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S&T NEWS BULLETIN

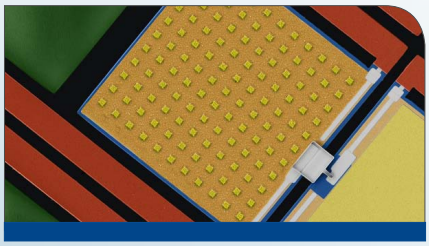
THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

Advanced materials (2)
Autonomous systems & robotics (2)
Biotechnology (1)
Communications technology (1)
Cyber security (1)
Energy (3)
Environmental science (1)
Imaging technology (1)
Information technology (5)
Materials science (4)
Microelectronics (1)
S&T policy (2)
Science without borders (1)
Sensors (4)

Feature Articles

Dormant, Yet Always-Alert Sensor Awakes Only in the Presence of a Signal of Interest

DARPA News, 11SEP2017



Unlike conventional sensors, the sensor built by researchers at Northeastern University consumes zero stand-by power when the IR wavelengths to be detected are not present. The technology features multiple sensing elements—each tuned to absorb a specific IR wavelength. Together, these combine into complex logic circuits capable of analyzing IR spectrums, which opens the way for these sensors to not only detect IR energy in the environment but to specify if that energy derives from a fire, vehicle, person or some other IR source. The capability of consuming power only when useful information is present will result in nearly unlimited duration of operation for unattended sensors deployed to detect infrequent but time-critical events. TECHNICAL ARTICLE

Tags: Sensors, Featured Article

Cooling system works without electricity

Science Daily, 05SEP2017

Building upon daytime radiative sky cooling, researchers at Stanford University have demonstrated that fluid cooling panels covered in a multilayer optical film sitting atop pipes of running water reflects about 97 percent of the sunlight and simultaneously emits the surface's thermal energy through the atmosphere. Through modelling, they showed that when integrated on the condenser side of the cooling system of a two-storey office building in a hot dry climate (Las Vegas), electricity consumption for cooling during the summer could be reduced by 21%. TECHNICAL ARTICLE

Tags: Energy, Featured Article

Letting programs manage their own processing resources

EurekAlert, 05SEP2017

As processing power requirements increase, multi-core process technology is reaching its limits. Researchers in Germany are currently developing a method to distribute processing power to programmes based on their needs which will enable computers to cope with future processing requirements. In their approach, the programs are analysed in advance and provide a framework for the use of resources. The performance requirements thus determined are shared with the operating system, which in turn ensures that resources are properly allocated. They are working on appropriate countermeasures providing enhanced security mechanisms built into the processor hardware to address the new security challenges raised by the approach. More information

Tags: Information technology, Foreign S&T, S&T Germany, Featured Article

S&T News Articles

ADVANCED MATERIALS

Graphene-based terahertz absorbers

Nanowerk, 12SEP2017

An international team of researchers (Italy, UK) has fabricated THz saturable absorbers (SA) by transfer coating and inkjet printing single and few-layer graphene films prepared by liquid phase exfoliation of graphite. SA decreases its absorption of light in the terahertz range with increasing light intensity. It has great potential for the development of terahertz lasers, with applications in spectroscopy and imaging. These high-modulation, mode-locked lasers open many prospects in applications, such as time-resolved spectroscopy of gasses and molecules, quantum information or ultra-high speed communication.

OPEN ACCESS TECHNICAL ARTICLE

Tags: Advanced materials, Communications technology, Terahertz technology

continued...

