



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Ultrasonic speaker lets you whisper to people 30 metres away](#)

[New Scientist](#), 12MAY2017

Researchers in the UK have built a device which uses ultrasound in a narrow beam so that only people directly in its path would hear the words being spoken. To use the device a person first attaches a speaker to their forehead or chest and four electrodes to their lips and jaw. Using electromyography, the electrodes capture the electrical signals produced by the facial muscles as a person talks. They trained the device using a machine learning algorithm to recognise which electrical muscle signals were associated with words. According to the researchers, later versions of the system could help soldiers communicate without alerting anyone to their presence. Ultrasound travels particularly well underwater so it could also be used to help divers communicate over long distances.

[OPEN ACCESS TECHNICAL ARTICLE](#)

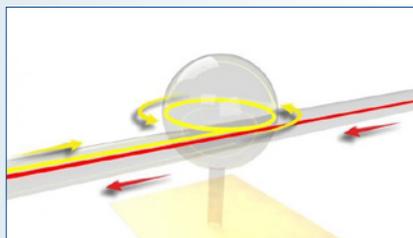
Tags: [Communications technology](#), [S&T UK](#), [Featured Article](#)

[Achieving near-perfect optical isolation using opto-mechanical transparency](#)

[Science Daily](#), 09MAY2017

Researchers at the University of Illinois at Urbana-Champaign have demonstrated complete linear optical isolation in a waveguide-resonator system composed entirely of silica glass by pushing the Brillouin Scattering Induced Transparency

interaction into the strong coupling regime. It is capable of generating a record-breaking 78.6 dB of contrast, meaning light propagating backwards is nearly 100-million times more strongly suppressed than light in the forward direction.



This is an illustration of ultralow-loss complete optical isolation in a fiber. Light in one direction is absorbed by the spherical resonator (yellow arrows) while light in the opposite direction passes through unaffected (red arrows).

Credit: Gaurav Bahl

Since it avoids magnetic fields, this approach is particularly attractive for chip-scale cold atom microsystems technologies, for both isolation and shuttering of optical signals, and on-chip laser protection without loss. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: [Microelectronics](#), [Featured Article](#)

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[Foundations of Intelligent Additive Manufacturing](#)

[ArXiv](#), 18APR2017

Additive manufacturing has largely remained limited to prototyping, tooling, fixtures, and non-critical components. Researchers at the Georgia Institute of Technology suggest developing processing-property relationships through precise, in situ monitoring coupled with formal methods and feedback control. It is necessary to have a set of semantic layers within 3D printing files relevant to the desired material specifications to provide the feedback laws of the control system. The evaluation and correction loop requires on-the-fly coupling of finite element analysis and topology optimization. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: [Advanced manufacturing](#)

ADVANCED MATERIALS

[Coatings for nuclear fuel to prevent explosions in reactors](#)

[Physorg.com](#), 16MAY2017

Researchers in Russia are creating protective titanium nitride-based two microns thick coatings to protect zirconium fuel rods from water and hydrogen accumulation. During tests, titanium nitride has proved itself with high hardness, wear resistance, heat resistance and inertia. The coatings can reduce

continued...

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hydrogen penetration in zirconium alloy. The material has applications in next-generation reactors and thermo nuclear reactors where temperatures are supposed to increase up to 400–450 °C to improve fuel burn-up efficiency. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Energy, Nuclear energy, S&T Russia

[The ultimate tuning of optoelectronic properties with nanoplatelets](#)

[Nanowerk, 15MAY2017](#)

An international team of researchers (Canada, Italy, China, Sweden) addressed the large size of 2D semiconducting nanoplatelets (NPLs) by making ultrasmall lead chalcogenide PbSe_{1-x}S_x nanoplatelets which exhibit an unprecedented quantum yield of ~60%, the highest ever reported for this structure. The NPLs are applied as light absorber in a photoelectrochemical system leading to record saturated photocurrent density in solar-driven hydrogen generation. Ultrasmall NPLs hold the potential for breakthrough developments in the field of optically active nanomaterials. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

[Electrostatic design of materials: A fundamentally new approach](#)

