



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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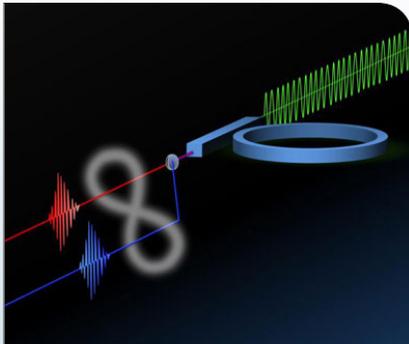
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FEATURE ARTICLES

S&T NEWS ARTICLES



Drawing of the silicon ring resonator with its access waveguide. Image: Università degli Studi di Pavia

[Entanglement on a chip: Breakthrough promises secure communications and faster computers](#)

[PhysOrg.com](#), 26JAN2015

An international team of researchers (Italy,

UK, Canada) has developed a microscopic component based on a design established in silicon technology known as a micro-ring resonator. By tailoring the design of the resonator, the research team created a novel source of entangled photons that is incredibly small, highly efficient and generates a continuous supply of entangled photons, making it an ideal on-chip component. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Featured Article

[Scientists slow down the speed of light travelling in free space](#)

[Science Daily](#), 23JAN2015

Researchers in the UK demonstrate that, after passing the light beam through a mask, photons move more slowly through space. Crucially, this is very different to the slowing effect of passing light through a medium such as glass or water where the light is only slowed during the time it is passing through the material; it returns to the speed of light after it comes out the other side. The effect of passing the light through the mask is to limit the top speed at which the photons can travel. [TECHNICAL ARTICLE](#)

Tags: Photonics, S&T UK, Featured Article

ADVANCED MANUFACTURING

[Massive chip design savings to be realized](#)

[Science Daily](#), 23JAN2015

Researchers in the Netherlands have developed a programming language making the massive costs associated with designing hardware more manageable. The newly developed, so-called functional programming language makes it possible to prove, in advance, that a design transformation is a hundred percent error-free.

Tags: Advanced manufacturing

[Scotty project eyes uniqueness, sharing issues in 3D printing](#)

[PhysOrg.com](#), 23JAN2015

Researchers in Germany started a project called Scotty, which teleports items by scanning them layer by layer and then grinding them away. The scan is sent securely to another 3D printer which recreates the object in plastic; the data transferred between machines is quickly destroyed once the object is printed.

Tags: Advanced manufacturing, S&T Germany

[Minimizing Uncertainty in Designing Complex Military Systems](#)

[DARPA News](#), 08JAN2015

DARPA's Enabling Quantification of Uncertainty in Physical Systems (EQUiPS) program aims to develop mathematical tools and methods to efficiently quantify, propagate and manage multiple sources of uncertainty. The goal is to create a computationally effective and mathematically rigorous framework for engineering that will accurately predict, on the basis of complex design specifications, the functional operation of complex defense-related physical and engineering systems.

[SOLICITATION](#)

Tags: Advanced manufacturing, Government S&T

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ADVANCED MATERIALS

Graphene enables electrical control of energy flow from light emitters

Nanowerk, 26JAN2015

An international team of researchers (Spain, US, France, Italy) working under Europe's Graphene Flagship has demonstrated active, in-situ electrical control of energy flow from erbium ions into photons and surface plasmons. The experiments reveal long-sought-after graphene plasmons at the near-infrared frequencies used in telecommunications applications. In addition, the strong concentration of optical energy observed offers new possibilities for data storage and manipulation through active plasmonic networks.

TECHNICAL ARTICLE

Tags: *Advanced materials, Medical Sciences, S&T EU***Researchers make magnetic graphene**

Nanowerk, 26JAN2015

Researchers at UC Riverside have found an ingenious way to induce magnetism in graphene while also preserving graphene's electronic properties. They have accomplished this by bringing a graphene sheet very close to a magnetic insulator—an electrical insulator with magnetic properties.

