



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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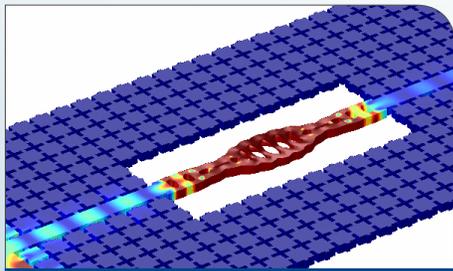
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FEATURE ARTICLES

[Multilingual circuit: 'Optomechanical transducer' links sound, light, radio waves](#)

[NIST, 28MAR2016](#)



Acoustic waveguide channels phonons into the optomechanical cavity, enabling the group to manipulate the motion of the suspended nanoscale beam directly. Credit: K. Balram/K. Srinivasan/NIST

An international team of researchers (USA - NIST, University of Maryland, South Korea) has developed a piezo-optomechanical circuit that converts signals among optical, acoustic and radio

waves. Future information processing systems may need to incorporate other information carriers, such as photons and phonons, in order to carry out different tasks in an optimal way. This work presents one platform for transducing information between such different carriers. [TECHNICAL ARTICLE](#)

Tags: Information technology, Featured Article

[Observation of twisted optical beam traveling slower than the speed of light](#)

[PhysOrg.com, 24MAR2016](#)

An international team of researchers (Canada, USA - University of Rochester) reports that twisted light pulses in a vacuum travel up to 0.1 percent slower than the speed of light. If the slow-light effect is not compensated for, information coded on twisted light might not arrive in the right order. Propagation speeds can significantly affect many protocols related to quantum communication. [TECHNICAL ARTICLE](#)

Tags: Photonics, Communications technology, Quantum science, Featured article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Perovskite Solar Cells Can Recycle Photons](#)

[Optics and Photonics News, 25MAR2016](#)

An international team of researchers (UK, the Netherlands) has discovered another property that could ratchet up the lead-halide perovskites potential efficiency still further: the ability to “recycle” waste photons, giving them another shot at contributing to the cell’s electric-current output. This “photon recycling” can dramatically boost the efficiency of a solar cell, in large part by enhancing its ability to transport energy internally. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Solar energy

[Crumpling Graphene Repeatedly Adds a New Wrinkle](#)

[IEEE Spectrum, 24MAR2016](#)

Last year, researchers in Japan discovered that by forming wrinkles in graphene you can restrict the movements of electrons. Researchers at Brown University found that repeated crumpling permits large areas of graphene oxide to be contained within a much smaller area after three-time compression, which enhances electrochemical current densities by 2000 percent. The graphene oxide is highly stretchable and flexible without breaking, is superhydrophobic and can retain good electrical conductivity. Such functionality could be useful for wearable multifunctional devices that can sense and respond to external stimuli, such as chemical detection. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Graphene nanoribbons: It's all about the edge](#)

[Science Daily, 24MAR2016](#)

Previously, researchers in Switzerland reported on a technique to transform graphene nanoribbons (GNR) into a semiconductor. Now an international team of researchers (Switzerland, Germany) describes how it managed to synthesise GNR with perfectly zigzagged edges using suitable carbon precursor molecules and

continued...

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a perfected manufacturing process. Researchers can give graphene ribbons different properties via the geometry of the ribbons and especially via the structure of their edges.

TECHNICAL ARTICLE

Tags: Advanced materials

Newly discovered organic nanowires leave humanmade technologies in their dust

[Science Daily, 24MAR2016](#)

An international team of researchers (USA - University of Rochester, Grand Valley State University, University of Illinois-Urbana, Michigan State University, Brazil) reports on a protein fiber produced by uranium-reducing Geobacter bacteria. The fibers are hair-like protein filaments called 'pili' that have the unique property of transporting charges at speeds of 1 billion electrons per second. Genetic engineering can be used to tune the electronic and biochemical properties of the nanowires and enable new functionalities. It is also possible to mimic the natural manufacturing process in the lab to mass-produce them in inexpensive and environmentally friendly processes. TECHNICAL ARTICLE

