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S&T NEWS BULLETIN

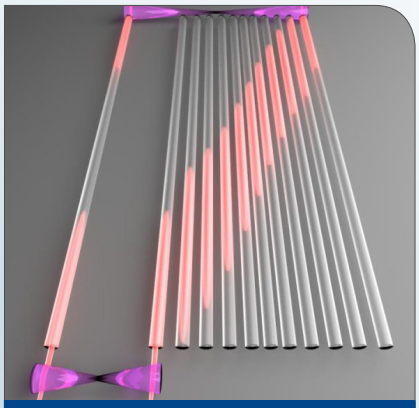
THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

Advanced materials (10)
Autonomous systems & robotics (1)
Big data (1)
Communications technology (2)
Energy (4)
Information technology (1)
Materials science (5)
Microelectronics (1)
Neuroscience (2)
Photonics (2)
Science without borders (1)
Sensors (2)

FEATURE ARTICLES

Quantum computing closer as scientists drive towards first quantum data bus

Science Daily, 18APR2016



Quantum information is encoded in single particles of light (photons). The perfect state transfer is applied to one photon of an entangled pair, relocating it to a distant location while preserving the delicate quantum information and entanglement. Credit: RMIT University

For the fist time, an international team of researchers (Australia, Italy, China) has demonstrated the perfect state transfer of an entangled quantum bit on an integrated photonic device. The device uses highly optimised quantum tunnelling to relocate qubits between distant sites. The protocol could be implemented in large scale quantum computing architectures, where interconnection between qubits will be essential. TECHNICAL ARTICLE

Tags: Communications technology, Quantum science, Featured Article

WiFi capacity doubled at less than half the size

Nanowerk, 15APR2016

Researchers at Columbia University have developed a breakthrough technology that needs only one antenna, thus enabling an even smaller overall system. This is the first time researchers have integrated a non-reciprocal circulator and a full-duplex radio on a nanoscale silicon chip. The technology could revolutionize the field of telecommunications. TECHNICAL ARTICLE

Tags: Communications technology, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

Carbon nanotubes light up on photonic chips

Physics World, 20APR2016

Researchers in Germany used a single carbon nanotube as a scalable and tunable light source and integrated it into a nanoscale waveguide. The nanotubes are part of a photonic-crystal waveguide that converts electric signals into light. The researchers hope their work could advance the field of optoelectronics and help to produce faster computer chips. TECHNICAL ARTICLE

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

Built-in shades may protect delicate sensors from blinding light

Science Daily, 19APR2016

Researchers at the University of Wisconsin-Madison are developing optical limiters using a special class of materials that can rapidly switch from transparent to opaque due to phase transitions. Because transition is an intrinsic property of the material itself, no complex circuitry or external power sources are required to manage the change from clear to cloudy. They plan to develop two-way versions of the devices that let light escape from a device, but prevent intense incoming beams from intruding. This technology could protect sensitive surveying technologies like LIDAR, which emit very powerful lasers, and then collect weak reflected signals to measure the environment.

Tags: Advanced materials

Carbon nanotube template produces sub-5 nm features

Nanotechweb, 18APR2016

Researchers in Korea have developed a new way to make nano-trenches less than 5 nm deep with a technique called atomic-layer deposition, and single-walled carbon nanotubes as templates. The structures produced could be used to make high-density resistive components for a wide range of nanoelectronics devices. TECHNICAL ARTICLE

Tags: Advanced materials

continued...

BACK TO TOP

A new combination of materials allows state-of-the-art operating controls with elastic circuits

Science Daily, 15APR2016

Using photochemical metallization, researchers in Germany have succeeded in manufacturing circuit paths on thin, elastic foil made of silicone. Since these are relatively insensitive to compression and elongation strain, the electrical circuits can adapt to the curvature of appliances. Conventional buttons, keys or switches will not be necessary.

Tags: Advanced materials, S&T Germany

Generation of tailored magnetic materials

Science Daily, 15APR2016

An international team of researchers (Switzerland, UK, France, Spain) has succeeded in modifying the properties of $LaNiO_3$ and $LaMnO_3$, which make up the artificial material, to be either ferromagnetic or antiferromagnetic. Control of the magnetic interactions could especially be used to develop future magnetic memories, allowing the high dissipation energy of current processors to be reduced. TECHNICAL ARTICLE