BACK TO TOP

Scientists introduce new material to store hydrogen

Physorg.com, 06SEP2017

Theoretically, magnesium can absorb hydrogen up to 7.6 percent of its own mass. However, in most current experimental work, the capacity of magnesium hydride does not exceed 5 to 6 percent. By adding nickel and palladium to the magnesium hydride, researchers in Russia obtained a material accumulating about 7 percent hydrogen. Open Access TECHNICAL ARTICLE

Tags: Advanced materials, Energy, Foreign S&T, S&T Russia

AUTONOMOUS SYSTEMS & ROBOTICS

How neural networks think

MIT News, 08SEP2017

During training, a neural net continually readjusts thousands of internal parameters until it can reliably perform a task. Researchers at MIT are presenting a new general-purpose technique for making sense of neural networks that are trained to perform natural-language-processing tasks. The technique applies to any system that takes text as input and produces strings of symbols as output, such as an automatic translator. It can work with online natural-language-processing services, without access to the underlying software. In their experiments, the researchers show that the technique can identify idiosyncrasies in the work of human translators, too. Open Access TECHNICAL ARTICLE

Tags: Autonomous systems & robotics, Artificial intelligence

IBM and MIT Bet That Materials and Quantum Advances Will Supercharge AI

MIT Technology Review, 07SEP2017

The project announced by IBM and MIT will research new approaches in deep learning that has led to big advances in areas such as machine vision and voice recognition. It will also explore completely new computing devices, materials, and physical phenomena, including efforts to harness quantum computers to make AI even more capable. The center will also look at ways that AI can be more effectively deployed in industries like health care and security. It will study the economic impact of artificial intelligence and automation, a hugely significant issue for society. Focusing on hardware may be a good way to reboot. Novel materials and computing architectures offer huge potential to enhance AI algorithms.

Tags: Autonomous systems & robotics, Artificial intelligence

BIOTECHNOLOGY

How to draw electricity from the bloodstream

Science Daily, 08SEP2017

Researchers in China wrapped an ordered array of carbon nanotubes around a polymeric core. For power generation, the thread or fiber-shaped fluidic nanogenerator (FFNG) was connected to electrodes and immersed into flowing water or simply repeatedly dipped into a saline solution. The electricity was derived from the relative movement between the FFNG and the solution. Compared with other types of miniature energy-harvesting devices, the FFNG's power conversion efficiency was more than 20%. It has elasticity, tunability, lightweight, and can be made stretchable. FENG can be used for harvesting electrical energy from the bloodstream for medical applications. First tests with frog nerves proved to be successful. TECHNICAL ARTICLE

Tags: Biotechnology, S&T China

COMMUNICATIONS TECHNOLOGY

Research demonstrates ability to gather and share data without internet during natural disasters

Physorg.com, 11SEP2017

Researchers at the Georgia Institute of Technology demonstrated that by harnessing edge computing resources, sensing devices can be enabled to identify and communicate with other sensors in an area. The team has proposed a generic software architecture that has three components—a central management function that resides in the cloud, a data processing element placed in the fog infrastructure, and a sensing component on the user's device. The proposed fog architecture can also benefit communities with limited or no internet access and monitoring sensing devices in remote areas. Their work was presented at recent conference.

Tags: Communications technology

CYBER SECURITY

HACKERS GAIN DIRECT ACCESS TO US POWER GRID CONTROLS

Wired, 06SEP2017

Security firm Symantec is warning that a series of recent hacker attacks not only compromised energy companies in the US and Europe but also resulted in the intruders gaining hands-on access to power grid operations—enough control that they could have induced blackouts on American soil at will. In more than 20 cases, Symantec says the hackers successfully gained access to the target companies' networks. At a handful of US power firms and at least one company in Turkey their forensic analysis found that the hackers obtained control of the interfaces power company engineers use to send actual commands to equipment like circuit breakers, giving them the ability to stop the flow of electricity into US homes and businesses.

Tags: Cyber security

continued...

