



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Pure Photons for Quantum Communications](#)

[American Physical Society, 21JAN2014](#)

Complete characterization of the emitted light field is necessary to assess the potential of single-photon sources for long-distance quantum communications. A new experiment by researchers in France shows that a cloud of cold rubidium atoms can be triggered to efficiently emit single photons of unprecedented purity, as certified by a stringent test of nonclassicality.

[TECHNICAL ARTICLE](#)

Tags: Communications Technology, Quantum science, S&T France, Featured Article

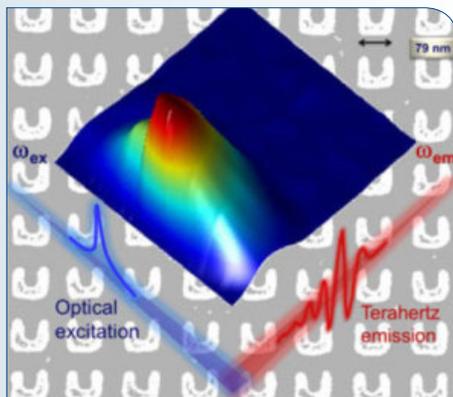
[Highly Efficient Broadband Terahertz Radiation from Metamaterials](#)

[Science Daily, 17JAN2014](#)

Researchers at the Department of Energy's Ames Laboratory have demonstrated that a combination of ultra-short laser pulses and unusual properties of the metamaterial generates efficient and broadband THz waves from emitters of significantly reduced thickness. The discovery may

help develop noninvasive imaging and sensing, and make possible THz-speed information communication, processing and storage. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T, Featured Article



A team led by Ames Laboratory physicists demonstrated broadband, gapless terahertz emission (red line) from split-ring resonator metamaterials (background) in the telecomm wavelength. This approach has potential to generate gapless spectrum covering the entire THz band, which is key to developing practical THz technologies and to exploring fundamental understanding of optics. (Credit: Image courtesy of DOE/Ames Laboratory)

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Frozen magnetic monopoles create new laboratory physics](#)

[Nanowerk, 20JAN2014](#)

To discover the secrets of transient, or far-from-equilibrium phenomenon, such as lightning, physicists need simple yet appealing laboratory systems. An international team of researchers (France, UK, Japan) has created such a system in the magnetic material known as "spin ice." Spin ice is an unusual magnetic material in that it contains the magnetic equivalent of electrical charges - so called magnetic monopoles. The currents of these charges form a magnetic equivalent of electricity or "magnetricity."

[TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Natural 3-D Counterpart to Graphene Discovered: New Form of Quantum Matter](#)

[Science Daily, 16JAN2014](#)

Researchers at the DOE's Lawrence Berkeley National Laboratory have discovered that sodium bismuthate can exist as a form of quantum matter called a three-dimensional topological Dirac semi-metal (3D TDS). This is the first experimental confirmation of 3D Dirac fermions in the interior or bulk of a material, a novel state that was only recently proposed by theorists. The discovery opens the door to more efficient optical sensors. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T, Materials science

AUTONOMOUS SYSTEMS & ROBOTICS

[Human Arm Sensors Make Robot Smarter](#)

[Science Daily, 16JAN2014](#)

Using arm sensors that can "read" a person's muscle movements, Georgia Institute of Technology researchers have created a control system that makes robots more intelligent. The sensors send information to the robot, allowing it to anticipate a human's movements and correct its own. The system is intended to improve time, safety and efficiency in manufacturing plants.

Tags: Autonomous systems & robotics

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Smart Object Recognition Algorithm Doesn't Need Humans

Science Daily, 16JAN2014

Researchers at Brigham Young University have created an algorithm that can accurately identify objects in images or video sequences without human calibration. The genetic algorithm is able to set its own parameters. It doesn't need to be reset each time a new object is to be recognized—it learns them on its own. [TECHNICAL ARTICLE](#)

Tags: Autonomous systems & robotics, Pattern recognition

BIOTECHNOLOGY

Lab-On-A-Chip Realizes Potential

Science Daily, 18JAN2014

An international team of researchers (Singapore, Switzerland) designed an easy-to-operate machine that combines microchip electrophoresis (MCE) with a sensing technology known as a dual capacitively-coupled contactless conductivity detector (dC4D). It can detect multiple ions and molecules down to a level of 300 parts per billion in less than a minute. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, S&T Switzerland

COMMUNICATIONS TECHNOLOGY

Optical soliton waves observed in silicon photonic crystal for the first time

Nanowerk, 20JAN2014

An international team of researchers (Australia, UK, Spain, China) have observed an on-chip soliton compression in a silicon photonic crystal for the first time. The discovery could allow for the miniaturisation of optical components featuring soliton-based functionality in integrated silicon photonic chips. [TECHNICAL ARTICLE](#)