Tags: Advanced materials

'Odd couple' monolayer semiconductors align to advance optoelectronics

Science Daily, 15APR2016

An international team of researchers (Oak Ridge National Laboratory, Vanderbilt University, University of Utah, China, Japan) synthesized a stack of atomically thin monolayers of gallium selenide, a "p-type" semiconductor, rich in "holes" and the other molybdenum diselenide, an "n-type" semiconductor, rich in electron charge carriers. The two semiconductor layers formed a p-n junction, which generated a photovoltaic response by separating electron-hole pairs that were generated by light. The research shows the promise of synthesizing mismatched layers to enable new families of functional two-dimensional (2D) materials. TECHNICAL ARTICLE

Tags: Advanced materials, Solar energy

Tesla Coil Remotely Induces Nanotubes to Self Assemble

IEEE Spectrum, 15APR2016

A team of researchers in the US (Rice University, University of Tennessee, Texas A&M University) was able to get nanotubes to self-assemble into long chains because the Tesla coil generates an electric field that causes the positive and negative charges in each nanotube to oscillate. Controlled assembly of nanomaterials from the bottom up could be useful in applications including regenerative medicine as well as fabricating electronic circuits without touching them. TECHNICAL ARTICLE

Tags: Advanced materials

Nanoparticles can grow in cubic shape

PhysOrg.com, 14APR2016

The efficiency of many applications depends dramatically on a finite-size property of nanoparticles. The principle of thermodynamic equilibrium predicts that the only shape of nanoparticles can be spherical or close-to-spherical. An international team of researchers (Finland, Japan, Palestine) showed that in some conditions, iron nanoparticles can grow in cubic shape. They showed the importance of kinetical processes in this phenomenon, namely the competition between surface diffusion and deposition rate of atoms. TECHNICAL ARTICLE

Tags: Advanced materials, Materials science

Scientists grow a material based on hafnium oxide for a new type of non-volatile memory

Nanowerk, 14APR2016

An international team of researchers (Russia, USA - University of Nebraska, Switzerland) have experimentally demonstrated that polycrystalline fused films of hafnium and zirconium oxides, with a thickness of just 2.5 nm, grown on a silicon substrate retain their ferroelectric properties. Researchers suggest that it will be possible to build volatile memory devices with this material directly onto silicon in the near future. TECHNICAL ARTICLE

Tags: Advanced materials, Microelectronics

A single-atom magnet breaks new ground for future data storage

Science Daily, 14JAN2016

An international team of researchers (Switzerland, Serbia, Qatar, France) placed single holmium atoms on ultrathin films of magnesium oxide, which were previously grown on a surface of silver. The electron structure of holmium atoms protects the magnetic field from being flipped, making magnets with robust remanence which is stable at temperatures around 40 Kelvin (-233.15 oC). TECHNICAL ARTICLE

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

Designing attack-resilient micro aerial vehicles

EurekAlert, 19APR2016

Researchers at the University of Delaware are developing consistent state estimation algorithms that will allow drones to detect abnormalities in their sensing and react to them to compensate for malicious attacks. The research will foster novel MAV-based applications, such as providing aerial transportation during humanitarian aid and delivering supplies in hard-to-reach areas during and after disasters.

Tags: Autonomous systems & robotics

continued...

"There is nothing that living things do that cannot be understood from the point of view that they are made of atoms acting according to the laws of physics." RICHARD FEYNMAN

BIG DATA

Artificial Intelligence Can Now Design Realistic Video and Game Imagery

MIT Technology Review, 14APR2016

Researchers in the UK developed a way to create high-quality videos or images from low-resolution ones. It feeds example images to a computer, which converts them to a lower resolution and then learns the difference between the two. What's unusual about this approach to processing video footage is that it does not need manually labeled examples. Instead, it recognizes statistical patterns in high-resolution and low-resolution examples and then teaches itself what edges, textures, straight lines, and other features should look like.

Tags: Big data, Artificial intelligence

ENERGY

Unexpected discovery leads to a better battery

Nanowerk, 18APR2016

The reason lithium-ion batteries fail after charging a few times is because we failed to control chemical equilibrium in rechargeable zinc-manganese energy storage systems. A team of researchers in the US (Pacific Northwest National Laboratory, University of Washington) shows that equilibrium needs to be controlled during a chemical conversion reaction to improve zinc-manganese oxide battery performance. They could be a more viable solution for large-scale energy storage. TECHNICAL ARTICLE

Tags: Energy, Battery, Government S&T

Artificial leaf? Successful synthesis of ammonia using visible light, water, and atmospheric nitrogen

