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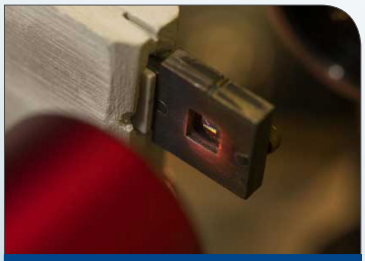
S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

Feature Articles

New nanomaterial may help to protect astronauts from radiation in space

Nanowerk, 03JUL2017



The sample here contains hundreds of thousands of nanoparticles that manipulate the incoming light. (Image: Stuart Hay, ANU)

An international team of researchers (Australia, China) has designed an all-dielectric metasurface with sharp resonances by achieving interference between magnetic dipole and electric quadrupole modes of constituted nanoparticles arranged in a 2D lattice. Thermal tuning of these resonances can cause drastic but reciprocal changes in the directional scattering of the metasurface in a spectral window of 75 nm. The material is so thin that hundreds of layers could fit on the tip of a needle and could be applied to any surface, including spacesuits. Potential applications include protecting astronauts or satellites with an ultra-thin film that can be adjusted to reflect various ultraviolet or infrared radiation in different environments. TECHNICAL ARTICLE

Tags: Advanced materials, Featured Article

New technique 'sees' radioactive material even after it's gone

Science Daily, 03JUL2017

Researchers at North Carolina State University have developed a technique that uses magnetic resonance for organic insulators and/or luminescence techniques on ubiquitous refractory material to characterize nuclear materials after they have been removed from an area leaving no chemical trace. The new approach is demonstrated to be fully capable of providing both previous source spatial distribution and emission energy grouping. TECHNICAL ARTICLE

Tags: Sensors, Featured Article

S&T News Articles

ADVANCED MATERIALS

Graphene and terahertz waves could lead the way to future communication

Nanowerk, 27JUL2017

The operating frequencies of G-FET integrated circuits are all below 30 GHz. Researchers in Sweden are working to replace the silicon base on which the graphene is mounted. This limits the performance of the graphene with other two-dimensional materials which can further enhance the effect. They present an optimized design of the mixer circuit. Metalized airbridges are added to the updated mixer circuit to balance the potentials of the ground planes as well as to ensure single-mode wave propagation at the circuit T-junctions. If the process on Si is adapted to flexible substrates, then the results of their experiments show promise for ubiquitous graphene millimeter-wave electronics. OPEN ACCESS TECHNICAL ARTICLE

Tags: Advanced materials, S&T Sweden

Shape memory composites for 3D-printed photoresponsive devices

Nanowerk, 03JUL2017

Researchers in Singapore used fused deposition modeling (FDM) printing technology to fabricate photoresponsive shape memory composites based on polyurethane and carbon black (PUCB). Addition of carbon black makes the device photoresponsive. Due to photoresponsive shape memory property, natural sunlight can also trigger the shape memory behavior of the devices. TECHNICAL ARTICLE

Tags: Advanced materials

Accelerating the quest for quicker, longer-lasting electronics

Science Daily, 23JUN2017

In transition metal–doped topological insulators, the quantum anomalous Hall effect (QAHE) is lost at practically relevant temperatures. A team of researchers in the US (UC Riverside, MIT, Pennsylvania State University, Arizona State University) has demonstrated drastically

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enhanced Tc by exchange coupling TIs to $Tm_3Fe_5O_{12}$, a high-Tc magnetic insulator with perpendicular magnetic anisotropy. Open Access TECHNICAL ARTICLE

Tags: Advanced materials

BIG DATA

Big Data Fabric Can Surmount Big Data Problems

Inside Big Data, 02JUL2017

The article is a review of 6 layers of big data fabric and its benefit in terms of agility to undergo profound transformations without impacting daily operations. According to the author big data implementations, on their own, will create as many problems as they solve. With Big Data fabric, however, Big Data implementations can surmount these problems and fulfill their promises.

Tags: Big data

BIOTECHNOLOGY

Physicists make quantum leap in understanding life's nanoscale machinery

Nanowerk, 03JUL2017

Motor molecules encode our genetic material, create the energy our cells use to function, and distribute nutrients at a sub-cellular level. An international team of researchers (Australia, Austria) applied techniques used to detect gravitational waves from black holes in outer space to the nanoscale to observe the behaviour of single biomolecules without large-label particles or damaging light intensities. The technique offers the possibility of a new biomedical diagnostics technique capable of detecting the presence of even a single cancer marker molecule. TECHNICAL ARTICLE

Tags: Biotechnology

COMMUNICATIONS TECHNOLOGY

Could this strategy bring high-speed communications to the deep sea?

