



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

[Advanced manufacturing \(1\)](#)

[Advanced materials \(7\)](#)

[Big data \(1\)](#)

[Biotechnology \(1\)](#)

[Cyber security \(1\)](#)

[Electronic warfare \(1\)](#)

[Energy \(2\)](#)

[Information technology \(3\)](#)

[Materials science \(2\)](#)

[Microelectronics \(5\)](#)

[Neuroscience \(2\)](#)

[Photonics \(1\)](#)

[Quantum science \(3\)](#)

[Science without borders \(1\)](#)

[Sensors \(1\)](#)

FEATURE ARTICLES

[Carbon nanotubes open new path toward quantum information technologies](#)

Nanowerk, 07SEP2015

Researchers at Los Alamos National Laboratory revealed a new path toward on-demand single photon generation by demonstrating that incorporation of pristine single-walled carbon nanotubes into a silicon dioxide matrix could lead to creation of solitary oxygen dopant state capable of fluctuation-free, room-temperature single photon emission. [TECHNICAL ARTICLE](#)

Tags: [Quantum science](#), [Government S&T](#), [Featured Article](#)

[Metallic gels produce tunable light emission](#)

MIT News, 03SEP2015



Luminescent materials produced by the MIT team are shown under ultraviolet light, emitting different colors of light that can be modified by their environmental conditions. These light-emitting beads were made by materials science and engineering students Caroline Liu and Rebecca Gallivan. Photo: Tara Fadenrecht

to a wide variety of external conditions. The materials could find a variety of uses in detecting chemical and biological compounds, or mechanical and thermal conditions. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Materials science](#), [Featured Article](#)

Researchers at MIT have developed a family of materials that can emit light of precisely controlled colors, even pure white light, and whose output can be tuned to respond

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[Synthesizing nanodiamond-like carbon chains inside nanotubes](#)

Nanowerk, 02SEP2015

The inner space of carbon nanotubes can act as a template for the synthesis of nanodiamond-like carbon chains. An international team of researchers (Japan, Germany, USA) used diamantane, a 10-carbon cage structure, as a precursor molecule and building block for polymerization. This templated polymerization approach paves the way for the design of novel one-dimensional nanomaterials. [TECHNICAL ARTICLE](#)

Tags: [Advanced manufacturing](#), [Advanced materials](#), [CNT](#)

ADVANCED MATERIALS

[First superconducting graphene created](#)

Nanowerk, 08SEP2015

An international team of researchers (Canada, Germany) reports that decorating monolayer graphene with a layer of lithium atoms enhances graphene's electron-phonon coupling to the point where superconductivity can be induced. To achieve this breakthrough, they prepared the Li-decorated graphene in ultra-high vacuum conditions and at ultra-low temperatures (5 K or -449 F or -267 C). [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#)

[Graphene and Perovskite Lead to Inexpensive and Highly Efficient Solar Cells](#)

IEEE Spectrum, 08SEP2015

Researchers in Hong Kong have combined these two materials to make a semi-transparent solar cell capable of power conversion efficiencies around 12 percent, a significant improvement over the roughly 7-percent efficiency of traditional semi-transparent solar cells. Perovskite serves as the active layer for harvesting light, and graphene acts as the transparent electrode material.

Tags: [Advanced materials](#), [Materials science](#), [Solar energy](#)

continued...

[BACK TO TOP](#)

Nano-dunes with the ion beam

Science Daily, 08SEP2015

An international team of researchers (Germany, China) has demonstrated a method for self-organization of nanostructured arrays via broad ion beam irradiation. The ions mill off the surface of the target and create the desired nanostructures. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials*

Perovskite quantum dots emit single photons

Nanotechweb, 07SEP2015

According to a team of researchers in the US (Los Alamos National Laboratory, University of New Mexico) individual perovskite quantum dots can operate as efficient room-temperature single-photon sources that emit photons one by one. The materials might be used in light-emitting diodes, with practical applications in displays. They fabricated perovskite quantum dots via a colloidal route. They showed that it is possible to tune their size and adjust the color they emit by varying the composition of the anion component. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials, Government S&T, Materials science*

Studying nanoparticles one at a time

Nanowerk, 07SEP2015

An international team of researchers (Sweden, Poland, Russia) has developed a new way to study nanoparticles one at a time, and has discovered that individual particles that may seem identical in fact can have very different properties. The results may prove to be important when developing new materials or applications such as hydrogen sensors for fuel cell cars. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials*