"The only way to do great work is to love what you do. If you haven't found it yet, keep looking." STEVE JOBS

ENERGY

Supercharging silicon batteries with nanostructures

Nanowerk, 06SEP2017

An atom of silicon can bind to four atoms of lithium at the same time, multiplying the battery capacity by more than 10-fold. However, this increases the volume of the anode leading to fracturing and loss of structural integrity. As a proof of concept, researchers in Japan used Cluster Beam Deposition to deposit unstructured silicon films alternatively with tantalum metal nanoparticle scaffolds sandwiching silicon in a tantalum frame. The design restrained swelling. The increase in power is attributed to the porosity of silicon structure in which lithium ions could travel at higher speeds. Silicon channels in the scaffolds allow the lithium ions to diffuse in the entire structure, increasing efficiency. Open Access TECHNICAL ARTICLE

Tags: Energy, Battery, S&T Japan

Newly-discovered semiconductor dynamics may help improve energy efficiency

Physorg.com, 05SEP2017

For a long time, scientists thought that the reason efficient conduction of electricity dropped off with the addition of more dopants to silicon was because the dopants caused the flowing electrons to be deflected away. A team of researchers in the US (University of Illinois at Chicago, Argonne National Laboratory, Northwestern University) used tiny chips of cadmium sulfide as a semiconductor base and doped them with copper ions, generated a flow of electrons by shooting them with a powerful blue laser beam, and at the same time, they took very high energy X-ray photos of the semiconductors. They found that when electrons were flowing through, the copper ions transiently formed bonds with the cadmium sulfate semiconductor base, which is detrimental to conduction. The research helps design smarter systems that minimize this effect, which they call 'charge carrier modulation of dopant bonding'. TECHNICAL ARTICLE

Tags: Energy, Battery

ENVIRONMENTAL SCIENCE

Researchers make alcohol out of thin air

Physorg.com, 11SEP2017

Researchers in the Netherlands have developed a process to effectively and precisely control the process of electroreduction of CO_2 to produce a wide range of useful products, including alcohol. Being able to use CO_2 as such a resource may be pivotal in tackling climate change. They describe the processes that takes place at the nanoscale when different metals are used in the electroreduction of CO_2. The process can be very precisely regulated by changing the lengths of the nanowires, and the electric potential. By tuning these conditions, any carbon-based product, or combinations in any ratio desired can be produced. Open Access TECHNICAL ARTICLE

Tags: Environmental science, Foreign S&T

IMAGING TECHNOLOGY

Algorithm reconstructs processes from individual images

Physorg.com, 07SEP2017

An international team of researchers (Germany, USA - MIT, UK) has developed an algorithm for reconstructing continuous biological processes, such as disease progression, using image data. They used artificial neural networks to combine individual pictures into processes and display them in a way that humans understand. They demonstrated their algorithm by reconstructing two diseases. In one case, the software was so fast that it extracted the cell development on the fly, while the analysis in the cytometer was still running. In the second case, it reconstructed the disease progression using 30,000 individual images, making it possible to predict the disease progression on a continuous scale. The software was less prone to errors than previous methods. Open Access TECHNICAL ARTICLE

Tags: Imaging technology, Biotechnology, Pattern recognition

INFORMATION TECHNOLOGY

Fast magnetic writing of data

EurekAlert, 07SEP2017

Magnetic storage technologies were long considered inadequate, mainly due to their low writing speed and relatively high energy consumption. An international team of researchers (Switzerland, Belgium) reports the direct observation of spin–orbit-torque-driven magnetization dynamics in $Pt/Co/AlO_x$ dots during current pulse injection. Time-resolved X-ray images reveal that switching is achieved within the duration of a subnanosecond current pulse by the fast nucleation of an inverted domain at the edge of the dot and propagation of a tilted domain wall across the dot. They sent up to a trillion inversion pulses through the cobalt dot at a frequency of 20 MHz without observing any reduction in the quality of the magnetization inversion. They have demonstrated that using a novel technique, magnetic storage can still be achieved very fast and without wasting energy. TECHNICAL ARTICLE

Tags: Information technology, Microelectronics

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'Learning Database' Speeds Queries from Hours to Seconds