Science Daily, 15APR2016

An international team of researchers (Japan, Taiwan) has developed a co-catalyst that can convert di-nitrogen into ammonia with good efficiency. By supporting the co-catalyst on a photoelectrode in which gold nanoparticles are loaded, they have succeeded in using water, di-nitrogen, and visible light to selectively synthesize ammonia. Artificial photosynthesis systems that convert solar energy into storable chemical energy may be a way to solve the global energy problem. TECHNICAL ARTICLE

Tags: Energy

Fossil fuels could be phased out worldwide in a decade, says new study

Science Daily, 15APR2016

An international team of researchers (Denmark, UK) presents a "mainstream" view of energy transitions as long, protracted affairs, often taking decades to centuries to occur. However, the article then offers some empirical evidence that the predominant view of timing may not always be supported by the evidence. The final part of the article argues for more transparent conceptions and definitions of energy transitions, and it asks for analysis that recognizes the causal complexity underlying them. TECHNICAL ARTICLE

Tags: Energy

Desk-Size Turbine Could Power a Town

MIT Technology Review, 11APR2016

GE Global Research is testing a desk-size turbine that could power a small town of about 10,000 homes. The unit is driven by "supercritical carbon dioxide," which is in a state that at very high pressure and up to 700 °C exists as neither a liquid nor a gas. After the carbon dioxide passes through the turbine, it's cooled and then repressurized before returning for another pass. The unit's compact size and ability to turn on and off rapidly could make it useful in grid storage. It has the potential to be 50 percent efficient at turning heat into electricity.

Tags: Energy

INFORMATION TECHNOLOGY

Clothes that receive and transmit digital information

KurzweilAI, 13APR2016

Researchers at Ohio State University have taken a key step in the design of "functional textiles"—clothes that gather, store, or transmit digital information. They've developed a breakthrough method of weaving electronic components into fabric with 0.1mm precision—small enough to integrate components such as sensors and computer memory devices into clothing. TECHNICAL ARTICLE

Tags: Information technology, Flexible electronics

MATERIALS SCIENCE

Making electronics out of coal

MIT News, 19APR2016

As a first demonstration of what they see as a broad range of potential high-tech uses for this traditionally low-tech material, researchers at MIT have succeeded in making a simple electrical heating device that could be used for defrosting car windows or airplane wings, or as part of a biomedical implant. In developing this initial application, they have also, for the first time, characterized in detail the chemical, electrical, and optical properties of thin films of four different kinds of coal: anthracite, lignite, and two bituminous types. TECHNICAL ARTICLE

Tags: Materials science

continued...

Physicists build engine consisting of one atom

Nanowerk, 15APR2016

Researchers in Germany used a Paul trap to capture a single electrically charged calcium atom which can be heated with the help of electrically-generated noise and cooled by using a laser beam, thus subjected to a thermodynamic cycle replicating the stroke of a typical engine. The atom also stores the energy. They report that it can generate power of 10-22 watts and operates at 0.3 percent efficiency. By reversing the cycle, it can be used as a single atom refrigerator to cool nano systems. TECHNICAL ARTICLE

Tags: Materials science, S&T Germany

Featured Resource

Scifeeds

SciFeeds is a smart science aggregator whose data sources include peer-reviewed journal articles, news media articles, blog posts, social media posts, and jobs.

'Weirdest martensite': Century-old smectic riddle finally solved

PhysOrg.com, 15APR2016

An international team of researchers (USA - Cornell University, University of Pennsylvania, Brazil) report on the unusual microstructure of smectics - liquid crystals whose molecules are arranged in layers and form ellipses and hyperbolas - and their similarity to martensites, a crystalline structure of steel. They developed a clustering algorithm and proposed a theory of smectic micro-structure that merges the laws of association between smectic liquid crystals and martensites. TECHNICAL ARTICLE

Tags: Materials science

Flake-like nanoparticles offer reliable rust protection

Science Daily, 14APR2016

Researchers in Switzerland have developed a special type of zinc-phosphate nanoparticles. In contrast to conventional, spheroidal zinc-phosphate nanoparticles, the new nanoparticles are flake-like. They are ten times as long as they are thick. As a result of this anisotropy, the penetration of gas molecules into the metal is slowed down.