[Science Daily, 12MAY2017](#)

Researchers in Austria used potentially disturbing influences arising from the regular arrangement of polar elements, so-called collective electrostatic effects, to intentionally manipulate material properties. They have demonstrated that this method works for controlling the electronic properties of three-dimensional materials. This approach enables design of complex quantum structures, such as quantum-cascades and quantum-checkerboards. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

[Q&A: On the future of human-centered robotics](#)

[MIT News, 15MAY2017](#)

Researchers at MIT studying the interaction between automation and human behavior discuss the interdependence of people, robots and infrastructure. According to the researchers, robotics and automation carry with them human assumptions about how work gets done, and how technology alters those assumptions and renders autonomous systems less autonomous when they make their way into real world human environments. According to the researchers, the new success of robots will depend on how well they situate into human environments and the strongest players are often the combinations of human and machine. The three critical elements are people, robots, and infrastructure—all interdependent.

Tags: Autonomous systems & robotics

[An Algorithm Summarizes Lengthy Text Surprisingly Well](#)

[MIT Technology Review, 12MAY2017](#)

Researchers in Canada developed an algorithm using several machine-learning tricks to produce surprisingly coherent and accurate snippets of text from longer pieces. The software is still a long way from matching a human's ability to capture the essence of document text, and other summaries it produces are sloppier and less coherent. Summarizing text perfectly would require genuine intelligence, including commonsense knowledge and a mastery of language. And while it isn't yet as good as a person, it hints at how condensing text could eventually become automated.

Tags: Autonomous systems & robotics, Artificial intelligence

[Soldiers will soon have rugged small personal drones](#)

[Defense Systems, 10MAY2017](#)

A company in California has developed a nano unmanned vehicle, called the Snipe, which is a 140-gram autonomous quadcopter that can reach speeds of up to 22 mph and endure winds up to 20 mph. Its flight duration is about 15 minutes which can be extended to 30 minutes. The drone has GPS navigation capability and once airborne, the soldier can program in "waypoints" for the mission on the control tablet. It has a tightly integrated package, with integrated sun-screen, radio, and antennas.

Tags: Autonomous systems & robotics, Military technology

BIOTECHNOLOGY

[Producing fertilizer from air could be five times as efficient](#)

[Science Daily, 15MAY2017](#)

The production of one of the key raw materials for fertilizer, ammonia, is responsible for about 2% of all global CO₂ emissions. Researchers in the Netherlands have developed the Gliding Arc (GA) reactor in which, under atmospheric pressure, a plasma-front (a kind of mini lightning bolt) glides between two diverging metal surfaces. This causes the plasma to cool to room temperature. During the trajectory of the 'lightning', the nitrogen and oxygen molecules react in the immediate vicinity of the lightning front to produce nitrogen oxides. According to the researchers it is five times as efficient as existing processes.

Tags: Biotechnology

[Water droplets as miniaturized test tubes](#)

[Science Daily, 12MAY2017](#)

Researchers in Germany have developed a surface on which aqueous solutions self-arrange in thousands of separate droplets. Every individual droplet is used as a type of test tube for biological experiments. An

“If the facts don't fit the theory, change the facts.”

ALBERT EINSTEIN

individual laboratory employee can execute thousands of substance screening experiments within a few seconds. Experiments can also be performed with a few living cells. The technology has big advantages when screening stem and primary cells for the effect of substances on human organs.

Tags: Biotechnology, S&T Germany

COMMUNICATIONS TECHNOLOGY

[Technology edits voices like text \(w/video\)](#)

[EurekaAlert](#), 15MAY2017

A team of researchers in the US (Princeton University, industry partner) has developed software named VoCo, which provides an easy means to add or replace a word in an audio recording of a human voice by editing a transcript of the recording. New words are automatically synthesized in the speaker's voice even if they don't appear anywhere else in the recording. The technology could provide a launching point for creating personalized robotic voices that sound natural. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Communications technology, Information technology

ENERGY

[Electroplating delivers high-energy, high-power batteries](#)