Tags: Advanced materials

Physicists discover large-magnitude elasto-optic effect in ferroelectric materials

[PhysOrg.com, 21MAR2016](#)

An international team of researchers (China, USA - University of Arkansas, Australia, France) applied epitaxial strain engineering to tune the optical response of BiFeO₃ thin films, and found a very large variation of the optical index with strain, corresponding to an effective elasto-optic coefficient larger than that of quartz. They observed a concomitant strain-driven variation in light absorption can be manipulated by an electric field. These findings broaden the potential of multiferroics towards photonics and thin film acousto-optic devices. TECHNICAL ARTICLE
1, 2

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

A novel written by AI passes the first round in a Japanese literary competition

[Science Alert, 25MAR2016](#)

The AI software isn't self-aware enough to think up and submit its own work. The short-form novel was written with the help of a team of researchers in Japan. Human beings selected certain words and phrases to be used, and set up an overall framework for the story, before letting the software come up with the text itself. According to the researchers, creativity is hard to emulate inside a computer, but it's surely only a matter of time before AI programs have the intelligence and the data to be able to do a passable job.

Tags: Autonomous systems & robotics, Artificial intelligence, Information technology

Video Friday: Robots Building Robots, EggBot Op Art, and The Beginning of T-1000

[IEEE Spectrum, 25MAR2016](#)

Human dexterity and agility vastly exceed that of contemporary robots. Yet humans have vastly slower 'hardware' (e.g. muscles) and 'wetware' (e.g. neurons). To combine both motion and interaction primitives, researchers from MIT propose a nonlinear generalization of the classical equivalent circuit. It reconciles contrasting constraints of information-processing (computation) and energy-processing (physical dynamics).

Tags: Autonomous systems & robotics

Machines Just Got Better at Lip Reading

[IEEE Spectrum, 24MAR2016](#)

Researchers in the UK have developed an algorithm that more precisely maps a viseme to one particular phoneme. It involves two training steps. In the first, the computer learns to map a viseme to the multiple phonemes it can represent. In the second, the viseme is duplicated and each copy trains on just one of the sounds. Researchers will present their paper at the 2016 IEEE ICASSP conference.

Tags: Autonomous systems & robotics

What 17 Prominent Robotists Think Google Should Do With Its Robots

[IEEE Spectrum, 23MAR2016](#)

The article includes over a dozen thoughtful comments from robotists to the question posed by IEEE Spectrum - "If you were in charge of Google's robotics division and you had all those robotics companies at your disposal, what would you do? What kinds of robots would you build and for what markets?"

Tags: Autonomous systems & robotics

COMMUNICATIONS TECHNOLOGY

New radio antenna avoids unwanted signals

[Physics World, 29MAR2016](#)

Antennas, from radiofrequencies to optics, are forced to transmit and receive with the same efficiency to/from the same direction limiting their efficiency. Researchers at UT Austin show that it is possible to efficiently overcome these bounds using temporally modulated traveling-wave circuits. They also prove that the proposed temporally modulated antenna can be efficiently used to transmit without being forced to listen to echoes and reflections, which are important implications for radio-wave communications. Similar concepts may be extended to infrared frequencies with relevant implications for energy harvesting.

TECHNICAL ARTICLE

Tags: Communications technology

“Science is simply common sense at its best, that is, rigidly accurate in observation, and merciless to fallacy in logic.” THOMAS HUXLEY

ENERGY

Chinese researchers develop new battery technology

PhysOrg.com, 28MAR2016

The new aluminum-graphite, dual-ion battery (AGDIB) developed by researchers in China offers significantly reduced weight, volume, and fabrication cost, as well as higher energy density in comparison with conventional lithium ion batteries. AGDIB's electrode materials are composed of low cost aluminum and graphite, while its electrolyte is composed of conventional lithium salt and carbonate solvent. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery, S&T China

Calculations reveal how sensors must take turns to harvest power efficiently from a data hub

