



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Novel inorganic material emitting laser light in solution discovered](#)

[PhysOrg.com](#), 12JAN2015



Laser solution. Credit: Spanish National Research Council

An international team of researchers (Spain, Czech Republic) has discovered a new type of laser material, a complex of boron and hydrogen and no carbon atoms, that emits laser light in solution. It presents efficient and degradation-resistant laser emission in the blue, a spectral region of interest in applica-

tions such as spectroscopy or materials processing.

[TECHNICAL ARTICLE](#)

Tags: Photonics, Featured Article

[The Algorithm That Unscrambles Fractured Images](#)

[MIT Technology Review](#), 09JAN2015

Researchers at MIT set to work out the contents of a picture reflected off a screen covered in glitter using SparkleVision, an image processing algorithm. They consider each piece of glitter to be a randomly oriented micromirror. Light from the picture hits a micromirror and is reflected to a sensor inside the camera. The task is to determine mapping for every pixel. There exists a forward scrambling matrix, and in principle they can find its inverse and unscramble the image. [TECHNICAL](#)

[ARTICLE](#)

Tags: Imaging technology, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Carbon nanotubes increase efficiency of solar cells](#)

[Nanowerk](#), 12JAN2015

Researchers in Iran have shown that adding carbon nanotubes in pigment sensitized solar cells and solar cells based on quantum dots increases efficiency. However, the modification in efficiency is much more noticeable in quantum dots sensitized solar cells.

[TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Graphene plasmons go ballistic](#)

[Nanowerk](#), 12JAN2015

When graphene is encapsulated in boron nitride, electrons can move ballistically for long distances without scattering, even at room temperature. An international team of researchers (Spain, USA, Italy, Japan) now shows that the graphene/boron nitride material system is also an excellent host for extremely strongly confined light and suppression of plasmon losses. In the future, low-loss graphene plasmons could make signal processing and computing much faster, and optical sensing more efficient. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Metasurface solves calculus problems as an analog computer](#)

[PhysOrg.com](#), 12JAN2015

Researchers in Denmark have demonstrated that when illuminated by a laser beam, a 2-D man-made material called metasurface can perform the two main types of calculus problems, spatial differentiation and integration. Essentially, the metasurface transforms the shape of the incoming light wave profile (the input) into the shape of its derivative or integral (the output).

[TECHNICAL ARTICLE](#)

Tags: Advanced materials

New superconducting hybrid nanowire crystals

Nanowerk, 12JAN2015

Researchers in Denmark have invented a way to make a perfect transition between nanowire and a superconductor. The atoms sit in a perfectly ordered lattice in the nanowire crystal, not only in the semiconductor and the metal, but also in the transition between the two very different components. They can make a chip with billions of identical semiconductor-metal nanowire hybrids. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

Solar cell polymers with multiplied electrical output

Nanowerk, 12JAN2015

A team of researchers from the US (Brookhaven National Laboratory, Columbia University) has paired up polymers that recover some of the lost energy by producing two electrical charge carriers per unit of light instead of the usual one. The discovery could lead to a significant leap in the development of third-generation, hot-carrier solar cells. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T

3-D 'pop-up' silicon structures: Transforming planar materials into 3-D microarchitectures

Science Daily, 08JAN2015

An international team of researchers (USA, South Korea, China) report that a stretched, soft substrate imparts forces at precisely defined locations to initiate controlled buckling processes that induce rapid, large-area extension into the third dimension. The result transforms these planar materials into well-defined, 3D frameworks with broad geometric diversity. 3D micro/nanostructures have great potential for use in biomedical devices, microelectromechanical components, photonics, optoelectronics and more. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

Defying the Achilles heel of 'wonder material' graphene: Resilience to extreme condition