Tags: Materials science, S&T Switzerland

Mysterious 'four-dimensional' iron oxide explained

Science Daily, 13APR2016

An international team of researchers (Germany, Russia, Estonia, China, Belgium, France) discovered that when Fe4O5 iron oxide is cooled to temperatures below 150K, it goes through an unusual phase transition related to a formation of charge-density waves—which lead to a "four-dimensional" crystal structure. TECHNICAL ARTICLE

Tags: Materials science

MICROELECTRONICS

Laser source for biosensors: First time organic lasers integrated into a silicon photonic chip

Science Daily, 15APR2016

An international team of researchers (Germany, Belgium) has developed a new class of lasers in the infrared range by combining silicon nano waveguides with a polymer doped with an organic dye. The energy to operate this "organic" laser is supplied from above, vertically to the chip surface, by a pulsed light source. The researchers succeeded in generating pulsed laser radiation with a wavelength of 1310 nm and a peak power of more than 1 Watt on one chip. By the use of various dyes and laser resonators, the wavelength of laser radiation can be varied over a wide range. TECHNICAL ARTICLE

Tags: Microelectronics, Photonics, Sensors

NEUROSCIENCE

Complex ideas can enter consciousness automatically

Science Daily, 14APR2016

Symbol manipulations such as mentally rearranging words or musical notes, or performing math operations -- have been regarded as being more multifaceted than the very different process of automatic memory retrieval. A study by a team of researchers in the US (San Francisco State University, University of Denver, UCSF) reveals that unintentional, unconscious processes can be more sophisticated than what has been thought before, consciousness is passive, and that its contents are often generated unconsciously. TECHNICAL ARTICLE

Tags: Neuroscience

Electrical brain stimulation enhances creativity, researchers say

Medical Express, 14APR2016

A team of researchers in the US (Georgetown University, University of Connecticut, NIH, Northwestern University, MedStar National Rehabilitation Hospital) found that individuals who were most able to ramp up activity in a region at the far front of the brain, frontopolar cortex, were the ones most able to ramp up the creativity of the connections they formed. Since ramping up activity in the frontopolar cortex appeared to support a natural boost in creative

continued...

thinking, they predict that stimulating activity in this brain region would facilitate this boost, allowing people to reach higher creative heights. TECHNICAL ARTICLE

Tags: Neuroscience

PHOTONICS

Controlling integrated optical circuits using patterns of light

Science Daily, 18APR2016

An international team of researchers (UK, France) makes use of multimode interference (MMI) devices, which form a versatile class of integrated optical elements routinely used for splitting and recombining different signals on a chip. The geometry of the MMI predefines its characteristics at the fabrication stage. They show that the intricate interplay between many modes travelling through the MMI can be dynamically controlled. TECHNICAL ARTICLE

Tags: Photonics

New nanodevice shifts light's color at single-photon level

Science Daily, 18APR2016

Optical frequency conversion has applications ranging from tunable light sources to telecommunications-band interfaces for quantum information science. A tiny ring-shaped resonator made of silicon nitride is the key component of the chip-integrated device which was developed by a team of researchers in the US (NIST, University of Maryland). The ring resonator is driven by two pump lasers, each operating at a separate frequency. In a scheme known as four-wave-mixing Bragg scattering, a photon entering the ring is shifted in frequency by an amount equal to the difference in frequencies of the two pump lasers. TECHNICAL ARTICLE

Tags: Photonics, Government S&T

SCIENCE WITHOUT BORDERS

All of the technology is nearly ready for megawatt space based laser systems for science and planetary defense

Nanowerk, 16APR2016

A team of researchers in the US (UC Santa Barbara, California Polytechnic State University, Ventura College, SRI, Industry partners) presents basic ideas behind a directed energy planetary defense system that heats the surface of the target to the point of high surface vapor pressure that causes significant mass ejection thus forming an ejection plume of material from the target that acts as a rocket to deflect the object. DE-STARLITE is a reduced-scale version of DE-STAR (Directed Energy System for Targeting of Asteroids and exploRation). TECHNICAL ARTICLE

Tags: Science without borders

SENSORS

Animal-inspired whiskers key to new navigation technology

Science Daily, 15APR2016

An international team of researchers (USA, Singapore) describes a whisker array they developed using five super-elastic metal alloy wires covered in plastic straws. A strain gauge located at the bottom of the array records any movement the whiskers make. These signals are accumulated to create an image of the gas or fluid brushing past it. According to the researchers, artificial whiskers might eventually be used in robotics as an alternative to conventional vision, radar or sonar systems.

Tags: Sensors

Coding and computers help spot methane, explosives

EurekAlert, 14APR2016

Mass spectrometers are typically the size of an oven or refrigerator. With the help of modern data analytics, a team of researchers in the US (Duke University, industry partner) demonstrated a technology using coded aperture that promises to shrink these devices while maintaining their performance. The advance could lead to portable mass spectrometers that could be used to detect environmental or safety hazards in the field. TECHNICAL ARTICLE

Tags: Sensors ■

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