PhysOrg.com, 25MAR2016

Supercapacitors offer a promising way to store energy, because they are smaller and charge more quickly than rechargeable batteries. However, supercapacitors cannot store energy for long periods because they tend to self-discharge. Researchers in Singapore developed a strategy to solve this problem by calculating the best ways to schedule transmissions around a network of sensors fitted with supercapacitors, so that each sensor was sure to have the energy it needed to send its data back to the hub. [TECHNICAL ARTICLE](#)

Tags: Energy

Flexible energy storage is smaller, cheaper, better

Science Daily, 25MAR2016

Field-assisted sintering technique (FAST), developed by researchers at Sandia National Laboratory, enables the creation of transformer cores from raw starting materials in minutes, without decomposing the required iron nitrides, as could happen at the higher temperatures used in conventional sintering. According to the researchers, using this method could make transformers up to 10 times smaller than the current size.

Tags: Energy, Government S&T

The Race for the Ultra-Efficient Jet Engine of the Future

MIT Technology Review, 23MAR2016

Experimental designs for jets that will reach the market in mid-century promise huge advances in reducing carbon emissions and noise from commercial aircraft. NASA announced a new program to develop advanced aviation

technologies that will reduce carbon dioxide emissions from jet aircraft by more than half. The space agency will support R&D on a number of experimental aircraft including a novel jumbo-jet design which could burn 70 percent less fuel than today's aircraft.

Tags: Energy, Space technology

GOVERNMENT S&T

New DARPA Grand Challenge to Focus on Spectrum Collaboration

DARPA News, 23MAR2016

The agency's Spectrum Collaboration Challenge (SC2) will reward teams for developing smart systems that collaboratively, rather than competitively, adapt in real time to today's fast-changing, congested spectrum environment—redefining the conventional spectrum management roles of humans and machines in order to maximize the flow of RF signals.

Tags: Government S&T, DARPA

Share Your Audacious Ideas to Improve Military Systems at the 2016 TTO Proposers Day

DARPA News, 23MAR2016

DARPA's Tactical Technology Office seeks contributors who can apply the Office's cross-cutting themes (agile development, cost inversion/imposition, autonomous/cooperative unmanned systems, weapons, as well as power and propulsion) to several focus areas. The two-day event encourages proposals for system-level technologies and prototypes that could redefine the state of the art for capabilities, development time and cost. [More information](#)

Tags: Government S&T, DARPA

IMAGING TECHNOLOGY

New Lens for Terahertz Radiation

Optics and Photonics News, 28MAR2016

An international team of researchers (USA - Brown University, Rice University, Japan) created its THz-focusing lens using a stack of 32 stainless-steel plates that are sculpted to create a lens shape and has a refractive index below one. Using this device design, the team was able to focus a 2-cm-diameter beam, at a frequency of 0.17 THz, down to a spot size of 4 mm. The lens transmitted more than 80 percent of the incident radiation. They showed that the performance and properties of the artificial-dielectric lens can be tuned to specific THz wavelengths by varying the spacing between the plates which could be useful in multispectral imaging. [TECHNICAL ARTICLE](#)

Tags: Imaging technology, Sensors, Terahertz technology

INFORMATION TECHNOLOGY

Unique anti-domain in self-assembled ferroelectric nanocapacitors

Nanotechweb, 25MAR2016

The nanocapacitor cells, developed by researchers in China, consist of conductive self-assembled nanoislands as top nanoelectrodes, epitaxial thin ferroelectric middle layers, and a conductive bottom electric layer of SrRuO₃ or LaSrMnO₃ on a single crystal SrTiO₃ substrate. Unique ferroelectric anti-domains are observed inside these capacitor structures. These exhibit opposite polarisation orientation in contrast to that of the bare ferroelectric films. They have application in high density memory devices. [TECHNICAL ARTICLE](#)

Tags: Information technology, S&T China

Plotting the complex path of products

MIT News, 23MAR2016

Researchers at MIT developed a software called Sourcemap that lets consumers map every connection of a product supply chain on a digital map. The software, which operates in the cloud, gives companies a visual map of all connected global supplier locations for their product. The software also employs predictive analytics to analyze real-time news feeds about disasters, corruption, local conflicts, or climate change, and alerts companies to find alternate routes to avert disaster. It will track customer demographics in different locations to help companies decide on branching out to new markets.