Science Daily, 08JAN2015

Researchers in the UK report that a new material, GraphExeter, adapted from graphene could withstand relative humidity of up to 100 per cent at room temperature for 25 days, as well as temperatures of up to 150C—or as high as 620C in vacuum. GraphExeter is a viable and attractive replacement to indium tin oxide, the main conductive material currently used in electronics, such as 'smart' mirrors or windows, or even solar panels. It could extend the lifetime of displays such as TV screens located in highly humid environments. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, S&T UK

Perovskite solar cell reaches record efficiency

PhysOrg.com, 08JAN2015

Researchers in South Korea have developed a new formula for mixing methylammonium lead bromide with formamidinium lead iodide just right. They found that an 85:15 mixture provided the best results. The team also reported that cells made using the mixture could be produced via a printing process, which would hopefully mean even lower production costs. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Solar energy

Metamaterial prism creates a reverse rainbow

PhysOrg.com, 05JAN2015

An international team of researchers (Portugal, Germany) has designed a prism made of metamaterials with nonlocal topology which gives rise to stronger refraction of longer wavelengths and the reverse rainbow. It may be possible to suppress the effects of material dispersion, and eliminate the chromatic aberrations for all light wavelengths. Possible applications include ultra-subwavelength waveguiding and focusing with planar lenses based on negative refraction. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

COMMUNICATIONS TECHNOLOGY

Next step for tactical nets: Sensors that know how to share

Defense Systems, 09JAN2015

The Army is developing Integrated Sensor Architecture, which allows sensors to interact with each other and deliver information to troops without being physically integrated. It improves a soldier's situational awareness by enabling them to query different sensors as they move through an area and access information that was previously 'invisible' to them.

Tags: Communications Technology, Sensors

CYBER SECURITY

A Cyberattack Has Caused Confirmed Physical Damage for the Second Time Ever

Wired, 08JAN2015

A German report released just before Christmas reports that hackers struck an unnamed steel mill in Germany. They did so by manipulating and disrupting control systems to such a degree that a blast furnace could not be properly shut down, resulting in "massive"—though unspecified—damage. This is only the second confirmed case in which a wholly digital attack caused physical destruction of equipment. The first case was Stuxnet.

Tags: Cyber security

“Engineers operate at the interface between science and society.”

GORDON STANLEY BROWN

ENERGY

[Flexible nanogenerators for energy harvesting applications](#)

Nanowerk, 13JAN2015

Researchers in South Korea discovered that inserting AlN insulating layers into ZnO-based harvesting devices led to a significant improvement of their performance – regardless of the layer thickness and/or layer position in the devices. The output voltage performance and polarity seem to depend on the relative position and thickness of the stacked ZnO and AlN layers, but this needs to be explored further. [TECHNICAL ARTICLE](#)

Tags: Energy, Materials science

[Compact batteries enhanced by spontaneous silver matrix formations](#)

Science Daily, 08JAN2015

A conductive silver matrix forming inside an otherwise poorly performing battery enhances its efficiency and potential applications. A team of researchers from the US (Brookhaven National Laboratory, Stony Brook University) has shown that a slow discharge rate early in the battery's life creates a more uniform and expansive conductive network, suggesting new design approaches and optimization techniques. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery, Government S&T

[Super-insulated clothing could eliminate need for indoor heating](#)

PhysOrg.com, 08JAN2015

Researchers at Stanford University have demonstrated that clothing dipped in a solution of metallic nanowires, such as AgNWs, provides passive insulation and allows for active heating when connected to an external power source. It reflects over 90% of an individual's body heat back to the individual. Average clothing material reflects back only about 20% of body heat. AgNW-coated clothing is breathable due to the nanowires' porous structure.