[Physorg.com](#), 12MAY2017

Traditional lithium-ion battery cathodes use lithium-containing powders mixed with glue-like binders spread on a thin sheet of aluminum foil and dried. An international team of researchers (China, USA - industry partner, University of Illinois at Urbana-Champaign, UC San Diego) bypassed the powder and glue process altogether by directly electroplating the lithium materials onto the aluminum foil. The team has demonstrated that the cathode packs in 30 percent more energy than a conventional cathode, charges and discharges faster and the electroplating process creates pure cathode materials, even from impure starting ingredients. This method opens the door to flexible and three-dimensional battery cathodes. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Energy, Advanced manufacturing, Battery

ENVIRONMENTAL SCIENCE

[More natural dust in the air improves air quality in eastern China](#)

[Science Daily](#), 11MAY2017

Based on model simulations, an international team of researchers (USA - UC San Diego, Pacific Northwest National Laboratory) shows that during years with

decreased wind speed, large decreases in dust emissions (29%) moderate the wintertime land-sea surface air temperature difference in China. The reason is that natural dust particles in the air help deflect sunlight. Fewer dust particles translates to a warmer-than-usual land surface and cooler-than-usual water. That reduces the temperature differential in winter between sea and land, resulting in weaker winds—and increased air stagnation. Human-made pollution is still the core of air pollution but it is important to understand the role of natural dust particles. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Environmental science, Climatology

FORECASTING

[Researcher identifies key differences in solar wind models](#)

[Physorg.com](#), 15MAY2017

An international team of researchers (USA - University of New Hampshire, UK) found that fast computing MHD models may capture some of the solar-wind behavior a lot better than expected. The finding could lead to a more efficient way to forecast space weather for institutions that need to continually model the solar wind, like NASA. They believe that their findings could help develop a set of criteria to determine which type of modeling would be most appropriate for their prediction efforts in specific situations. [TECHNICAL ARTICLE](#)

Tags: Forecasting, Space technology

IMAGING TECHNOLOGY

[Level Playing Field for Million Scale Face Recognition](#)

[ArXiv](#), 01MAY2017

When tested at the million-scale, face recognition exhibits dramatic variation in accuracy across the different algorithms. Researchers at the University of Washington created a benchmark, MF2, that requires all algorithms to be trained on the same data, and tested at the million scale. MF2 is a public large-scale set with 672K identities and 4.7M photos. Compared to other large-scale benchmarks, MF2 trained algorithms performed better. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Imaging technology

INFORMATION TECHNOLOGY

Software convenes rapid, on-demand ‘flash organizations’

Science Daily, 10MAY2017

Traditional crowdsourcing can't be applied to complex and open-ended goals. Researchers at Stanford University tried to overcome the shortcomings of traditional crowdsourcing with a new, more structured approach called flash organizations. Flash organizations combine the most adaptable parts of both traditional crowdsourcing and traditional offline organizations. Like traditional crowdsourcing, the workforce in flash organizations is completely virtual and assembled on-demand from massive online labor markets. But, like a brick-and-mortar business, it is composed of experts assembled in an organizational hierarchy.

Tags: *Information technology*

FEATURED RESOURCE

Digital Trends

Digital Trends helps their audience make informed decisions that allow them to maximize the potential of technology and help integrate it into everyday life. [RSS](#)

Sound over silicon: Computing's wave of the future

Nanowerk, 10MAY2017

Researchers at the University of Arizona are working to build a type of quantum computing analogue that might perform as well as existing quantum computers and overcome problems that plague current quantum computing prototypes. They have shown that information can be stored as phi-bits (units of phonons) in a superposition state, like qubits, and that multiple phi-bits can be assembled so they cannot be separated—analogue to qubit entanglement. Phi-bits can be made at room temperature, and they are less sensitive than qubits to external conditions. According to the researchers, phonon-based computing can make more powerful computers, and have a far reaching impact on artificial intelligence, cryptography and medical sciences.