Tags: Communications Technology, Materials science

How Information Flows During Emergencies

MIT Technology Review, 15JAN2014

Mining the mobile phone data from 10 million people over 4 years reveals the subtle changes that occur in the flow of information when disaster strikes, say researchers in China. [TECHNICAL ARTICLE](#)

Tags: Communications Technology, S&T China

CYBER SECURITY

Fridge sends spam emails as attack hits smart gadgets

BBC News, 17JAN2014

The fridge was one of more than 100,000 devices used to take part in the spam campaign. Uncovered by security firm Proofpoint the attack compromised computers, home routers, media PCs and smart TV sets. The attack is believed to be one of the first to exploit the lax security on devices that are part of the "internet of things."

Tags: Cyber security

ENERGY

How to tap the sun's energy through heat as well as light (w/video)

MIT Technology Review, 19JAN2014

A new approach to harvesting solar energy, developed by MIT researchers, could improve efficiency by using sunlight to heat a high-temperature material whose infrared radiation would then be collected by a conventional photovoltaic cell. This technique could also make it easier to store the energy for later use, the researchers say. [TECHNICAL ARTICLE](#)

Tags: Energy, Solar energy

IMAGING TECHNOLOGY

Seeing things: A new transparent display system could provide heads-up data

MIT News, 21JAN2014

Transparent displays have a variety of potential applications—such as the ability to see navigation or dashboard information while looking through the windshield of a car or plane, or to project video onto a window or a pair of eyeglasses. Now, researchers at MIT have come up with a new approach that can have significant advantages over existing systems, at least for certain kinds of applications: a wide viewing angle, simplicity of manufacture, and potentially low cost and scalability. [TECHNICAL ARTICLE](#)

Tags: Imaging technology

Researchers demonstrate proof of creation of a mirror by optical matter

PhysOrg.com, 20JAN2014

Researchers in Switzerland put several micrometer-sized polystyrene beads in water and placed them on a very small pane of glass. Next they fired a laser causing the beads to come close enough to one another that electrostatic force could pull them tightly together. Once in place the beads together formed a reflective surface—reflective enough for the device to be considered a rudimentary mirror. The discovery might lead to giant space based telescopes. [TECHNICAL ARTICLE](#)

Tags: Imaging technology, S&T Switzerland

MATERIALS SCIENCE

Plastic crystals open up possibilities for novel materials

PhysOrg.com, 21JAN2014

Researchers in Denmark have discovered that plastic crystals, which constitute a special type of matter, can be made with the help of rod-shaped particles. The crystals could be used, for example, in colour monitor screens based on electronic ink.

Tags: Materials science

“I want to put a ding in the universe.”

STEVE JOBS

Understanding the functioning of a new type of solar cell

EurekaAlert, 19JAN2014

An international team of researchers (Switzerland, Germany) have uncovered the mechanism by which novel, revolutionary solar cells, based on lead iodide perovskite light-absorbing semiconductor, transfer electrons along their surface. The finding shows these devices constitute a new type of solar cells and open the way to the design of photovoltaic converters with improved efficiency.

TECHNICAL ARTICLE

Tags: *Materials science, Solar energy*

Carbon Dioxide Tamed: Making This Ubiquitous Gas Industrially Useful

Science Daily, 18JAN2014

Researchers in Singapore have shown that a copper catalyst can incorporate carbon dioxide into organic molecules under much milder conditions to make it useful to industry. The commercially available catalyst consists of a copper atom joined to a bulky ligand called 1,3-bis-(2,6-diisopropylphenyl)imidazol-2-ylidene (IPr).

TECHNICAL ARTICLE

Tags: *Materials science*

Improving the Reliability of Electronic Devices by Mitigating Corrosive Effects

Science Daily, 18JAN2014

One in five electronic-device failures is a result of corrosion. Researchers in Singapore have charted how moisture can affect the stability of the bonding and developed a scheme for improving the reliability of these connections.

TECHNICAL ARTICLE

Tags: *Materials science*

A catalyst with a million uses

RIKEN Research, 17JAN2014

Using a controlled chemical etching procedure, researchers in Japan constructed a dense forest of nanowires projecting upward from a silicon wafer, then placed immobilized catalytic palladium nanoparticles on the upper part of the array. These hybrid catalysts containing abundant confined nanospaces, and a wafer just one square centimeter in size can provide plentiful reaction capacity.