Scientists predict phagraphene, a 'relative' of graphene

Nanowerk, 02SEP2015

Using computer generated simulation, an international team of researchers (China, USA - Stony Brook University, Russia) have predicted the existence of a new two-dimensional carbon material, a "patchwork" analogue of graphene called phagraphene. Unlike graphene, a hexagonal honeycomb structure with atoms of carbon at its junctions, phagraphene consists of penta-, hexa- and heptagonal carbon rings. Due to the different number of atoms in the rings, the Dirac cones are 'inclined.' Hence the velocity of electrons in it depends on the direction. It possesses all the other properties of graphene. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials, Materials science*

BIG DATA**The Website That Visualizes Human Activity in Cities Across the World**

MIT Technology Review, 08SEP2015

Researchers at MIT and their industry partner have unveiled a powerful online tool called [ManyCities](#) that uses mobile phone data to visualize human activity in cities all over the world. The tool allows anybody to study human activity in various cities with unprecedented detail. But the key is that it organizes and presents the data in intuitive ways that quickly reveals trends and special events. [TECHNICAL ARTICLE](#)

Tags: *Big data*

BIOTECHNOLOGY**A new type of bandage will draw out bacteria and speed up healing**

Science Alert, 02SEP2015

A new type of nanofibre mesh bandage developed by researchers in Australia is coated with a compound called allylamine, which makes a range of different bacteria quickly attach to it. The mesh has already been successfully tested on bacterial colonies and engineered skin models in the lab, and the results suggest that bacteria will choose to move out of a wound and onto the material. [TECHNICAL ARTICLE](#)

Tags: *Biotechnology, Medical Sciences, S&T Australia*

CYBER SECURITY**Online security braces for quantum revolution**

Nature News, 08SEP2015

Computer-security specialists are meeting in Germany this week to discuss quantum-resistant replacements for today's cryptographic systems. On the day that the first large quantum computer comes online, some widespread and crucial encryption methods will be rendered obsolete. Quantum computers exploit laws that govern subatomic particles, so they could easily defeat existing encryption methods. PQCRYPTO, a European consortium of quantum-cryptography researchers in academia and industry, released a preliminary report on 7 September recommending cryptographic techniques that are resistant to quantum computers. [TECHNICAL ARTICLE](#)

Tags: *Cyber security, Quantum science*

ELECTRONIC WARFARE**Air Force looks to boost its EW capabilities**

Defense Systems, 04SEP2015

The Air Force has issued a [solicitation](#) for an electronic warfare test kit which can test and simulate certain EW prototypes. The test kit would also include an automated software tool that creates realistic radar and background emitters. It should have the capability to analyze raw

continued...

“Almost everything that distinguishes the modern world from earlier centuries is attributable to science.” **BERTRAND RUSSELL**

digitized data captured from the stimulus and the response, both individually and simultaneously.

Tags: Electronic warfare, Military technology, Sensors

ENERGY

Solar water-splitting technology developed

[Science Daily](#), 04SEP2015

Researchers at Rice University have developed a system which relies on a configuration of light-activated gold nanoparticles that harvest sunlight and transfer solar energy to highly excited electrons, referred to as “hot electrons.” The energy from hot electrons is used to split molecules of water into oxygen and hydrogen. [TECHNICAL ARTICLE](#)

Tags: Energy, Materials science, Solar energy

Hot electrons point the way to perfect light absorption

[Science Daily](#), 01SEP2015

Using coherent two-dimensional nanoscopy and coherent light scattering, researchers in Germany demonstrate the existence of localized photonic states in nanotextured amorphous silicon layers. Resonant absorption in these states accounts for the enhanced absorption in the long-wavelength cutoff region. They established that Anderson localization is a highly efficient resonant absorption enhancement mechanism offering interesting opportunities for the design of efficient future absorber layers.

[TECHNICAL ARTICLE](#)

Tags: Energy, Materials science, S&T Germany, Solar energy

INFORMATION TECHNOLOGY

Physicists catch a magnetic wave that offers promise for more energy-efficient computing

[PhysOrg.com](#), 09SEP2015

A team of researchers in the US (New York University, Stanford University, SLAC National Accelerator Laboratory) created a condition in magnetic materials where the sought-after solitons should exist. They observed an abrupt onset of magnetic waves with a well-defined spatial profile that matched the predicted form of a solitary magnetic wave. Solitons could potentially be harnessed to transmit data in magnetic circuits in a way that is far more energy efficient than current methods that involve moving electrical charge.