Tags: *Information technology*

MATERIALS SCIENCE

Gas gives laser-induced graphene super properties

Physorg.com, 15MAY2017

An international team of researchers (USA - Rice University, Israel) found that forming laser-induced graphene (LIG) in argon or hydrogen makes it superhydrophobic, a property highly valued for separating water from oil or de-icing surfaces. Forming it in oxygen or air makes it superhydrophilic. They report that fabricating LIG in oxygen improved its capacitance, hydrophobic or -philic properties could be tuned and surface orientation of LIG's flakes have a lot to do with how it reacts with water. The discovery should also allow some leeway in adjusting the material's properties. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

Next-gen solar cells could be improved by atomic-scale redesign

Science Daily, 12MAY2017

Perovskite cells degrade rapidly in natural conditions due to the formation of 'superoxides' that attack the perovskite material, greatly decreasing their performance in a matter of days. Researchers in the UK have found that superoxide formation is helped by spaces in the structure of the perovskite normally taken up by molecules of iodide. They demonstrated that stability could be improved by filling the vacancies with additional iodide ions. The findings open a new way of optimising the material for enhanced stability by controlling the type and density of defects. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Materials science, S&T UK*

MEDICAL SCIENCES

Prolonged military-style training causes changes to intestinal bacteria, increases inflammation

Medical Express, 05MAY2017

An international team of researchers (USA - US Army, Ft. Detrick, Norway) report that long periods of physiological stress can change the intestinal microbiota, which could increase health risks in endurance athletes and military personnel. According to the researchers, intestinal microbiota may be the mediator of intestinal permeability responses to severe physiologic stress, and that targeting the microbiota before stress exposure may be one strategy for maintaining intestinal permeability. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Medical sciences*

MICROELECTRONICS

Fast, simple way to create two-dimensional electronic circuits

Science Daily, 12MAY2017

An international team of researchers (Poland, USA - Northwestern University) has developed a route to 'pull' flexible granular and colloidal chains out of a dispersion by combining field-directed assembly and capillary effects. The chains are stabilized by liquid bridges formed between adjacent particles, without the need for special particle functionalization. They can be deposited onto any surface and form desired conductive patterns, potentially applicable to the manufacturing of simple electronic circuits. The discovery could lead to a new generation of electronic devices and a fast, simple method to write two-dimensional electronic circuits. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Microelectronics***Faster, smaller, more powerful computer chips: Hafnia dons a new face**

Science Daily, 12MAY2017

Tetragonal form of hafnium dioxide used in optical coatings has attractive properties for computer chips but it is stable only at temperatures above 3100 degrees Fahrenheit. A team of researchers in the US (University of Kentucky, University of Buffalo, Texas A&M University, Oak Ridge National Laboratory) has found a way to achieve the tetragonal phase at 1100 degrees Fahrenheit by shrinking monoclinic hafnium dioxide particles down to the size of tiny crystal nanorods, and gradually heating them. The new phase of hafnia has higher ability to store charge which would allow transistors to work fast using less power. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Materials science***Scientists Can Now Switch Between Electrons And Photons in a Single Transistor**

Science Alert, 11MAY2017

According to researchers at the University of Illinois at Urbana-Champaign, despite the allure of photonics, we will still need to accommodate electrons in future chip designs. They describe how the transistor laser can switch between the two signals. They detail how they've got their bistable switch working at -50 degrees Celsius, and claim to have gotten the device working at room temperature. The research could lead to the development of light-based computer systems where data is shuttled between semiconductors by photons instead of simply electrons. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

QUANTUM SCIENCE

Miniaturised 'heat engines' could power nanoscale machines of the future

Physorg.com, 15MAY2017

In most cases, heat engines are simplified using the assumption that the interaction between the working system and the thermal reservoirs is vanishingly small. Researchers in the UK found that the engine's performance diminishes as the interaction strength becomes more appreciable, and thus non-vanishing system-reservoir interaction strengths constitute an important consideration in the operation of quantum mechanical heat engines. The collective coordinate mapping holds considerable promise for wider studies of thermodynamic systems beyond weak reservoir coupling. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Quantum science, S&T UK***Why Quantum Computers Might Not Break Cryptography**