TECHNICAL ARTICLE

Tags: *Advanced materials, Materials science***Carbon Nanotube Transistors Go Head-to-Head With Silicon**

IEEE Spectrum, 23JAN2015

Researchers at Stanford University have made carbon nanotube transistors with record-setting current densities and stacked them to make 3-D circuits. They can make carbon nanotube transistors with current densities and other properties that rival similarly sized silicon transistors. To prove the approach's compatibility with silicon, the Stanford team used the multiple-transfer strategy to create a "monolithic" 3-D integrated circuit.

Tags: *Advanced materials, Materials science***Infrared imaging technique operates at high temperatures**

PhysOrg.com, 23JAN2015

Currently, commercial technologies for MWIR detection, such as indium antimonide and mercury-cadmium-telluride, can only operate at cryogenic temperatures in order to reduce thermal and electrical noise. Researchers at Northwestern University developed an indium arsenide/gallium antimonide (InAs/GaSb) type II superlattice that demonstrated high-resolution MWIR images while operating at high temperatures.

Tags: *Advanced materials, Materials science***Nanotechnology changes behavior of materials used in solar cells**

Nanowerk, 23JAN2015

A team of researchers in the US (Washington University in St. Louis, University of Minnesota) found that by changing the structure of a thin film made of zinc oxide nanoparticles, electrons no longer flowed through the system in a conventional way, but hopped from place to place by tunneling. The new composite became highly conductive.

TECHNICAL ARTICLE

Tags: *Advanced materials***Silver nanowires demonstrate unexpected self-healing mechanism: Potential for flexible electronics**

Science Daily, 23JAN2015

By varying the tension on silver nanowires thinner than 120 nanometers and monitoring their deformation with electron microscopy, an international team of researchers (USA, South Korea) characterized the cyclic mechanical behavior. They found that permanent deformation was partially recoverable, meaning that some of the material's defects actually self-healed and disappeared upon cyclic loading. These results indicate that silver nanowires could potentially withstand strong cyclic loads for long periods of time.

TECHNICAL ARTICLE

Tags: *Advanced materials, Materials science***Supersonic impact**

Nature Materials, 23JAN2015

So far graphene's mechanical properties have been mainly investigated under quasistatic loading; response to dynamic loads is relatively unknown. Researchers at the University of Massachusetts at Amherst now explore this regime by performing impact testing by firing single micrometre-sized silica spheres at supersonic speeds at multilayer graphene, achieving strain rates of $\sim 10^7$ s⁻¹.

Tags: *Advanced materials***The latest fashion: Graphene edges can be tailor-made**

Nanowerk, 23JAN2015

Researchers at Rice University show it should be possible to control the edge properties of graphene nanoribbons by controlling the conditions under which the nanoribbons are pulled apart. The way atoms line up along the edge of a ribbon of graphene controls whether it is metallic or semiconducting. Researchers can fracture graphene nanoribbons to get the edges they need for applications.

TECHNICAL ARTICLE

Tags: *Advanced materials*

“For me, it is far better to grasp the Universe as it really is than to persist in delusion, however satisfying and reassuring” **CARL SAGAN**

Graphene Devices Stand the Test of Time

IEEE Spectrum, 22JAN2015

Researchers have been reasonably successful at engineering a band gap into graphene in the lab. Now an international team of researchers (Germany, Spain) has demonstrated a sophisticated encapsulation technique using aluminum oxide that they claim is easily reproducible and should allow graphene devices in normal atmosphere to last for several months. **TECHNICAL ARTICLE**

Tags: *Advanced materials*

AUTONOMOUS SYSTEMS & ROBOTICS

Video Friday: Mars Helicopter, 100 Dancing Robots, and Putin's Combat Cyborg

IEEE Spectrum, 23JAN2015

NASA's Jet Propulsion Laboratory is proposing that we send a little robotic helicopter to Mars as an aerial scout for a rover on the ground. The copter would be completely self-contained, using a small solar panel to give it a few minutes of flight time every day, while simultaneously storing up enough energy to keep itself from freezing to death at night.