University of Michigan, 31AUG2017

Researchers at the University of Michigan have developed a "thin layer" software called Verdict, a nimble piece of software that can be placed in front of any existing database. At first, it simply stores queries that go in and out of the database, compiling them into a query synopsis. After storing a given number of queries, it goes into action, breaking each query up into component parts called snippets and using them to build a mathematical model of questions and answers. When a new query comes in, it uses that model to point the database to a certain subset of data where the answer is likely to be found. They have demonstrated that Verdict can deliver answer more than 200 times faster while maintaining 99 percent accuracy. Open Access TECHNICAL ARTICLE

Tags: Information technology, Big data

Featured Resource

e! Science News

It is powered by the e! news engine and is a fully automated artificial intelligence. It constantly surfs the web to gather, regroup, categorize, tag and rank science news from all major science news sources. RSS feeds

Peptides as versatile scaffolds for quantum computing

ArXiv, 30AUG2017

Researchers in Spain report on the potential of peptides as versatile scaffolds for quantum computing and molecular spintronics. They demonstrated quantum coherent oscillations in a Neodymium peptidic qubit. Employing bacterial biosynthesis, they investigated the possibility of increasing the number of qubits in the same molecular system. Biochemical modification was used for the preparation of paramagnetic, chiral, Self-Assembled Monolayers which would allow single-molecule electrical contact. According to the researchers, their research shows that this is a promising structure for spintronic applications, and will improve on a state-of-the-art approach to molecular spin qubits, based on the electrical reading of nuclear spin qubits. Open Access TECHNICAL ARTICLE

Tags: Information technology, Biotechnology, Quantum science

Information Storage and Retrieval using Macromolecules as Storage Media

ArXiv, 26AUG2017

Researchers at the University of Arizona, Tucson, propose to adapt, integrate, and extend the techniques developed by chemists and molecular biologists for manipulating biological and other macromolecules. According to the researchers, the device can be fabricated on the surface of a glass substrate using lithography or other surface patterning techniques. Transfer of the molecular data blocks between the parking lots and the various read/write/erase stations may be achieved via controlled electric-field gradients, optical tweezers, micro-fluidic pumps, opto-electronic micro-motors, etc. The possibility of using multiple parallel read/write stations should enable the proposed scheme to compete with the projected data-transfer-rates in conventional optical and magnetic storage technologies. Open Access TECHNICAL ARTICLE

Tags: Information technology

MATERIALS SCIENCE

Nanocrystals grow by twisting, aligning and snapping together

Nanowerk, 08SEP2017

A team of researchers in the US (Pacific Northwest National Laboratory, University of Pittsburgh) measured and modeled the van der Waals force, that causes two nanosize crystals to twist, align, slam into each other, and snap together. They fabricated the nanosize crystal with a designated crystal surface, watched the crystals interact and measured the torque between two nanosize crystals. They discovered that the van der Waals force, between the two crystals depended on molecular coverage of water on the crystal surface as well as the relative orientation of the crystal. The findings provide insights into crystal self-assembly and the understanding could be harnessed to create new materials for energy storage, production and use. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

Scientists unravel new insights into promising semiconductor material

Science Daily, 08SEP2017

An international team of researchers (Singapore, Taiwan, Saudi Arabia) has uncovered the role of oxygen in MoS_2, and a novel technique to create multiple tunable, inverted optical band gaps in the material. In-depth analysis revealed that the energy storage capacity of MoS_2 can be altered using oxygen; it displayed that a higher dielectric function when exposed to oxygen and electron doping of MoS_2 on gold can create two unusual optical band gaps which are tunable via a simple, straight forward annealing process. The findings shed light on how adsorption and desorption of oxygen by MoS_2 can be employed to modify its electronic and optical properties to suit different applications. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

Superpropulsion of Liquid Drops

American Physical Society Focus, 08SEP2017

Researchers in France investigating the motion of liquid drops on superhydrophobic surfaces propelled a droplet initially resting on them upward by the surface rapidly rising and then descending again. They found that the

continued...