Science Daily, 06JUL2017

Using acoustic waves to transmit information is currently the dominant technique for underwater applications. However, the low-frequency bandwidth limits the data transmission rate and information capacity. A team of researchers in the US (UC Berkeley, Lawrence Berkeley National Laboratory) proposed and experimentally demonstrated an approach using the orbital angular momentum (OAM) of acoustic vortex beams, which provides an independent channel that enhances the data transmission rate. The OAM multiplexing method will significantly impact future underwater communications. TECHNICAL ARTICLE

Tags: Communications technology

Communication in times of crisis

Physorg.com, 04JUL2017

Researchers in Germany founded an interdisciplinary research centre "Networked Infrastructureless Cooperation for Emergency Response" (NICER). The basic idea is to network the population by means of infrastructureless information and communication technologies. To achieve this objective, NICER is focused on three key themes: the establishment of autonomous communication islands, the construction of bridges between the islands, and the operation of an overall network with special applications for use in crisis situations. They are re-engineering various mobile devices to increase their performance.

Tags: Communications technology, S&T Germany

CYBER SECURITY

New firewall protects cellphones from security threat

Science Daily, 29JUN2017

Field replaceable units in phones, such as touchscreens, chargers, and battery or sensor assemblies, are all susceptible to significant security breaches and attacks. Researchers in Israel have developed an innovative firewall that can be implemented as a tiny chip, or as an independent software module running on the CPU. They used machine learning algorithms to monitor the phones' internal communications for anomalies that may indicate malicious code. Their software allowed them to identify and prevent hardware-generated data leaks and hacks. Their paper will be presented at a conference in Canada in August.

Tags: Cyber security, Foreign S&T

Adaptive cyber security decision support to prevent cyber attacks

Physorg.com, 27JUN2017

An international team of researchers (UK, USA - Carnegie Mellon University) is working under an EU project to establish the foundations for a digital 'Online Cyber Security System' decision support service (OCYSS). The approach is underpinned by novel research on integrating information from a number of different sources while managing discord and potential dependencies of individual components within systems. The aim is to enable systems which are capable of maximizing the utility of the available cyber security insights and to rapidly deliver user-tailored, up-to-date threat analysis and decision support to help organisations mitigate potential cyber attacks before they happen.

Tags: Cyber security

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"All inquiries carry with them some element of risk. There is no guarantee that the universe will conform to our predispositions" CARL SAGAN

ENERGY

Superstretchable, supercompressible supercapacitors

Physorg.com, 03JUL2017

Researches in China introduced vinyl hybrid silica nanoparticle cross-linkers into polyacrylamide hydrogel backbones to promote dynamic cross-linking of the polymer networks. The cross-linkers serve as stress buffers to dissipate energy when strain is applied, providing a solution to the intrinsically low stretchability and compressibility shortcomings of conventional supercapacitors. The newly developed supercapacitor and electrolyte can be stretched up to an unprecedented 1000 % strain with enhanced performance, and compressed to 50 % strain with good retention of the initial performance. TECHNICAL ARTICLE

Tags: Energy, S&T China

FORECASTING

Could volcanic eruptions be predicted using satellite observations?

Physics World, 03JUL2017

The ground movements can be measured using both GPS and satellite-based radar data, and be used to develop models of the depth and shapes underlying magma reservoirs. These models do not yield information on the pressures of the underlying magma system. Researchers in France use data assimilation, a time-stepping approach, that combines models, observations and error statistics to forecast the state of a dynamic system. They are applying their new approach to two real-life case studies: the Grímsvötn volcano in Iceland and Alaska's Mount Okmok. Open Access TECHNICAL ARTICLE

Tags: Forecasting

IMAGING TECHNOLOGY

Seeing the forest through the trees with a new LiDAR system

Science Daily, 27JUN2017

With a specially designed laser system and a new methodology based on gated digital holography, researchers at the Naval Research Laboratory have developed a method to give LiDAR an enhanced ability to see through otherwise obscuring elements of terrain like foliage or netting. The real key to making the system work is the interference between two laser beams on the sensor. They send one laser beam out to the target and then it returns, and at the exact same time that return [beam] hits the detector, they interfere it locally with another laser beam. The new method gives LiDAR an enhanced ability to see through otherwise obscuring elements of terrain like foliage or netting.

Tags: Imaging technology, Government S&T, Photonics

New research could help humans see what nature hides

Science Daily, 26JUN2017

The visibility of a target object may be affected by the specific properties of the background scene at and near the target's location, and by how uncertain the observer is about the values of the background and target properties. Researchers at UT Austin measured how several background properties, and uncertainty, affect human detection thresholds for target objects in natural scenes. The thresholds varied as predicted from the statistical structure of natural scenes. The findings have applications in radiology, camouflage and imaging. TECHNICAL ARTICLE

Tags: Imaging technology

INFORMATION TECHNOLOGY

New system greatly speeds common parallel-computing algorithms

Physorg.com, 03JUL2017

Researchers at MIT have developed a new system called Fractal that supports unordered and timestamp-ordered nested parallelism. FRACTAL lets programmers seamlessly compose speculative parallel algorithms, and lets the architecture exploit parallelism at all levels. It can parallelize a broader range of applications than prior speculative execution models. They are designing a FRACTAL implementation that extends the Swarm architecture and focuses on parallelizing at the finest (deepest) levels. Their approach sidesteps the issues of nested parallel HTMs and uncovers abundant fine-grain parallelism. As a result, FRACTAL outperforms prior speculative architectures by up to 88× at 256 cores. Open Access TECHNICAL ARTICLE

Tags: Information technology

MICROELECTRONICS

Insulated transcriptional elements enable precise design of genetic circuits

Nature Communications, 03JUL2017

Rational engineering of biological systems is often complicated by the complex but unwanted interactions between cellular components at multiple levels. Researchers in China address this issue at the level of prokaryotic transcription by insulating minimal promoters and operators to prevent their interaction and enable the

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biophysical modeling of synthetic transcription without free parameters. This approach allows genetic circuit design with extraordinary precision and diversity, and simplifies the design-build-test-learn cycle of circuit engineering to a mix-and-match workflow.

