)

[Nanowerk](#), 15FEB2016

A team of researchers in the USA (University of Utah, Air Force Research Laboratory) made a semiconductor using one atom thick 2D layer tin monoxide, allowing electrical charges to move through it much faster than conventional 3D materials such as silicon. The discovery could lead to computers and smartphones that are more than 100 times faster than regular devices. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

[The Missing Link of Artificial Intelligence](#)

[MIT Technology Review](#), 18FEB2016

The recent successes of deep learning are built on software that needs human help to learn—something that limits how far artificial intelligence can go. Google's experiment used unsupervised learning which has proved incredibly effective for many problems. According to the Google Brain group unsupervised learning is probably needed if software is to keep getting better at understanding the world.

Tags: Autonomous systems & robotics, Artificial intelligence

[Enabling human-robot rescue teams](#)

[PhysOrg.com](#), 17FEB2016

Autonomous robots performing a joint task send each other continual updates. Communication consumes some power, and in some circumstances the cost of processing new information could be a much more severe resource drain. Researchers at MIT believe that their new way of modeling robot collaboration that reduces the need for communication by 60 percent could make it easier to design systems that enable humans and robots to work together as teams. The work could also have implications for multirobot collaborations that don't involve humans.

[TECHNICAL ARTICLE](#)

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

[Microchip used to build a first-ever artificial kidney](#)

[Science Daily](#), 15FEB2016

Researchers at Vanderbilt University are building an implantable artificial kidney with microchip filters and living kidney cells that will be powered by a patient's own heart. They use live kidney cells that will grow on and around the microchip filters. The goal is for these cells to mimic the natural actions of the kidney. It is roughly the size of a soda can.

Tags: Biotechnology

COMMUNICATIONS TECHNOLOGY

[Using plasmonics to transmit more data](#)

[Nanowerk](#), 23FEB2016

A team of researchers in the US (Northwestern University, Argonne National Laboratory) successfully controlled plasmons in the near-infrared wavelength region by using indium-tin-oxide (ITO) nanorod arrays. The low electron density of ITO enables a substantial redistribution of electron energies, which results in light signal modulation with very large absolute amplitude. By tailoring the geometry of the ITO nanorod arrays, they could further tune the spectral range of the signal modulation at will, which opens the door for improved telecommunications and molecular sensing. [TECHNICAL ARTICLE](#)

Tags: Communications technology, Information technology

[New launch communications antenna ready for business](#)

[PhysOrg.com](#), 15FEB2016

ESA inaugurated a new tracking dish in Australia. The new antenna is sited at ESA's existing ground station, in New Norcia, Western Australia, and will be used for communicating with rockets and new satellites. In the coming years, the new antenna will track launches from Kourou, as well as high-profile missions such as Galileo navigation satellites, the BepiColombo Mercury probe, and ExoMars going to the Red Planet.

Tags: Communications technology, S&T EU, Space technology

CYBER SECURITY

[Dynamic detection system could protect smartphones from malicious content](#)

[PhysOrg.com](#), 23FEB2016

In order to curb attacks from hidden malicious ads, researchers at Northwestern University developed software which electronically clicks the ads within apps and follows a chain of links to the final landing page. It then downloads that page's code and completes an analysis to determine whether or not it is malicious. It also uses machine-learning techniques to track the evolving behaviors of malware as it attempts to elude detection.

Tags: Cyber security

[World's first encryption technology able to match multi-source data encrypted with different keys](#)

[PhysOrg.com](#), 16FEB2016

Researchers in Japan have developed an encryption technology that can match the data of various organizations that was encrypted with different keys, and can determine the results of this matching for a specified group of organizations. Data cannot be decrypted with the key used for matching, so sensitive information from multiple organizations can be matched in a cloud environment while preserving confidentiality.