[TECHNICAL ARTICLE](#)

Tags: Energy, Advanced materials

GOVERNMENT S&T

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

DARPA News, 08JAN2015

DARPA's Enabling Quantification of Uncertainty in Physical Systems (EQUiPS) program aims to solve the problem of uncertainty by developing 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: Government S&T, Mathematics

INFORMATION TECHNOLOGY

[Virtual reality enters a new dimension](#)

PhysOrg.com, 09JAN2015

The new headset developed by a company in California has improved ergonomics, optics and audio quality, and software that enable better head tracking to follow the user's movements. With the headset on, you find yourself in a world with dinosaurs or extraterrestrials that seem real enough to touch. The image follows your movements when you look up, down or behind. [CES 2015](#)

Tags: Information Technology

MATERIALS SCIENCE

[Solar cells - Maximum efficiency, minimum materials and complexity](#)

Nanowerk, 12JAN2015

An international team of researchers (Germany, USA) has constructed a hybrid solar cell of two extremely thin layers of amorphous silicon and an organic layer made of fullerenes mixed with semiconducting polymers. It is able to convert infrared light that cannot be utilised by the silicon layers into electrical energy. Despite the low volume of materials employed, the hybrid cell attains efficiency of 11.7%. [TECHNICAL ARTICLE](#)

Tags: Materials science, Advanced materials, Solar energy

[Ultra-thin nanomaterial is at the heart of a major battery breakthrough](#)

Nanowerk, 12JAN2015

Researchers in the UK found that the oxygenated surface of an ultrathin MnO₂ nanosheet chemically recycles sulphides in a two-step process involving a surface-bound intermediate, polythiosulfate. The result is a high-performance cathode that can recharge more than 2000 cycles. The discovery helps to overcome a primary hurdle to building a lithium-sulphur (Li-S) battery. [TECHNICAL ARTICLE](#)

Tags: Materials science, Battery

continued...

Predicting nanoparticle agglomeration

Nanotechweb, 09JAN2015

A team of US researchers (UCLA, UC Riverside) shows that accounting for non-DLVO hydration repulsion energy is critical to quantifying the agglomeration behaviour of nanoparticles in aqueous solution. This is particularly true at high ionic strength and low absolute zeta potential. Size distribution of nanoparticles impacts the fate and transport of nanomaterials in the environment and their potential toxicity. [TECHNICAL ARTICLE](#)

Tags: *Materials science***New light shed on electron spin flips**

Science Daily, 07JAN2015

An international team of researchers (Germany, USA) has derived a new set of equations that allows for calculating electron paramagnetic resonance (EPR) transition probabilities with arbitrary alignment and polarization of the exciting electromagnetic radiation. This breakthrough in EPR methodology strongly improves the predictive power of EPR for applications in life sciences, spintronics or energy materials research and paves the way for future EPR experiments with novel excitation schemes.

[TECHNICAL ARTICLE](#)Tags: *Materials science***FEATURED RESOURCE****SciTech Daily**

Selected analysis, opinion, features, background and book reviews from international news sources. [RSS](#)

MICROELECTRONICS**'Batman' leads way to superfast and precise data storage**

Nanowerk, 12JAN2015

An international team of researchers (Switzerland, Germany, the Netherlands, Japan) has demonstrated the feasibility of selective magnetization switching inside a microstructure by using laser light. Their findings open opportunities for very-high-density information storage media. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Materials science***NEUROSCIENCE****Human brain keeps memories tidy by pruning inaccurate ones**

Medical Express, 09JAN2015

An experiment conducted by a team of researchers in the US (Princeton University, University of Texas,

Austin) shows that the human brain uses memories to make predictions about what it expects to find in familiar contexts. When those subconscious predictions are shown to be wrong, the related memories are weakened and are more likely to be forgotten. And the greater the error, the more likely you are to forget the memory. [TECHNICAL ARTICLE](#)

Tags: *Neuroscience***Brain imaging may help predict future behavior**

Science Daily, 08JAN2015

Researchers at MIT describe the predictive power of brain imaging across a variety of different future behaviors, including infants' later performance in reading, students' later performance in math, criminals' likelihood of becoming repeat offenders, adolescents' future drug and alcohol use, and addicts' likelihood of relapse. [TECHNICAL ARTICLE](#)

Tags: *Neuroscience***QUANTUM SCIENCE****Toward quantum chips: Packing single-photon detectors on an optical chip is crucial for quantum-computational circuits**

Science Daily, 09JAN2015

Single-photon detectors are notoriously temperamental: Of 100 deposited on a chip using standard manufacturing techniques, only a handful will generally work. An international team of researchers (USA, Japan) describes a procedure for fabricating and testing the detectors separately and then transferring those that work to an optical chip built using standard manufacturing processes. In addition to yielding much denser and larger arrays, the approach also increases the detectors' sensitivity. In experiments, the researchers found that their detectors were up to 100 times more likely to accurately register the arrival of a single photon than those found in earlier arrays.

