



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Light and matter merge in quantum coupling](#)

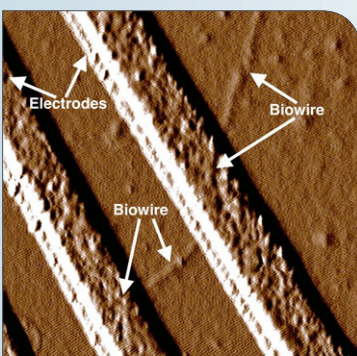
[Nanowerk, 22AUG2016](#)

A team of researchers in the US (Rice University, Sandia National Laboratory, Purdue University) is closing in on a way to create a new condensed matter state in which all the electrons in a material act as one by manipulating them with light and a magnetic field. The effect made possible by a custom-built, finely tuned cavity for terahertz radiation shows one of the strongest light-matter coupling phenomena ever observed. It could help advance technologies like quantum computers and communications and condensed matter physics. [TECHNICAL ARTICLE](#)

Tags: Materials science, Featured Article

[Synthetic biological nanowires to conduct electricity](#)

[Nanowerk, 16AUG2016](#)



Scientists have genetically engineered a new strain of bacteria, found naturally in dirt, to create electrical wires that not only conduct electricity, but also rival the thinnest wires known to humanity. (Image: Dr. Derek Lovley)

Geobacter produces microbial nanowires enabling it to make electrical connections with the iron oxides that support its growth in the ground. But the current is too weak for human use. A team of researchers in the US (UMass at Amherst, Yale University) replaced and rearranged two amino acids naturally present in the wires with tryptophan. Tryptophan-infused nanowires were 2,000 times more conductive than their natural counterparts, durable and much smaller. The nanowires could feed electrical currents to specially engineered microbes to create butanol, an alternative fuel, and enable the bacteria to sense pollutants and explosives. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Synthetic biology, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Thermoelectric paper devices utilize waste heat to power electronics and sensors \(w/ video\)](#)

[Nanowerk, 23AUG2016](#)

To efficiently recover heat from the environment, thermoelectric generators should have maximum thermal contact with heat sources that often have arbitrary geometries. Researchers at the New Jersey Institute of Technology fabricated flexible thermoelectric materials and modules by merging colloidal nanomaterials (quantum dots) that can be tuned for efficient heat-to-electricity energy conversion with naturally abundant cellulose paper that have inherently low thermal conductivity. Paper thermoelectric modules could potentially be used pervasively to power wireless sensor devices. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Energy

[Carbon molecular sieve membranes could cut energy in hydrocarbon separations](#)

[Science Daily, 18AUG2016](#)

The new material, developed by a team of researchers in the US (Georgia Institute of Technology, industry partner), is based on polymer hollow fibers treated to retain their structure and pore sizes as they are converted to carbon through pyrolysis. The carbon membranes are then used in a new organic solvent reverse osmosis process in which pressure is applied to effect the separation without requiring a phase change in the chemical mixture. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Nanostructured device grabs more solar energy to disinfect water faster](#)

[Nanowerk, 15AUG2016](#)

A team of researchers in the US (Stanford University, SLAC National Accelerator Laboratory) has created a nanostructured device, about half the size of a postage stamp, based on molybdenum disulfide nanoflakes. The device disinfects water much faster than the UV

continued...

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method by also making use of the visible part of the solar spectrum, which contains 50 percent of the sun's energy.

TECHNICAL ARTICLE

Tags: Advanced materials

Scientists have created a ceramic, resistant to extreme temperatures

Science Daily, 15AUG2016

Researchers in Russia have created a multilayer ceramic with different types of ceramics based on hafnium carbide and zirconium diboride and oxide with heat resistance of the upper layer of more than 3,000 degrees Celsius. This development is intended primarily for space and aviation. It will increase the temperature in the combustion chamber of jet engines. It will also provide increased protection of objects during reentry to the atmosphere.

[OPEN ACCESS](#) TECHNICAL ARTICLE

Tags: Advanced materials, S&T Russia

AUTONOMOUS SYSTEMS & ROBOTICS

Video Friday: Robo Foosball, Fetch Snackbot, and Europa Submarine

IEEE Spectrum, 19AUG2016

A playlist for most of the of the talks of the AI Now Symposium on "The Social and Economic Implications of Artificial Intelligence Technologies in the Near-Term."