Tags: Cyber security, S&T Japan

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“Basic research, to which we owe everything, is relatively very cheap when compared with other outlays of modern society” ALBERT SZENT-GYÖRGYI

ENERGY

Chemically storing solar power

Science Daily, 22FEB2016

By combining highly specialised new materials, researchers in Austria have managed to combine high temperature photovoltaics with an electrochemical cell. Ultraviolet light can be directly used to pump oxygen ions through a solid oxide electrolyte. The energy of the UV light is stored chemically. In the future, this method could also be used to split water into hydrogen and oxygen. [TECHNICAL ARTICLE](#)

Tags: Energy, Advanced materials, Solar energy

FORECASTING

Looking Ahead to 2020

R&D Magazine, 23FEB2016

The R&D 100 Awards & Technology Conference Expert Panel Predicts Changes and Challenges Five Years Out. Information capacity is now basically endless. Access to revolutionary tools is greater than ever. But having the savvy to get everything in its right place will separate the quick and the dead by the year 2020. Most of the panel agreed that scientists have not done well in outreach to non-inventors and non-innovators to help them understand and respect science. The tech transformation may further alienate the non-expert skeptics.

Tags: Forecasting, Science without borders

10 Breakthrough Technologies 2016

MIT Technology Review, 22FEB2016

The 10 technologies on this list all had an impressive milestone in the past year or are on the verge of solving a big problem and opening up new opportunities. They are - Immune Engineering, Precise Gene Editing in Plants, Conversational Interfaces, Reusable Rockets, Robots That Teach Each Other, DNA App Store, SolarCity's Gigafactory, Slack, Tesla Autopilot, and Power from the Air.

Tags: Forecasting

Model perfect: Researchers document new approach to dealing with uncertainties in mathematical models

Science Daily, 22FEB2016

To address the issue of uncertainties in predictive models an international team of researchers (USA - University of Delaware, UMass Amherst; China) has developed a framework by looking at the effects of correlated parameters. They document their work on predicting the collective behavior of reaction networks, with the goal of improving chemical transformations in catalysis. The

approach has applications in fields ranging from catalysis and combustion to environmental sciences and biology.

[TECHNICAL ARTICLE](#)

Tags: Forecasting, Simulation and modeling

IMAGING TECHNOLOGY

Algorithm makes hyperspectral imaging faster

PhysOrg.com, 18FEB2016

A team of researchers in the US (North Carolina State University, University of Delaware) has developed an algorithm that can quickly and accurately reconstruct hyperspectral images using less data. They were able to reconstruct image quality in 100 seconds of computation that other algorithms couldn't match in 450 seconds. The higher quality of the image reconstruction means that fewer measurements need to be acquired and processed by the hardware, speeding up the imaging time. And fewer measurements mean less data that needs to be stored and transmitted. [TECHNICAL ARTICLE](#)

Tags: Imaging technology

INFORMATION TECHNOLOGY

Eternal 5D data storage could record the history of humankind

Science Daily, 15FEB2016

Using nanostructured glass, researchers in the UK have developed the recording and retrieval processes of five dimensional digital data by femtosecond laser writing. The storage allows unprecedented properties including 360 TB/disc data capacity, thermal stability up to 1,000°C and virtually unlimited lifetime at room temperature (13.8 billion years at 190°C) opening a new era of eternal data archiving. The technology could be highly useful for organisations with big archives, such as national archives, museums and libraries, to preserve their information and records.

Tags: Information technology, S&T UK

MATERIALS SCIENCE

New research introduces 'pause button' for boiling

Science Daily, 23FEB2016

A team of researchers in the US (Syracuse University, NIST, University of Maryland, Rensselaer Polytechnic Institute) used a focused laser beam to essentially hit the pause button on boiling, creating a single vapor bubble in a pool of liquid that can remain stable on a heated surface for hours, instead of milliseconds. This method gives researchers the time necessary to microscopically

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study vapor bubbles and determine ways to optimize the boiling process--maximizing the amount of heat removal with a minimal rise in surface temperature. The new understanding will open the door for creating the next-generation technology for thermal management in electronics. [TECHNICAL ARTICLE](#)