liquid droplet became flattened initially as the surface rose beneath it, but then the droplet sprang back, becoming elongated in the vertical direction as it continued to vibrate. This oscillating deformation can increase the upward motion of the droplet's center of mass, a phenomenon they dubbed "superpropulsion." According to the researchers, the effect could be useful for saving energy in technologies that involve propulsion of soft or fluid objects and elastic systems that launch aircraft from ships. TECHNICAL ARTICLE

Tags: Materials science, Foreign S&T, S&T France

Aeroices: Newly discovered ultralow-density ice

Science Daily, 05SEP2017

The molecules of the ice form a zeolite structure, a 3-D crystalline cage, in which guest molecules or atoms are trapped inside. Removing the guest molecules results in a stable, ultralow density ice at high negative pressures. Researchers in Japan have theoretically discovered a new family of ice phases called aeroices that have the lowest density of all known ice crystals and the most stable solid phases of water near the absolute zero temperature under negative pressure. The discovery could accelerate the understanding of the fundamental properties and behavior of water in nanotubes and other nanopores, as well as in biomolecules. OPEN ACCESS TECHNICAL ARTICLE

Tags: Materials science, Foreign S&T, S&T Japan

MICROELECTRONICS

Integrated lasers on different surfaces

Nanowerk, 08SEP2017

Researchers in Singapore used a smooth, extremely thin layer of silicon oxide to bond the lasers to a silicon substrate. The surface was exposed to oxygen plasma to increase its adhesive properties and the bonding process was initiated at ambient temperature by bringing the two substrates slowly together ensuring a much stronger bond. The bonding was then completed at relatively low temperatures of around 220 degrees Celsius. The work demonstrates a versatile on-chip laser that can be integrated on to any material platform and could lead to new applications for photonic devices, such as detector-on-chip and modulator-on-chip technologies. TECHNICAL ARTICLE

Tags: Microelectronics

QUANTUM SCIENCE

Using mirrors to improve the quality of light particles

Science Daily, 11SEP2017

NV centers are considered a proven structure for storing and processing information. To use them for applications in quantum information technology, an international team of researchers (Switzerland, Germany) has succeeded in boosting the yield of useful photons from these NV centers from 3% to a current value of 50% by placing a nanofabricated piece of diamond, measuring just a few hundred nanometers across, between two tiny mirrors. Their results pave the way for much enhanced spin-photon and spin-spin entanglement rates. TECHNICAL ARTICLE

Tags: Quantum science, Information technology

High-speed quantum memory for photons

Physorg.com, 08SEP2017

Researchers in Switzerland have developed a simple and fast quantum memory that stores photons in a gas of rubidium atoms. A laser controls the storage and retrieval processes. The technology used does not require cooling devices or complicated vacuum equipment and can be implemented in a highly compact setup. The researchers were also able to verify that the memory has a very low noise level and is suitable for single photons. The combination of a simple setup, high bandwidth and low noise level is very promising for future application in quantum networks. TECHNICAL ARTICLE

Tags: Quantum science, Communications technology, Foreign S&T, S&T Switzerland

Flip-flop qubits: Radical new quantum computing design invented

Nanowerk, 06SEP2017

An international team of researchers (Australia, USA - Purdue University) has developed a new design that allows for a silicon quantum processor that can be scaled up without the precise placement of atoms required in other approaches. In the new architecture, the qubit can be controlled using electric signals, which are significantly easier to distribute and localise within an electronic chip. It allows qubits to be placed hundreds of nanometres apart and still remain coupled, unlike spin-based qubits which need to be placed only 10 to 20 nanometers apart. It is easier to fabricate than atomic-scale devices, but still allows placing a million qubits on a square millimetre. OPEN ACCESS TECHNICAL ARTICLE

Tags: Quantum science

S&T POLICY

UK-China projects to develop next generation of offshore renewable energy technologies

EurekAlert, 07SEP2017

Researchers from the UK and China will collaborate on five projects to develop the next generation of offshore renewable energy (ORE) technologies. The multidisciplinary three-year-long projects will use environmental science, technology and engineering to tackle key challenges affecting the development of ORE systems, such as offshore wind, wave and tide facilities, and maximise their environmental and socio-economic benefits. The projects will determine where the best energy resource is available and where would be best to implement ORE technologies, as well as inform the development of technology so that structures are resilient to extreme events such as typhoons and earthquakes.