Tags: Microelectronics, S&T China

Nanoelectronics scientists shatter 'impossible' record

Nanowerk, 03JUL2017

The rectification ratios of commercial silicon-based diodes have ratios between 105 and 108. A fundamental theoretical limitation of a single molecule had limited molecular diodes to rectification ratios no higher than 103, far from the commercial values of silicon-based diodes. An international team of researchers (Singapore, Ireland, USA - University of Central Florida) formed macroscale tunnel junctions based on a single layer of molecular diodes resulting in a record-high rectification ratio of 6.3 x 105. TECHNICAL ARTICLE

Tags: Microelectronics

Featured Resource

Science 360 Video Library

Sponsored by the National Science Foundation, Science360 is an up-to-date view of breaking science from around the world. It is a collection of the latest science videos provided by scientists, colleges and universities, science and engineering centers, the National Science Foundation and more.

PHOTONICS

Record laser on chip created

Science Daily, 03JUL2017

Researchers in the Netherlands have developed a minuscule hybrid laser on a chip with a maximum bandwidth of just 290 Hertz. The signal is more than ten times coherent than any other laser on a chip. The laser is tunable within a broad range. It has applications in 5G mobile internet, faster data flows through glass fiber networks, and more accurate GPS systems and sensors.

Tags: Photonics

QUANTUM SCIENCE

Supercool breakthrough brings new quantum benchmark

Physorg.com, 04JUL2017

While the potential of quantum materials, such as superconductors, is undeniable, we need to fully grasp the underlying quantum physics at play in these systems to establish their true capabilities. An international team of researchers (Australia, Finland, Denmark) has developed a system that allows theories of superconductivity and related quantum effects to be precisely checked against experiment, to see whether the theories are accurate and how they could be refined. TECHNICAL ARTICLE

Tags: Quantum science

S&T POLICY

Germany and Poland launch research 'twinning' effort

Nature News, 04JUL2017

Germany and Poland are to jointly fund top scientists to start research groups at Polish institutes, in a scheme that could provide a new blueprint for east–west research collaboration in the European Union. The programme aims to boost research excellence in the EU's less-developed science regions, and is overseen by Germany's Max Planck Society. If successful, it will be extended to nearby EU countries.

Tags: S&T policy, S&T EU

SENSORS

Mobile control with facial gestures

Physorg.com, 04JUL2017

Researchers in Germany have developed a sensing device called EarFieldSensing (EarFS) that recognizes facial gestures via a special ear plug. It measures the muscular currents and distortions of the ear canal which occur during facial movements. The sensor detects even the smallest movements in the face. According to the researchers, the device offers further development possibilities besides its use on mobile devices.

Tags: Sensors

Tiny embedded electrodes pick up nerve signals loud and clearTiny embedded electrodes pick up nerve signals loud and clear

Medical Express, 04JUL2017

To generate more refined, natural movements prosthetics need signals from specific nerves in the adjoining tissue. Researchers in South Korea have developed a flexible penetrating microelectrode array (FPMA), made of multiple silicon needle microelectrodes laid out in a grid atop a flexible support platform. A 4 x 4 electrode array spans about four square millimetres. The array is expected to cause less damage to surrounding tissue. They successfully detected nerve signals using a new kind of high-channel-count nerve interfacing device. TECHNICAL ARTICLE

Tags: Sensors, Neuroscience

New method of measurement could lead to cheaper, more accurate sensors

Science Daily, 30JUN2017

Researchers in Canada proposed a nano scale self-powered sensor with a moving miniature permanent magnet

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mounted on a nanoplate, and a stationary electromagnetic coil. They showed that the new method of measurement has the potential to generate electricity, which would greatly reduce interference and improve accuracy. The voltage could be used to power the sensor itself.
TECHNICAL ARTICLE
Tags: Sensors, S&T Canada

Extremely small gas and pressure sensors made from 'white graphene'

Nanowerk, 28JUN2017

An international team of researchers (the Netherlands, UK) created a one-atom thick sheet of h-BN, or 'white graphene', on a piece of iron foil and transferred it to a silicon substrate containing tiny circular cavities. By doing so, they created microscopic 'drums'. These drums function as mechanical resonators and could be used as infinitesimal gas or pressure sensors, for instance in mobile phones. The sensor has applications in electronics.
Open Access TECHNICAL ARTICLE
Tags: Sensors ■

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