Tags: Autonomous systems & robotics

Natural scale caterpillar soft robot is powered and controlled with light

Science Daily, 18AUG2016

An international team of researchers (Poland, Italy, UK) has developed a natural-scale soft caterpillar robot with an opto-mechanical liquid crystalline elastomer monolithic design. The robot body is made of a light sensitive elastomer stripe with patterned molecular alignment. By controlling the travelling deformation pattern, the robot mimics different gaits of its natural relatives. It can also walk up a slope, squeeze through a slit and push objects as heavy as ten times its own mass, demonstrating its ability to perform in challenging environments and pointing at potential future applications. TECHNICAL ARTICLE

Tags: Autonomous systems & robotics, Photonics

BIOTECHNOLOGY

'Radically rewritten' bacterial genome unveiled

Nature News, 18AUG2016

An international team of researchers (USA - Harvard University, Purdue University, MIT, France) replaced 7 of E. coli's 64 genetic codons with others that produce the same components. They were able to reduce the number of codons by synthesizing the DNA in 55 fragments, each of which was 50,000 base pairs long. They have yet to

reassemble those pieces into a functioning E. coli. According to the team it is a major step in the push to engineer organisms with new properties, such as resistance to infection by viruses. The work also serves as a prototype for the Human Genome Project. TECHNICAL ARTICLE

Tags: Biotechnology, Synthetic biology

Nanoribbons in solutions mimic nature

Nanowerk, 15AUG2016

Researchers at Rice University show that graphene behaves differently in a solution than it does in air. Like DNA and proteins, nanoribbons in solution naturally form folds and loops, but can also form helicoids, wrinkles and spirals. Graphene and graphene oxide materials can be functionalized to integrate with biological devices, biomolecule detection and molecular medicine. The sensitivity of graphene bio-devices can be improved by using narrow graphene materials like nanoribbons. [OPEN ACCESS](#) TECHNICAL ARTICLE

Tags: Biotechnology, Advanced materials

COMMUNICATIONS TECHNOLOGY

China launches world's first quantum science satellite

Physics World, 16AUG2016

In collaboration with Austria, China has launched the world's first satellite dedicated to testing the fundamentals of quantum communication in space. The 600 kg satellite called Micius will now be put into Earth orbit around 500 km above ground. The craft's main instrument is a "Sagnac" interferometer that is used to generate two entangled infrared photons by shining an ultraviolet laser on a non-linear optical crystal. It will demonstrate the feasibility of quantum communication between Earth and space, and test quantum entanglement over unprecedented distances.

Tags: Communications technology, Quantum science

CYBER SECURITY

New hacking technique imperceptibly changes memory of virtual servers

Science Daily, 11AUG2016

Researchers in the Netherlands have developed a technique with which an attacker can crack the keys of secured virtual machines or install malware without it being noticed. It's a new deduplication-based attack in which data can not only be viewed and leaked, but also modified using a hardware glitch. By doing so the attacker can order the server to install malicious and unwanted software or allow logins by unauthorized persons.

Tags: Cyber security

“Innovation distinguishes between a leader and a follower.” STEVE JOBS

ENERGY

[2D electrode materials enable high performance sodium ion full cells](#)

Nanowerk, 17AUG2016

Searching for suitable electrode materials is still a challenge for the development of the SIBs. Researchers at UT Austin designed and fabricated an advanced sodium ion full battery. Both of the cathode and anode materials possessed very unique two-dimensional nanostructured architecture which resulted in excellent rate capability (fast charge/discharge) and stable cycling performance.

[TECHNICAL ARTICLE](#)

Tags: Energy, Battery

IMAGING TECHNOLOGY

[New 3-D thermal imaging capability for satellites](#)

PhysOrg.com, 16AUG2016

Using thermal imaging, researchers in the UK have developed a new technique for taking 3D thermal images of satellites which provide supplementary information. Satellite developers can use these measurements to model and validate behaviour prior to launch. Greater resolution and confidence provided by the measurements may result in reducing the number of thermocouples needed.

Tags: Imaging technology, S&T UK, Satellite technology

INFORMATION TECHNOLOGY

[Computer programming made easier](#)

Science Daily, 15AUG2016

In order to simplify program development, an NSF-supported project called Expeditions in Computer Augmented Program Engineering (ExCAPE), is developing technology that provides human operators with automated assistance. A team of researchers in the US (University of Pennsylvania, University of Illinois at Urbana-Champaign, Microsoft, UC Berkeley) working on the project has developed a method that formalized and standardized the core computational problem in emerging synthesis tools.