Tags: Materials science, Breakthrough technology

[Topological insulators: Magnetism is not causing loss of conductivity](#)

[PhysOrg.com](#), 19FEB2016

An international team of researchers (Germany, Austria, Czech Republic, Russia) investigated samples of bismuth-selenide doped with the magnetic element Mn forming $(\text{Bi}_{1-x}\text{Mnx})_2\text{Se}_3$ with various concentrations of Mn. Theoretically a band gap should have opened so that the previously conductive surface becomes insulating. The magnetism of the impurities should be the critical influence in this process. But they showed that the band gap formed independent of the strength of the magnetisation and even when the sample was doped with nonmagnetic impurities. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T EU

FEATURED RESOURCE

[Horizon 2020](#)

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020). It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

[Trapped charge carriers delay light emission](#)

[Nanotechweb](#), 18FEB2016

An international team of researchers (the Netherlands, France) used cadmium selenide nanoplatelets and excited them using laser pulses with a wavelength of 441 nm to show that "delayed light emission" caused by trapped charge carriers might be more important in colloidal nanoplatelets than previously thought. Nanoplatelets might be used in many optoelectronics applications, including as electroluminescent materials in light-emitting diodes, gain materials in lasers, photodetectors and photocatalysts. [TECHNICAL ARTICLE](#)

Tags: Materials science, Photonics

[New physics and application of antiferromagnet uncovered](#)

[Science Daily](#), 17FEB2016

Researchers in Japan fabricated switching devices from a stack with an antiferromagnetic PtMn and a ferromagnetic Co/Ni multilayer, and electrically evaluated their

switching properties at room temperature. They found that the current flowing in the antiferromagnet generates a spin-orbit torque large enough to induce the magnetization switching in the neighboring ferromagnet. These findings shed light on a new physics of antiferromagnet and also open various pathways toward ultralow-power integrated circuits and neuromorphic computing. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T Japan

PHOTONICS

[Controlling ultrafast electrons in motion](#)

[Nanowerk](#), 23FEB2016

An international team of researchers (Italy, Australia, Slovenia, Russia, USA - Drake University, Japan, Germany) used a beam of light of two wavelengths and managed to control the direction of emission of electrons ejected from an atom by the light. The experiment had a time resolution of 3 attoseconds. The technique opens the way to the study of more complex processes which occur in nature on the scale of attoseconds, such as photosynthesis, combustion, catalysis and atmospheric chemistry.

Tags: Photonics, Science without borders

[Match-head nanowire structures boost photovoltaic efficiency](#)

[Nanowerk](#), 17FEB2016

Controlled silicon crystal growth on top of silicon wires creates a match-head structure which acts as a light concentrator. A team of researchers in the US (Los Alamos National Laboratory, UC San Diego) reports that light absorption was increased by 36% and photovoltaic efficiency was increased by 20%. Because the match-head crystal is naturally grown and minimizes surface energy, this technique is applicable for a wide range of materials and device architectures to boost performance. [TECHNICAL ARTICLE](#)

Tags: Photonics, Advanced materials

QUANTUM SCIENCE

[Physicists discover easy way to measure entanglement—on a sphere](#)

[PhysOrg.com](#), 19FEB2016

Researchers in the UK turned the difficult analytical problem of quantifying entanglement into an easy geometrical one. They showed that, in many cases, the amount of entanglement between states corresponds to the distance between two points on a Bloch sphere, which is basically a normal 3D sphere that physicists use to model quantum states. This could have applications in quantum cryptography, computation, communication, provide insight into understanding the foundations of thermodynamics, condensed matter physics, and biology. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T UK

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[Researchers demonstrate ‘quantum surrealism’](#)

PhysOrg.com, 19FEB2016

An international team of researchers (Canada, Australia) demonstrated that particles at the quantum level can in fact be seen as behaving something like billiard balls rolling along a table, and not merely as the probabilistic smears that the standard interpretation of quantum mechanics suggests. They tracked the trajectories of photons as the particles traced a path through one of two slits and onto a screen. But the researchers went further, and observed the “nonlocal” influence of another photon that the first photon had been entangled with.