Tags: *Autonomous systems & robotics*

COMMUNICATIONS TECHNOLOGY

First-of-its-kind tube laser created for on-chip optical communications

PhysOrg.com, 23JAN2015

Researchers in Canada have developed a tiny laser 100 micrometers long and 5 micrometers in diameter—right at the limit of what the unaided human eye can see. As the first rolled-up semiconductor tube laser that is electrically powered, it can fit on an optical chip and serve as the light source for future optical communications technology. **TECHNICAL ARTICLE**

Tags: *Communications Technology, S&T Canada*

New algorithm resolves Wi-Fi interference problems

PhysOrg.com, 23JAN2015

Researchers in Switzerland have developed an algorithm that automatically selects the best frequency band according to the usage of neighboring networks. This system increases the initial capacity of the data path by up to seven times. The system optimizes the free frequency band without interfering with the networks of neighbors.

Tags: *Communications Technology, S&T Switzerland*

ENERGY

Beijing team proposes effortless phone charging with light beams

PhysOrg.com, 20JAN2015

Researchers in China have developed a two-step detection and charging technique called AutoCharge applied indoors with a wireless lightbeam. The prototype was able to detect the presence of a smartphone in seconds. Charging time was as fast as existing wired chargers. **TECHNICAL ARTICLE**

Tags: *Energy*

ENVIRONMENTAL SCIENCE

Invention slows water evaporation, generates energy

PhysOrg.com, 23JAN2015

Researchers at the University of Arizona invented the Hexocover, which consists of floating hexagonal plastic panels that sandwich 4-inch balls linked together to form a cover to prevent evaporation. The panel design addresses the need for mobility through the inclusion of a propulsion system as well as GPS, so the panels can be built to be remotely configurable. Further, when configured with solar cells, the panels can generate electricity.

Tags: *Environmental science, Energy*

INFORMATION TECHNOLOGY

Hybrid memory device for superconducting computing

PhysOrg.com, 26JAN2015

Researchers at NIST have devised and demonstrated a novel nanoscale memory technology for superconducting (SC) computing. It offers the prospect of moving information without loss over zero-resistance channels. SC systems employ Josephson junctions which operate near absolute zero, dissipate minuscule amounts of energy, and can be switched between states at hundreds of billions times a second.

Tags: *Information Technology, Government S&T*

Software teaches computers to translate words to math

PhysOrg.com, 21JAN2015

Software developed at the University of Illinois enables machines to understand mathematical reasoning expressed in language, which could greatly improve search engines access to data. **TECHNICAL ARTICLE**

Tags: *Information Technology, Mathematics*

MATERIALS SCIENCE

Chemists control structure to unlock magnetization and polarization simultaneously

Nanowerk, 26JAN2015

Researchers in the UK were able to demonstrate that magnetisation and polarisation are coupled by measuring the linear magnetoelectric coefficient, a key physical quantity, for the integration of such materials in a device. This coupling arises because both properties are produced by the same single set atomic motions that they built in to the material. **TECHNICAL ARTICLE**

Tags: *Materials science, S&T UK*

FEATURED RESOURCE

Inside Science

Inside Science provides editorially independent research news and information on science, engineering, mathematics, and related fields for general audiences. **RSS**

Surface activated bonding of GaAs and SiC wafers at room temperature for improved heat dissipation in high-power semiconductor lasers

IOP Science, 23JAN2015

To realize thin-film semiconductor lasers directly bonded on a high-thermal-conductivity substrate, researchers in Japan applied surface-activated bonding using an argon fast atom beam to the bonding of gallium arsenide and silicon carbide wafers. The GaAs/SiC structure was demonstrated in the wafer scale (2 in. in diameter) at room temperature. The cross-sectional transmission electron microscopy observations showed that void-free bonding interfaces were achieved.