Tags: Information technology

Shedding light on the era of ‘dark silicon’

[PhysOrg.com](#), 07SEP2015

Software developers are struggling to cope with the dramatic increase in hardware complexity and the current tools are simply inadequate to the task. Researchers in the UK are working on new ‘smart’ compilers which use machine learning to self-educate and find more efficient

ways of doing their job as the middle man between software and hardware. For the first time, machine learning will live in the application environment, learning how to optimise programs for individual computing devices.

Tags: Information technology, S&T UK

Turning clothing into information displays

[PhysOrg.com](#), 02SEP2015

Researchers in the Netherlands have demonstrated the world’s first stretchable and conformable thin-film transistor driven LED display laminated into textiles. This paves the way to wearable displays in clothing providing users with feedback. The LED displays are fabricated on a polyimide substrate and encapsulated in rubber, allowing the displays to be laminated in to textiles that can be washed.

Tags: Information technology, Flexible electronics

MATERIALS SCIENCE

Magnetic ‘wormhole’ connecting two regions of space created for the first time

[Science Daily](#), 03SEP2015

Researchers in Spain used metamaterials and metasurfaces to build the tunnel experimentally, so that the magnetic field from a source appears at the other end of the ‘wormhole’ as an isolated magnetic monopole. The ‘wormhole’ in this experiment is a sphere made of different layers: an external layer with a ferromagnetic surface, a second inner layer, made of superconducting material, and a ferromagnetic sheet rolled into a cylinder that crosses the sphere from one end to the other. The sphere is made in such a way as to be magnetically undetectable from the exterior. [TECHNICAL ARTICLE](#)

Tags: Materials science, Breakthrough technology

Material surfaces are not just two-dimensional, researcher discovers

[PhysOrg.com](#), 03SEP2015

A team of researchers in the US (University of Wyoming, Louisiana State University, Lawrence Berkeley National Laboratory, SLAC National Accelerator Laboratory, Stanford University) report that the interaction between electron and phonon at the surfaces is determined by all four major entities: electrons in bulk, electrons at surfaces, phonon in bulk and phonon at surfaces. In particular, the broken symmetry induced surface electrons and phonon play a decisive role to enhance the electron-phonon interactions at the surfaces. They studied the interaction in beryllium crystal. [TECHNICAL ARTICLE](#)

Tags: Materials science

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MICROELECTRONICS

[Silicon nanoparticle is a new candidate for an ultrafast all-optical transistor](#)[Science Daily, 08SEP2015](#)

Researchers in Russia found that they can dramatically change the properties of a silicon nanoparticle by irradiating it with intense and ultrashort laser pulse. The laser thus acts as a control beam, providing ultrafast photoexcitation of dense and rapidly recombining electron-hole plasma whose presence changes the dielectric permittivity of silicon for a few picoseconds. This abrupt change in the optical properties of the nanoparticle opens the possibility to control the direction, in which incident light is scattered. This concept of ultrafast switching is very promising for designing of an all-optical transistor.

TECHNICAL ARTICLE

*Tags: Microelectronics, S&T Russia***[Encapsulation layers keep carbon nanotube transistors stable in open air](#)**[Nanowerk, 07SEP2015](#)

A team of researchers in the US (Northwestern University, University of Minnesota) developed encapsulation layers that protect carbon nanotubes from environmental degradation. To demonstrate proof of concept, they designed and fabricated arrays of working SRAM circuits. Not only did the encapsulation layers protect the sensitive device from the environment, but they improved spatial uniformity among individual transistors across the wafer.

TECHNICAL ARTICLE

Tags: Microelectronics, Advanced materials, CNT

FEATURED RESOURCE

[Science360 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.

[Ultra low-power computing](#)[Nanotechweb, 07SEP2015](#)

Field-effect transistors require a minimum amount of energy to emit charge carriers which limits the ability to reduce power consumption. Researchers at IBM (US) have developed a piezoelectronic transistor which bypasses this limitation by transduction of electric signals into mechanical (acoustic) waves and then back again. Theoretically, this device could operate at 1/50 the power of conventional Si-based transistors.