TECHNICAL ARTICLE

Tags: *Materials science, Advanced materials, S&T Japan*

Smooth Sailing: Rough Surfaces That Can Reduce Drag

Science Daily, 17JAN2014

Researchers at UCLA modeled the fluid flow between two surfaces covered with tiny ridges. They found that even

in turbulent conditions the rough surface reduced the drag created by the friction of flowing water. Researchers expect such surfaces might cover the undersides of cargo vessels and passenger ships. It could lead to significant energy savings and reduction of greenhouse gas emissions.

TECHNICAL ARTICLE

Tags: *Materials science*

Sudden Thickening of Complex Fluids Modeled

Science Daily, 16JAN2014

For simple liquids, such as water or glycerin, resistance increases in proportion to the stirring speed. According to researchers at the City College of New York, in complex fluids such as suspensions, emulsions and polymers the relationship is not proportional. Resistance increases either faster than the stirring speed—shear thickening—or slower—shear thinning. Since concentrated suspensions are found in everything from consumer products to cement, a range of industries stand to find better ways to manage suspensions.

TECHNICAL ARTICLE

Tags: *Materials science*

Nanotechnology: A Deeper Look at Interfaces

Science Daily, 15JAN2014

An international team of researchers (USA, Germany, Netherlands) combined two well-established techniques for studying electronic structure in crystalline materials into a new technique called SWARPES (Standing Wave Angle-Resolved Photoemission Spectroscopy), that is optimized for examining electronic properties at subsurface interfaces. For the first time SWARPES allows us to selectively study buried interfaces with either soft or hard x-rays.

TECHNICAL ARTICLE

Tags: *Materials science*

MICROELECTRONICS

Superconducting spintronics pave way for next-generation computing

Nanowerk, 20JAN2014

Researchers in the UK have provided the first evidence that superconductors could be used as an energy-efficient source for “spin-based” devices. Spintronics promises the potential to create a new generation of super-fast computers, capable of processing vast amounts of data in an energy-efficient way.

TECHNICAL ARTICLE

Tags: *Microelectronics, S&T UK*

NEUROSCIENCE

Brain On Autopilot: How the Architecture of the Brain Shapes Its Functioning

Science Daily, 26JAN2014

According to researchers in Germany, in comparison to other networks, the default mode network which is associated with daydreaming, imagination, and self-referential thought, uses the most direct anatomical connections. They think that neuronal activity is automatically directed to level off at this network whenever there are no external influences on the brain. [TECHNICAL ARTICLE](#)

Tags: Neuroscience, S&T Germany

Training your brain using neurofeedback

EurekaAlert, 20JAN2014

Researchers in Canada are the first to demonstrate that magnetoencephalography (MEG) can be used as a potential therapeutic tool to control and train specific targeted brain regions. This advanced brain-imaging technology has important clinical applications for numerous neurological and neuropsychiatric conditions. MEG is a non-invasive imaging technology that measures magnetic fields generated by nerve cell circuits in the brain.

Tags: Neuroscience, S&T Canada

Brain Regions 'Tune' Activity to Enable Attention

Science Daily, 16JAN2014

According to researchers at Washington University the brain appears to synchronize the activity of different regions to make it possible for a person to pay attention or concentrate on a task. They think that the brain not only puts regions that facilitate attention on alert but also makes sure those regions have open lines for calling each other. [TECHNICAL ARTICLE](#)

Tags: Neuroscience

FEATURED RESOURCE

Armed with Science

Armed with Science is a daily blog site for the Department of Defense that incorporates print, video, and social media assets of over 50 scientific organizations across the Federal government. [RSS](#)

Discovery of Quantum Vibrations in 'Microtubules' Inside Brain Neurons Supports Controversial Theory of Consciousness

Science Daily, 16JAN2014

According to a team of international researchers (USA, UK) EEG rhythms derived from deeper level microtubule vibrations corroborates a 20-year-old theory of consciousness.

From a practical standpoint, treating brain microtubule vibrations could benefit a host of mental, neurological, and cognitive conditions. [TECHNICAL ARTICLE 1, 2](#)

Tags: Neuroscience

Erasing traumatic memories

MIT News, 16JAN2014

Researchers at MIT have now shown that they can extinguish well-established traumatic memories in mice by giving them a type of drug called an HDAC2 inhibitor, which makes the brain's memories more malleable, under the right conditions. According to the researchers giving this type of drug to human patients receiving psychotherapy may be much more effective than psychotherapy alone.

Tags: Neuroscience

How Vision Captures Sound Now Somewhat Uncertain

Science Daily, 16JAN2014

While past research has shown that the brain creates a similar code for vision and hearing to integrate this information, Duke University researchers have found the opposite: neurons in a particular brain region respond differently, not similarly, based on whether the stimuli is visual or auditory. The finding provides insight into how vision captures the location of perceived sound.