Tags: S&T policy, Foreign S&T

The secret to Germany's scientific excellence

Nature News, 06SEP2017

The reasons behind Germany's success go beyond science budgets. Germany was a world leader in science and technology before the turbulence of the twentieth century; it established traditions that many countries still follow. German research is looking as strong as ever, particularly on a global stage that seems increasingly indifferent to science. The structure of modern German science rests on concepts developed two centuries ago by Wilhelm von Humboldt who pioneered ideas that continue to hold sway around the world. His philosophy that education should be both broad and deep, and that academic life should be free from politics and religion, remains engraved in the German psyche.

Tags: S&T policy, Foreign S&T, S&T Germany

SCIENCE WITHOUT BORDERS

The world is facing a global sand crisis

The Conversation, 07SEP2017

According to an international team of researchers (Germany, USA - Boise State University, University of Georgia, MSU East Lansing) over-exploitation of global supplies of sand is damaging the environment, endangering communities, causing shortages and promoting violent conflict. Sand and gravel are now the most-extracted materials in the world, exceeding fossil fuels and biomass (measured by weight). Sand is a key ingredient for concrete, roads, glass and electronics. Massive amounts of sand are mined for land reclamation projects, shale gas extraction and beach renourishment programs. Recent floods in Houston, India, Nepal and Bangladesh will add to growing global demand for sand. Plentiful evidence strongly suggests that sand is becoming increasingly scarce in many regions. OPEN ACCESS TECHNICAL ARTICLE

Tags: Science without borders

SENSORS

Graphene single photon detectors

Physorg.com, 06SEP2017

An international team of researchers (USA - MIT, Harvard University, Spain, South Korea) envisioned a sheet of graphene that is placed in between two superconducting layers creating Josephson junction which allows a supercurrent to flow across the graphene when it is cooled down to 25 mK. The heat capacity of the graphene is so low that when a single photon hits the graphene layer it can heat up the electron bath so significantly that the supercurrent becomes resistive giving rise to an easily detectable voltage spike across the device. This effect would occur almost instantaneously enabling the ultrafast conversion of absorbed light into electrical signals allowing for a rapid reset and readout. The research shows a promising path towards single-photon-resolving imaging arrays and quantum information processing applications of optical and microwave photons. TECHNICAL ARTICLE

Tags: Sensors, Communications technology

New nanowire fingerprint technology for highly reliable security and ID applications

Nanowerk, 06SEP2017

Researchers in France working on an EU sponsored project have developed a pressure-based fingerprint sensor derived from the integration of piezo-electric ZnO nanowires grown on silicon which could reach resolution much higher than 1,000 DPI. The demonstrator has a silicon chip embedded with 250 pixels and associated electronics for signal collection and post-processing. According to the researchers, the technology holds promise for significant improvement in both security and identification applications.

Tags: Sensors, Foreign S&T, S&T EU, S&T France

Acoustic Metacages for Omnidirectional Sound Shielding

ArXiv, 29AUG2017

Conventional sound shielding structures typically prevent fluid transport between the exterior and interior. A team of researchers in the US (Duke University, North Carolina State University) proposes a structure design based on acoustic gradient-index metasurfaces composed of open channels and shunted Helmholtz resonators. The strong parallel momentum on the metacage surface rejects in-plane sound at an arbitrary angle of incidence which leads to low sound transmission through the metacage. Its performance was verified by numerical simulations and measurements on a three-dimensional printed prototype. The acoustic metacage has potential applications in sound insulation where steady fluid flow is necessary or advantageous. OPEN ACCESS TECHNICAL ARTICLE

Tags: Sensors, Materials science ■

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