Tags: Information technology

FEATURED RESOURCE

Perry-Castañeda Library Map Collection (UT Austin)

Collection includes historical maps, worldwide coverage, and an extensive directory of links to other sites. Out of the 250,000 maps in the printed collection only 70,000 maps are digitized. Most of the maps scanned by the University of Texas Libraries and served from this web site are in the public domain.

MATERIALS SCIENCE

Quantum effects at work in the world's smelliest superconductor

PhysOrg.com, 28MAR2016

Last year, researchers in Germany reported that when subjected to extreme pressure, hydrogen sulphide displays superconducting behaviour at temperatures as high as 203 Kelvin. New theoretical results, obtained by an international team of researchers (Spain, France, UK, China, USA - Carnegie Institution of Washington, Italy), suggest that the quantum behaviour of hydrogen may

be the reason, as it changes the structure of the chemical bonds between atoms. They believe that a similar quantum hydrogen-bond symmetrisation occurs in the hydrogen sulphide superconductor. [TECHNICAL ARTICLE](#)

Tags: Materials science, Quantum science

MICROELECTRONICS

Internet on a chip: Researchers step towards energy-efficient multicore chips

PhysOrg.com, 29MAR2016

Researchers at Carnegie Mellon University identify a new approach for enabling energy-efficient multicore systems. Much like bypassing road congestion when traveling long distances, by using wireless on-chip communication between individually controllable clusters, researchers were able to provide an efficient communication backbone, which can be tailored for large scale multicore systems.

[TECHNICAL ARTICLE](#)

Tags: Microelectronics, Communications technology

PHOTONICS

Photon's Lifetime Extended

American Physical Society Spotlight, 29MAR2016

Researchers in France show that introducing a slow-light medium into a whispering-gallery-mode microresonator extends a photon's lifetime in the resonator by several orders of magnitude. This feature of a resonator defines the length of time a photon can circulate in the device, and thus be stored, before being absorbed or scattered. The new technique could be used to make microarrays of solid-state optical memories that can store photons for long periods of time. [TECHNICAL ARTICLE](#)

Tags: Photonics, S&T France

Single-atom lasers change gears

Nanowerk, 25MAR2016

An international team of researchers (Japan, USA - University of Michigan, Finland) investigated a single-atom laser in which the 'atom' is a pair of quantum dots—tiny gate-defined regions of a semiconductor containing just a few electrons. Their calculations predict that such devices should exhibit dynamic bistability, switching between high- and low-activity regimes. The two stable lasing regimes are predicted to emit photons at low and high rates. By modulating this electric current, it should be possible to attain unprecedented control of photon emission from such lasers. [TECHNICAL ARTICLE](#)

Tags: Photonics

Study points the way to new photonic devices with one-way traffic lanes

PhysOrg.com, 21MAR2016

An international team of researchers (USA - MIT, University of Wisconsin, University of Minnesota, Hong Kong) found that as plasmons move along tiny ribbons

continued...

of two-dimensional materials, such as graphene and transition metal dichalcogenides, they can be separated into two different streams moving in opposite directions at the edges of the ribbons without the need for strong magnetic fields or other exotic conditions. It may be possible to construct an electrically tunable on-chip isolator based on this concept, which can be a very critical component in integrated optics. [TECHNICAL ARTICLE](#)

Tags: Photonics

QUANTUM SCIENCE

[Unlocking the gates to quantum computing](#)

[Chinese Academy of Science, 25MAR2016](#)