Tags: *Materials science, S&T Japan, Semiconductors***Negative capacitance in a ferroelectric capacitor**

Nature Materials, 15DEC2014

Researchers at UC Berkeley report the observation of negative capacitance in a thin, epitaxial ferroelectric film. When a voltage pulse is applied, the voltage across the ferroelectric capacitor is found to be decreasing with time—in exactly the opposite direction to which voltage for a regular capacitor should change. The discovery presents an unprecedented insight into the intrinsic energy profile of the ferroelectric material and could pave the way for completely new applications.

Tags: *Materials science***Perovskite solar cells: Switchable photovoltaics**

Nature Materials, 08DEC2014

Researchers in South Korea report that the migration of ions under the effect of an external electric field locally modifies the doping of organometal halide perovskite films. This is used to reversibly switch the photocurrent direction in very simple photovoltaic architectures.

Tags: *Materials science*

MICROELECTRONICS

Electronic circuits with reconfigurable pathways closer to reality

Nanowerk, 26JAN2015

Researchers in Switzerland demonstrated that it was possible to control the formation of walls on a film of ferroelectric material, and thus create pathways where they wanted at given sites. The trick lies in producing a sandwich-like structure with platinum components on the outside and a ferroelectric material on the inside.

Tags: *Microelectronics, S&T Switzerland***3-D Transistors Made with Molecular Self-Assembly**

MIT Technology Review, 23JAN2015

Researchers at IBM used existing photolithography methods to prepattern a photoresist coating to form a series of deep, parallel trenches. These trenches then help direct the assembly of block copolymers, which are arranged in patterns needed to etch transistor fins that were smaller and more densely packed together than is possible with photolithography alone. The resulting working devices had features as close together as 29 nanometers, far smaller than the 80 nanometers that is currently possible.

Tags: *Microelectronics***Improvements in transistors will make flexible plastic computers a reality**

Science Daily, 23JAN2015

In this article researchers in Japan review light emitting organic field-effect transistors from the viewpoint of the evolution of device structures and performances. In the second part, various kinds of light receiving organic field-effect transistors are featured. These are categorized according to their functionality: phototransistors, non-volatile optical memories, and photochromism-based transistors. **TECHNICAL ARTICLE**

Tags: *Microelectronics, S&T Japan***Thermal transport: Cool electronics**

Nature Materials, 23JAN2015

Researchers at Stanford University report that although heat removal in electronics at room temperature is typically governed by a hierarchy of conduction and

continued...

convection phenomena, heat dissipation in cryogenic electronics can face a fundamental limit analogous to that of black-body emission of electromagnetic radiation.

Tags: Microelectronics

QUANTUM SCIENCE

Do Quantum Superpositions Have a Size Limit?

American Physical Society Spotlight, 20JAN2015

In an experiment that allows the motion of a large atom in an optical lattice to be tracked, researchers in Germany demonstrated that a cesium atom travels in a truly non-classical fashion, moving as a quantum superposition of states and thus occupying more than one distinct location at a time. Their technique could also be used to test superpositions on even more macroscopic scales, such as with larger atoms or molecules. **TECHNICAL ARTICLE**

Tags: Quantum science, S&T Germany

SCIENCE WITHOUT BORDERS

Big Twist for Electron Beam

American Physical Society Spotlight, 23JAN2015

An international team of researchers (Italy, Canada, USA) has demonstrated intense electron beams with angular momentum hundreds of times greater than the electron's spin, which could be used for fundamental studies and to probe the properties of magnetic materials. An electron microscope employing such beams could map the magnetization at the nanoscale in materials and potentially detect the sonic-boom-like radiation that is predicted to emerge when such a beam with a high magnetic moment transits a material. **TECHNICAL ARTICLE**

Tags: Science without borders, Particle physics

The Wild West of physics

PhysOrg.com, 22JAN2015

In a new National Science Foundation-funded project, University at Buffalo physicists are looking to bridge the gap between two related but distinctive fields: the study of "outer space" (stars and galaxies) and "inner space" (fundamental particles and forces). To better understand the world around us—the origins of our universe, and the smallest particles that make up the matter in the cosmos, on Earth and inside of each one of us—is a worthwhile goal, the scientists say.

Tags: Science without borders ■

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