TECHNICAL ARTICLE

*Tags: Microelectronics***[Squishy transistors—a device concept for fast, low-power electronics](#)**[PhysOrg.com, 04SEP2015](#)

An international team of researchers (UK, USA - IBM, New York, Auburn University) has demonstrated the capabilities of PET as a post-CMOS technology that could overcome fundamental physical limits and restore voltage scaling. The team explains the physics underlying the PET's behaviour and use theory and simulation to predict its performance when optimised across a wide range of application spaces, spanning several different length scales: including radio frequency switches (on the micron scale) and devices such as smartphones and phased array radar.

*Tags: Microelectronics***[Shift from electronics to spintronics opens up possibilities of faster data](#)**[Nanowerk, 02SEP2015](#)

Spintronics researchers are working to replace electric current-based DRAM with MRAM. While it is not as fast as DRAM, magnetic cells are able to maintain their stored spin orientations and the data they represent, without power. MRAM is likely to replace commonly used flash memory as it doesn't suffer from flash memory's limited lifespan. Spintronics has several advantages over conventional electronics. As electronics approaches the limits of silicon, spintronic components will play an important role in ensuring we enjoy steady performance gains, and faster, higher-capacity storage at lower power and cost.

Tags: Microelectronics

NEUROSCIENCE

[Changing behavior through synaptic engineering](#)[Medical Express, 08SEP2015](#)

Researchers at UMass Medical School replaced the inhibitory ion channel with an excitatory version of the channel in a live nematode. Cells that are normally inhibited in the brain now get activated. The engineered channel is properly incorporated and does not affect development of neural circuits of the worm brain. They were able to completely reverse the behavior by simply switching the sign of a synapse in the neural network.

*Tags: Neuroscience***[In analyzing a scene, we make the easiest judgments first](#)**[EurekAlert, 03SEP2015](#)

Researchers at Brown University report that the hypothesis that we classify scenery by following some order of cognitive priorities may have been overlooking something simpler. Their research suggests that the fastest categorizations our brains make are simply the ones where the necessary distinction is easiest. Whatever is happening in the visual system might not be as sophisticated as we thought.

*Tags: Neuroscience**continued...*

PHOTONICS

Multi-dimensional single-spin nano-optomechanics with a levitated nanodiamond

Nature Photonics, 07SEP2015

An international team of researchers (USA - University of Rochester, Finland) demonstrates a hybrid nano-optomechanical system composed of a nanodiamond (containing a single nitrogen-vacancy centre) that is levitated in an optical dipole trap. The mechanical state of the diamond is controlled by modulation of the optical trapping potential. This result represents the first step towards a hybrid quantum system, based on levitating nanoparticles, that simultaneously engages optical, phononic and spin degrees of freedom.

Tags: Photonics, Advanced materials

QUANTUM SCIENCE

Improved stability of electron spins in qubits

Nanowerk, 07SEP2015

An international team of researchers (Switzerland, UK, USA - UC Santa Barbara) has demonstrated that electron exchange in quantum dots fundamentally limits the stability of spin states. Control of this exchange process paves the way for further progress in the coherence of the fragile quantum states. **TECHNICAL ARTICLE**

Tags: Quantum science

Spins on the edge

Nanowerk, 04SEP2015

Researchers in Japan propose a model system that could allow a range of electron-spin-related phenomena to be experimentally observed. They report that quantum Hall effect opens up a 'channel' along the edges of a topological insulator film, along which electrical charges and spins could flow, and electric fields could be used to generate more spins in the channels. **TECHNICAL ARTICLE**

Tags: Quantum science, S&T Japan

SCIENCE WITHOUT BORDERS

Electronic 'ear' aims to pick up gravitational waves in real time

PhysOrg.com, 09SEP2015

Using a software based electronic 'ear' developed by researchers in Australia, scientists can listen in for anomalies picked up by Laser Interferometer Gravitational-Wave Observatories (LIGO) in real time. Gravitational waves carry vital information about their origin and about the nature of gravity itself, so their detection will create an entirely new form of astronomical study.

Tags: Science without borders, S&T Australia

SENSORS

Pitt researchers developing a novel way to identify pathogens

PhysOrg.com, 08SEP2015

When the specifically engineered protein hydrogel, developed by researchers at the University of Pittsburgh, interacts with the carbohydrates on the surface of *Candida albicans*, almost immediately it emits a specific light signature that can be recognized by the naked eye or a spectroscope. Different antibodies can be used to make hydrogels tailored for specific pathogens. **TECHNICAL ARTICLE**

Tags: Sensors, Biotechnology, Materials science ■

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