At present, even small and medium scale quantum computer circuits cannot be produced because of the requirement to integrate many logic gates into the circuits. An international team of researchers (Australia, France) used quantum entanglement of photons to implement the controlled-SWAP operation directly. The quantum Fredkin gate can also be used to perform a direct comparison of two sets of qubits to determine whether they are the same or not. [TECHNICAL ARTICLE](#)

Tags: Quantum science

[Alice and Bob have their quantum fingerprints checked](#)

[Physics World, 23MAR2016](#)

An international team of researchers (China, USA - MIT) has beaten not only the best existing classical protocol but the theoretical classical limit by using superconducting rather than standard avalanche photon detectors, which reduced the number of false-positive signals from the beam splitter and so improved the accuracy of the yes/no outputs, and designed a novel kind of interferometer. They compared two roughly two-gigabit video files by transmitting just 1300 photons along 20 km of spooled fibre-optic cable. [TECHNICAL ARTICLE](#)

Tags: Quantum science

[The Long-Awaited Promise of a Programmable Quantum Computer](#)

[MIT Technology Review, 23MAR2016](#)

Researchers at the University of Maryland demonstrate a trapped-ion quantum computer module that can be programmed in software to implement arbitrary quantum algorithms by executing any sequence of universal quantum logic gates. They compile algorithms into a fully-connected set of gate operations native to the hardware. Reconfiguring these gate sequences provides the flexibility to implement a variety of algorithms without altering the hardware. [TECHNICAL ARTICLE](#)

Tags: Quantum science

S&T POLICY

[Russia upgrading current and future submarines with new missiles and underwater robotic drones](#)

[Next Big Future, 25MAR2016](#)

Unmanned submarine drones will be released from the main submarine for environmental monitoring using different hardware or to attack the enemy. Torpedoes can be used as a weapon on these carriers. The Sevmas shipyard in northern Russia said the construction of fifth-generation nuclear-powered submarines could begin by 2020.

Tags: S&T policy, Military technology, S&T Russia

SENSORS

[Hybrid pixel array detectors enter the low-noise regime](#)

[PhysOrg.com, 30MAR2016](#)

An international team of researchers (Switzerland, Sweden, Germany) shows that it is now possible to develop hybrid pixel array detectors with sufficient low noise to allow single-photon detection below 1 keV as well as to perform spectroscopic imaging. This means that the system uses relatively standard and thus easy-to-manufacture components, making it possible to envision building larger and/or further-optimised systems in the near future. [TECHNICAL ARTICLE 1, 2](#)

Tags: Sensors

[New terahertz source could strengthen sensing applications](#)

[Nanowerk, 28MAR2016](#)

Researchers at Northwestern University have demonstrated a room temperature continuous wave, highly tunable, high-power terahertz source. Based on nonlinear mixing in quantum cascade lasers, the source can emit up to multi-milliwatts of power and has a wide frequency coverage of one-to-five terahertz in pulsed mode operation. The device has the ability to detect explosives, chemical agents, and dangerous biological substances from safe distances. [TECHNICAL ARTICLE](#)

Tags: Sensors, Terahertz technology

[Sniffing out a dangerous vapor](#)

[Science Daily, 26MAR2016](#)

A team of researchers in the US (University of Utah, University of Illinois at Urbana-Champaign) developed a type of fiber composite that involves two nanofibers transferring electrons from one to the other. When an alkane is present, it sticks in between the two materials, blocking the electron transfer between the two nanofibers. A prototype of the handheld detector, with an array of 16 sensor materials, is able to identify a broad range of chemicals including explosives. [TECHNICAL ARTICLE](#)

Tags: Sensors

Nuclear contraband could be spotted using laser pulses

Physics World, 24MAR2016

A team of researchers in the US (University of Maryland, NRL) has developed a technique that involves firing a low-intensity laser beam at the air surrounding a radioactive source, which increases the number of negative ions created by the gamma rays. A high-intensity laser pulse is then fired at the same region to create an avalanche electrical breakdown. Once the spark has fully formed, the air acts like a mirror, reflecting the laser pulse back to a detector. TECHNICAL ARTICLE

Tags: Sensors ■

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