[TECHNICAL ARTICLE](#)

Tags: Neuroscience

In the blink of an eye

MIT News, 16JAN2014

A team of researchers from MIT and Penn State University have found that the human brain can process entire images that the eye sees for as little as 13 milliseconds. The job of the eyes is not only to get the information into the brain, but to allow the brain to think about it rapidly enough to know what you should look at next. So in general we're calibrating our eyes so they move around just as often as possible consistent with understanding what we're seeing.

[TECHNICAL ARTICLE](#)

Tags: Neuroscience

PHOTONICS

Laser-induced damage in focus

RIKEN Research, 17JAN2014

The most efficient way to convert light into different wavelengths is to use nonlinear optical crystals, but these tend to suffer crystal damage at high laser intensities. Researchers in Japan have now discovered that such crystal damage arises from small localized temperature rises due to photon absorption and electric field effects within the crystal. The discovery could enhance laser device performance. [TECHNICAL ARTICLE 1, 2](#)

Tags: Photonics, Materials science, S&T Japan

QUANTUM SCIENCE

Peeking into Schrodinger's box: Direct measurement shows potential for quantum information

PhysOrg.com, 20JAN2014

An international team of researchers (USA, Austria, UK) developed a direct measurement technique which consists of two types of measurements performed one after the other, first a “weak” measurement followed by a “strong” measurement. The trick lies with the first measurement being so gentle that it only slightly disturbs the system and does not cause the wavefunction to collapse. [TECHNICAL ARTICLE](#)

Tags: Quantum science

Energy Teleportation Overcomes Distance Limit

MIT Technology Review, 16JAN2014

The ability to teleport energy from one location to another could revolutionise the way quantum devices operate, but only if it can be made to work over practical distances. Now physicists in Japan think they know how. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T Japan

Quantum Physics Could Make Secure, Single-Use Computer Memories Possible

Science Daily, 15JAN2014

Researchers at NIST have shown in theory how the laws of quantum physics could allow for the construction of a “one-shot” memory unit. This would have a wide range of possible applications such as protecting the transfer of large sums of money electronically. It might contain two authorization codes: one that credits the recipient's bank account and one that credits the sender's bank account, in case the transfer is canceled. Crucially, the memory could only be read once, so only one of the codes can be retrieved, and hence, only one of the two actions can be performed—not both.

Tags: Quantum science, Government S&T

SCIENCE WITHOUT BORDERS

An old mathematical puzzle soon to be unraveled?

PhysOrg.com, 15JAN2014

According to the twin primes conjecture there exists an infinite number of pairs of prime numbers whose difference is two. In April 2013, the University of New Hampshire mathematicians presented a “weak version” of this conjecture by showing that you will never stop finding pairs of primes separated by at most 70 million. A researcher in Canada went even further, reducing the gap to 600. This represents a huge step forward in the quest to establish the twin primes conjecture. Expanding our knowledge about prime numbers will allow us to solve complex problems in other disciplines such as engineering and chemistry.

Tags: Science without borders, Mathematics, S&T Canada

SENSORS

Liquid crystal turns water droplets into 'gemstones'

PhysOrg.com, 21JAN2014

Researchers at the University of Pennsylvania and Swarthmore College describe new research into a type of liquid crystal that dissolves in water rather than avoid it as do the oily liquid crystals found in displays. This property means that these liquid crystals hold potential for biomedical applications, where their changing internal patterns could signal the presence of specific proteins or other biological macromolecules. [TECHNICAL ARTICLE](#)

Tags: Sensors, Biotechnology

Nanotechnology e-whiskers as tactile sensors for robotics

Nanowerk, 21JAN2014

Researchers at Berkeley Lab and the University of California, Berkeley have created tactile sensors from composite films of carbon nanotubes and silver nanoparticles similar to the highly sensitive whiskers of cats and rats. These new e-whiskers respond to pressure as slight as a single Pascal, about the pressure exerted on a table surface by a dollar bill. Among their many potential applications is giving robots new abilities to “see” and “feel” their surrounding environment.

Tags: Sensors, Autonomous Systems & Robotics

EU-funded project to take biometric security systems to the next level

EU R&D News, 20JAN2014

TABULA RASA consortium, which is supported by EU research and innovation investment, has set out to identify just how well biometric software works, in particular against the growing phenomenon of “spoofing” i.e. using everyday materials such as make-up, photographs and voice recordings to subvert or directly attack biometric systems. Participants in the project include EU countries and China.

Tags: Sensors, Biometrics, S&T EU ■

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