Quantum Magazine, 15MAY2017

A team of researchers in the US (Oak Ridge National Laboratory, University of Tennessee) notes that even though a quantum computer running Shor's algorithm would be faster than a classical computer, the RSA algorithm is faster than both. And the larger the RSA "key", the greater the speed difference. They estimate that attacking a terabyte-size key using Shor's algorithm would require around 2100 operations on a quantum computer; a real quantum computer wouldn't be able to accomplish this in any reasonable amount of time. The researchers conclude that RSA is not entirely dead even if quantum computers are practical. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Quantum science, Cyber security***Entropy landscape sheds light on quantum mystery**

Physorg.com, 12MAY2017

An international team of researchers (Germany, USA - Rice University) has gleaned new evidence about the possible causes of high-temperature superconductivity and similar phenomena, by precisely measuring the entropy of a cerium copper gold alloy with baffling electronic properties cooled to nearly absolute zero. This demonstration provides a foundation to better understand how novel behaviors like high-temperature superconductivity are brought about. These odd behaviors defy traditional physical theories. They also occur at very cold temperatures and come about when the materials are tuned to a "quantum phase transition". [TECHNICAL ARTICLE](#)

Tags: *Quantum science, Materials science*

SCIENCE WITHOUT BORDERS

Physics may bring faster solutions for tough computational problems

Physorg.com, 12MAY2017

Using statistical mechanics, a team of researchers in the US (Boston University, University of Central Florida) has discovered a way to map the original computational problem onto a statistical model without phase transitions, which they called the vertex model which is defined on a two-dimensional lattice. Each vertex corresponds to a reversible logic gate. The use of reversible logic gates and the regularity of the lattice were crucial ingredients in avoiding the phase-transition snag. The vertex model may help solve complex problems in machine learning, circuit optimization, and other major computational challenges and cryptography. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Science without borders, Mathematics

SpaceX will begin deploying low cost mass produced internet satellites starting in 2019

Next Big Future, 12MAY2017

The company is aiming to launch 4,425 internet communication satellites to low Earth orbit beginning in 2019, with full deployment expected by 2024. They are expected to be in the smallsat-class of 100-to-500 kg (220-to-1,100 lb)-mass, which are intended to be orbiting at an altitude of approximately 1,100 kilometers (680 mi).

Tags: Science without borders, Satellite technology, Space technology

SENSORS

One laser is enough

Physorg.com, 12MAY2017

Researchers in Switzerland developed a method to create two frequency combs with just one laser instead of two. They inserted a birefringent crystal into a laser, which causes the light to travel slightly different distances according to its polarisation. The two laser beams thus produced have slightly different pulse periods, which in turn leads to frequency combs with different frequency spacings. As the two frequency combs are created by the same laser, stabilizing them against each other becomes redundant. The technology can be used to probe gases in the environment precisely and rapidly. [TECHNICAL ARTICLE](#)

Tags: Sensors, S&T Switzerland

Internet of things made simple: One sensor package does work of many

Science Daily, 10MAY2017

Researchers at Carnegie Mellon University have developed a plug-in sensor package called Synthetic Sensors consisting of nine sensors. Using machine learning algorithms, the sensors combine and interpret raw feeds identifying a wide range of events and objects and track the state of the devices. More advanced sensing can infer human activity. Most of the processing occurs on the sensor platform itself, so detailed and sensitive data need not be transmitted or recorded. The sensor platform can be manually trained to recognize various phenomena. It is possible to have each sensor platform communicate with other nearby sensors to create a home-wide sensing environment with just a few sensors.

Tags: Sensors, Information technology

STEM

NVIDIA to Train 100,000 Developers on Deep Learning in 2017

Inside Big Data, 14MAY2017

To meet surging demand for expertise in the field of AI, NVIDIA announced that it plans to train 100,000 developers this year, a tenfold increase over 2016, through the NVIDIA Deep Learning Institute. It is estimated that 80 percent of all applications will have an AI component by 2020. The Institute provides developers, data scientists and researchers with practical training on the use of the latest AI tools and technology. There is a real demand for developers who not only understand artificial intelligence, but know how to apply it in commercial applications.

Tags: STEM, Information technology

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