[TECHNICAL ARTICLE](#)

Tags: Information technology

MATERIALS SCIENCE

[A changed exchange for magnetic materials](#)

Nanowerk, 19AUG2016

Researchers in Japan show that the Dzyaloshinskii–Moriya interaction arises because of a Doppler effect due to an intrinsic spin current which modifies the propagation

of exchange interactions between spins. The strength of the Dzyaloshinskii–Moriya interaction is equal to the magnitude of the intrinsic spin current. A better understanding of how the Dzyaloshinskii–Moriya interaction arises, and methods for predicting its strength are needed to aid the development of better spintronic materials and devices. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T Japan

[Physicists discover ‘apparent departure from the laws of thermodynamics’](#)

PhysOrg.com, 19AUG2016

Researchers at UCLA demonstrated that ions never truly cool to the temperature of the surrounding gas. They discovered that under certain conditions, two final temperatures exist, and the temperature that the ions choose depends on their starting temperature. They trace these strange features to the heating and cooling rates which exist in the system—the peculiar temperature dependence of the interaction among multiple ions in an ion trap.

For the first time, fundamental limits have been placed on the use of buffer gas cooling in ion traps. [OPEN ACCESS](#)

[TECHNICAL ARTICLE](#)

Tags: Materials science

[Moire Nanosphere Lithography allows fabrication of large-area tunable graphene metasurfaces](#)

Nanowerk, 16AUG2016

Researchers at UT Austin have demonstrated for the first time an effective method to pattern large area graphene into moiré metasurfaces with gradient nanostructures having multiband resonance peaks in mid infrared range. The tunable and multiple plasmon resonance modes in the MIR and THz range of electromagnetic spectra make graphene moiré metasurfaces very promising candidates for ultrathin light modulators, biosensors, flexible optoelectronics and photodetectors. [TECHNICAL ARTICLE](#)

Tags: Materials science

[Russia develops stealth ferrite material to protect tanks and planes against precision guided weapons](#)

Next Big Future, 16AUG2016

The new lightweight and highly flexible fabric, developed by researchers in Russia, is designed for protection against electromagnetic emissions ranging from 0.5 GHz to 50 GHz. It helps decrease the level of the electromagnetic field to 10-30 dB (emissions reflected from the fabric) and up to 100 dB (emissions passing through the fabric), helping

to ensure the resilience of radio-electronic equipment against electromagnetic interference. The material can be used to protect the electronic equipment employed by ground and naval forces and personnel stationed at facilities with high electromagnetic radiation field levels.

Tags: Materials science, Military technology, S&T Russia

New material discovery allows study of elusive Weyl fermion

[Science Daily, 15AUG2016](#)

An international team of researchers (USA - Ames National Laboratory, Ohio State University, University of Tennessee, Oak Ridge National Laboratory, Japan) has discovered a new type of Weyl semimetal, a material that opens the way for further study of Weyl fermions, a type of massless elementary particle hypothesized by high-energy particle theory. It is potentially useful for creating high-speed electronic circuits and quantum computers.

[OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Materials science, Particle physics

FEATURED RESOURCE

Defense Update

Highlights worldwide defense programs; asymmetric, hybrid warfare and net centric operations; and provides a comprehensive list of professional events and exhibitions. [RSS](#)

MICROELECTRONICS

New microchip demonstrates efficiency and scalable design

[Nanowerk, 22AUG2016](#)

Researchers at Princeton University designed a chip (called Pitcon) they say can substantially increase processing speed while slashing energy needs. The chip architecture is scalable; designs can be built that go from a dozen cores to several thousand. Also, the architecture enables thousands of chips to be connected together into a single system containing millions of cores. To hasten further developments leveraging and extending the Pitcon architecture, they made its design open source.

Tags: Microelectronics

NEUROSCIENCE

Neuromorphic computing mimics important brain feature

[PhysOrg.com, 18AUG2016](#)

Researchers in Switzerland have designed a neuromorphic computing system that mimics neural selectivity. They physically implemented artificial neurons

using phase-change materials which have two stable states: a crystalline, low-resistivity state and an amorphous, high-resistivity state. The states can be switched by the application of a voltage. They have demonstrated that phase-change-based memristive devices can be used to create artificial neurons and synapses to store and process data.

[OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Neuroscience, S&T Switzerland

Cognitive offloading: How the Internet is increasingly taking over human memory

[Science Daily, 16AUG2016](#)

A team of researchers in the US (UC Santa Cruz, University of Illinois, Urbana-Champaign) shows that as we use the Internet to support and extend our memory we become more reliant on it in our daily lives. Time will tell if this pattern will have any further reaching impacts on human memory than has our reliance on other information sources.

[OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Neuroscience

PHOTONICS

X-ray optics on a chip

[Science Daily, 18AUG2016](#)

Creating waveguides for X-rays has posed tremendous challenges in fabrication, so they are still only in an early stage of development. Researchers in Germany fabricated and tested a millimetre-sized chip capable of splitting a beam of X-rays. The results of simulations were backed up by experimental measurements at the European Synchrotron Radiation Facility. Illumination of samples by the two beams could provide some interesting advantages for coherent imaging and opens up the possibility of a new form of nano-interferometer. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Photonics, S&T Germany

The Next Generation of Adaptive Optics: PI (Physik Instrumente) and the Fraunhofer IOF Support Visualization of Exoplanets in the E-ELT

[Physics World, 16AUG2016](#)

Researchers in Germany are developing a new actuator concept for the European Extremely Large Telescope (E-ELT). It is intended to use 11,000 PICMA® multilayer piezo actuators in extremely accurate adaptive optics (XAO) to make it possible to get a clear and sharp view into space with pitch of less than 4 mm. The corrected image information allows observation of the finest details on faint celestial objects with a hitherto unattained resolution when compared to terrestrial telescopes currently being used.

Tags: Photonics, S&T Germany

S&T POLICY

NASA just made all the scientific research it funds available for free

Science Alert, 18AUG2016

In response to a new NASA policy, which requires that any NASA-funded research articles in peer-reviewed journals be publicly accessible within one year of publication, any published research funded by NASA will now be available at the public web portal PubSpace.

Tags: S&T policy, NASA

China develops an anti-submarine missile-torpedo hybrid weapon

Next Big Future, 17AUG2016

China has developed a hybrid missile-torpedo (ASW missile Yu-8) that literally joins the two capabilities into a single weapon. The chief advantage of this arrangement is to vastly expand the range and speed of the torpedo system. The Yu- missile is expected to be about five meters in length and weighs less than 700 kilograms. The range is said to be approximately thirty kilometers at a speed of Mach .9 to .95. China plans to increase the missile's overall flight range to fifty-five to seventy kilometers.

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

Explainable Artificial Intelligence (XAI)

DARPA News, 10AUG2016

Explainable AI—especially explainable machine learning—will be essential if future warfighters are to understand, appropriately trust, and effectively manage an emerging generation of artificially intelligent machine partners. XAI aims to produce more explainable models, while maintaining a high level of learning performance (prediction accuracy) and enable human users to understand, appropriately trust, and effectively manage the emerging generation of artificially intelligent partners.

BAA

Tags: S&T policy, Artificial intelligence, DARPA

SCIENCE WITHOUT BORDERS

2016 R&D 100 Awards Finalists

R&D Magazine, 19AUG2016

The R&D 100 Awards have a 50+ year history of recognizing excellence in innovation. The award provides a mark of excellence known to industry, government, and consumers.

Tags: Science without borders

Method to entangle thousands of atoms could lead to record clock stability

PhysOrg.com, 19AUG2016

A team of researchers in the US (Harvard University, University of Nevada, MIT, University of Colorado) has proposed a method for entangling hundreds of

atoms, and then entangling a dozen or so groups of these hundreds of atoms, resulting in a quantum network of thousands of entangled atoms. Small bundles of these entangled groups can function as atomic clocks. If realized, these clocks will have an order of magnitude with greater stability than today's best atomic clocks. Superstable clocks are critical for measuring astronomical effects such as gravitational waves and, potentially, dark matter.

TECHNICAL ARTICLE

Tags: Science without borders, Quantum science

UA engineers twist physics laws to boost sonic science

PhysOrg.com, 17AUG2016

A team of researchers in the US (University of Arizona, University of Washington) is working on manipulating how sound waves behave. Light and sound waves lose energy when encountering a wall, for example, and may attempt to reverse course. The researchers aim to break this symmetry of light and sound waves by making them travel in only one direction. So, when encountering a wall, a sound wave might continue around it, or even be completely absorbed by it.

Tags: Science without borders

How to create sounds that only you can hear in a venue

PhysOrg.com, 16AUG2016

By carefully controlling the waves and where they combine, it is possible to have them cancel in some spaces and amplify in other spaces. Theoretically, with unlimited power, any size and any number of zones of sound or silence can be created. Researchers in Australia have shown that it is possible to provide a couple of distinct zones (with about half a metre between them). One zone can contain speech (or music) at a volume equivalent to a regular conversation, the other zone can contain a sound at a volume similar to background air conditioning.

Tags: Science without borders, S&T Australia ■

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