[TECHNICAL ARTICLE](#)

Tags: Quantum science

[Electronic Qubit Integrated Into Solid-State Switch](#)

IEEE Spectrum, 12FEB2016

A team of researchers in the US (University of Maryland, NIST) built a device based on the much theorized idea that nanophotonic cavities or waveguides can bring photons and qubits together in a solid-state device. The quantum phase switch that researchers have developed based on this concept is capable of modifying the polarization of a photon that comes in contact with the spin of an electron trapped in the cavity. The switch can be used as a fundamental building block to make quantum computers and quantum networks.

[TECHNICAL ARTICLE](#)

Tags: Quantum science, Government S&T

S&T POLICY

[How robotics could transform risky and costly underwater operations](#)

EU Research and Innovation, 18FEB2016

Under an EU funded project researchers are developing dexterous clamps with three fingers, which will make robotic operations closer to human capabilities. For onshore, they are developing exoskeleton systems to enable humans to get a ‘feel’ for what the robot is doing, so that underwater robots can be operated intuitively by experts on land. Offshore oil and gas sector and underwater geological and archaeological research could benefit from the research.

Tags: S&T policy, Autonomous systems & robotics, S&T EU

SCIENCE WITHOUT BORDERS

[NASA researchers are working on a laser propulsion system that could get us to Mars in 3 days](#)

Science Alert, 22FEB2016

Researchers at NASA are working on a ‘photonic propulsion’ system that relies on the momentum of photons to move forward. But instead of photons from the Sun’s rays, NASA’s design would be given a push by giant Earth-based lasers.

[TECHNICAL ARTICLE](#), [VIDEO](#)

Tags: Science without borders, Government S&T, Space technology

[New satellite with superior x-ray vision launched](#)

SLAC National Accelerator Laboratory, 19FEB2016

ASTRO-H satellite launched by Japan will collect the X-ray signals of countless cosmic objects from its orbit around the Earth, including hot gas in galaxy clusters, powerful particle streams spit out by black holes, and the remnants of supernova explosions with very dense, rapidly rotating neutron stars at their center. These data will provide new insights into many aspects of astrophysics and cosmology, such as the physics of black holes, the formation of chemical elements, stars and galaxies, and the evolution of the universe itself.

Tags: Science without borders, S&T Japan

[Five-dimensional black hole could ‘break’ general relativity](#)

PhysOrg.com, 18FEB2016

General relativity underpins our current understanding of gravity: everything from the estimation of the age of the stars in the universe, to the GPS signals we rely on to help us navigate. Researchers in the UK have successfully simulated a black hole shaped like a very thin ring, which eventually becomes a series of miniature black holes. Should this type of black hole form, it would lead to the appearance of a ‘naked singularity’, which would cause the equations behind general relativity to break down.

[TECHNICAL ARTICLE](#)

Tags: Science without borders, S&T UK

SENSORS

[Faster airport queues with facial recognition](#)

Science Daily, 19FEB2016

Researchers in Norway have developed algorithms that recognize people’s faces, based on electronic passports with a photo and ID number. It detects and tracks you from the second you arrive at the airport until you’re out of the arrivals hall at your destination. Recognized and identified individuals would be let through automatically. The device will be tested in several airports worldwide.

Tags: Sensors, Pattern recognition

Smart skin made of recyclable materials may transform medicine and robotics

PhysOrg.com, 18FEB2016

Developed by researchers in Saudi Arabia, the flexible, paper-based skin is layered onto a post-it note, with paper, aluminum foil, lint-free wipes, and pencil lines acting as sensing components. It is a multi-sensor artificial skin that's capable of sensing pressure, temperature, humidity, proximity, pH, and air flow. TECHNICAL ARTICLE

Tags: Sensors ■

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