[TECHNICAL ARTICLE](#)Tags: *Quantum science***Quantum optical hard drive breakthrough**

Science Daily, 08JAN2015

Researchers in Australia developing a prototype optical quantum hard drive have improved storage time by a factor of over 100. The team's record storage time of six hours is a major step towards a secure worldwide data encryption network based on quantum information which could be used for banking transactions and personal emails.

[TECHNICAL ARTICLE](#)Tags: *Quantum science, Information technology, S&T Australia*

Quantum pigeonholes are not paradoxical after all, say physicists

Physics World, 08JAN2015

Researchers in the UK have calculated that quantum-interference effects can make it appear that each location only holds one particle, even though two particles might actually be present. They warn, however, that measuring the effect in the lab would be an extraordinarily difficult task. TECHNICAL ARTICLE

Tags: Quantum science, S&T UK

Spin designers with nanomagnets

Nanowerk, 08JAN2015

A University of Minnesota-led team of 32 professors, and over 100 graduate students from 18 universities is trying to restructure computers from the bottom up. The researchers want to use the “spin” of electrons on nanomagnets—rather than electric charge—to encode zeros and ones. If they are successful, the computers of 2025 could be 10 times faster than today’s computers, while using only 1 percent of their energy. More information

Tags: Quantum science, Information technology

S&T POLICY

Scientists urge artificial intelligence safety focus

PhysOrg.com, 13JAN2015

An open letter signed by famous physicist Stephen Hawking, Jaan Tallinn, Elon Musk along with some of the top minds from universities such as Harvard, Stanford, MIT, Cambridge, and Oxford, and companies like Google, Microsoft and IBM said “...we cannot predict what we might achieve when this intelligence is magnified by the tools AI may provide, but the eradication of disease and poverty are not unfathomable. Because of the great potential of AI, it is important to research how to reap its benefits while avoiding potential pitfalls.” Open letter

Tags: S&T policy, Science without borders

SCIENCE WITHOUT BORDERS

How well can information be stored from the beginning to the end of time?

PhysOrg.com, 13JAN2015

An international team of researchers (Italy, USA) has investigated the fundamental limits to preserving information on a literally cosmic scale. Specifically, they wanted to know how well a given amount of information can be preserved from the beginning to the end of time, with limitations only from physical laws and not technological imperfections in the specific storage medium. Their main result is that, the faster the universe expands, the less well the information can be preserved. TECHNICAL ARTICLE

Tags: Science without borders

A 100-year study of artificial intelligence? Microsoft Research’s Eric Horvitz explains

Science Magazine, 09JAN2015

Microsoft Research lab is launching a project, “The One Hundred Year Study on Artificial Intelligence (AI100)”, based at Stanford University which aims to track the impact of artificial intelligence on all aspects of life, from national security to public psychology and privacy.

Tags: Science without borders, Artificial intelligence

STEM

Effective Implementation of Next Generation Science Standards Requires Consistency and Collaboration

National Research Council, 08JAN2015

A new report released today by the National Research Council offers guidance to district and school leaders and teachers on the steps necessary for putting the Next Generation Science Standards (NGSS) into practice over the next decade and beyond. These standards are informed by research findings that emphasize that science and engineering involve both knowing and doing; that developing rich, conceptual understanding is more productive for future learning than simply memorizing discrete facts.

Tags: STEM, S&T Policy ■

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