



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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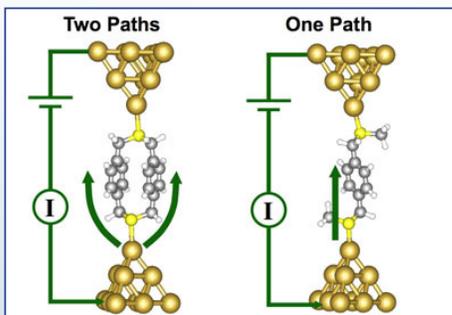
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## FEATURE ARTICLES



Atomic scale visualization of the single molecule junctions formed with two equivalent pathways (left) and one pathway (right), including the bonding to the tips of two gold electrodes and a schematic of the external electrical circuit.

### Electronics play by a new set of rules at the molecular scale

Nanowerk, 03SEP2012

In a molecular circuit, the rules that govern current flow involve fundamental quantum

mechanics. To make the circuits, a team of researchers from DOE and Columbia University adapted a scanning tunneling microscope (STM) apparatus to repeatedly press a sharp gold tip into another gold electrode and then pull it away. When this junction breaks, there is a moment when the gap between the two pieces of gold is a perfect fit for the molecule. Once the circuit system is set up, the conductance measurement is fast and can be repeated thousands of times to get statistically reliable data. [TECHNICAL ARTICLE](#)

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

### Synchronized lasers measure how light changes matter: Effects of light at atomic scale probed by mixing x-ray and optical light waves

Science Daily, 03SEP2012

How matter responds to light lies at the core of vision, photosynthesis, solar cells, and many other fields of scientific and practical import. But until now, it hasn't been possible to see just how light does it. An international team of scientists led by U.S. used resources at the SLAC National Accelerator Laboratory to mix a pulse of superbright x-rays with a pulse of lower frequency, "optical" light from an ordinary laser. By aiming the combined pulses at a diamond sample, the team was

able to measure the optical manipulation of chemical bonds in the crystal directly, on the scale of individual atoms. [TECHNICAL ARTICLE](#)

Tags: [Breakthrough technology](#), [Government S&T](#), [Featured Article](#)

## S&T NEWS ARTICLES

### AUTONOMOUS SYSTEMS & ROBOTICS

#### Chinese researchers develop FlyingBuddy2, a mind-controlled drone

Digital Trends, 04SEP2012

The technology uses an EEG headset that is commercially available. The device, coined the EEG neuroheadset, is worn over a user's head. Using non-invasive measures, it tracks the electrical signals firing in the brain. There are 16 tendril-like sensors that enable the owner to program and track for up to 12 different movements. The headset can reportedly also detect emotions. [VIDEO](#)

Tags: [Autonomous systems & robotics](#), [S&T China](#)

#### A whisker-inspired approach to tactile sensing

Science Daily, 03SEP2012

Inspired by the twitching whiskers of common rats and Etruscan shrews, researchers in the UK have developed rodent-like robots and an innovative tactile sensor system that could be used to help find people in burning buildings, make vacuum cleaners more efficient and eventually improve keyhole surgery.

Tags: [Autonomous systems & robotics](#), [S&T EU](#)

#### Researchers engineer light-activated skeletal muscle

MIT News, 31AUG2012

Scientists at MIT and the University of Pennsylvania have genetically engineered muscle cells to flex in response to light, and using the light-sensitive tissue to build highly articulated robots. This "bio-integrated" approach, as they call it, may one day enable robotic animals that move with the strength and flexibility of their living counterparts.

[VIDEO](#)

Tags: [Autonomous systems & robotics](#)

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## **Video Friday: Brain-Controlled Drones, Huggable Robobears, and Frikkin' Robot Laser Snakes**

IEEE Spectrum, 31AUG2012

A snake-arm robot from OC Robotics that's been outfitted with a 5kW laser. Actually, it was outfitted with the laser in order to assist with "dismantling and decommissioning complex structures in hazardous and confined nuclear environments."

Tags: *Autonomous systems & robotics*

## BIOTECHNOLOGY

### **TB outbreaks could be 'solved' by DNA tracking, scientists say**

Science Daily, 04SEP2012

Researchers in Canada used whole-genome sequencing to analyse the bacterial DNA in samples from 36 of 41 infected individuals in a TB outbreak. They were able to track the pathogen's movements through the community in British Columbia, including where it started and who infected whom. From this they could identify key persons, places, and behaviours that contributed to the spread of disease.

Tags: *Biotechnology, S&T Canada*

### **Intelligent self-repairing clothing and sensors will detect potential onset of an epileptic seizure**

Science Daily, 03SEP2012

Melding design with science, technology, engineering and mathematics (STEM) disciplines, P<sup>3</sup>i (printable, paintable and programmable intelligent materials) brings together leading designers and engineers to find technology-based solutions for society's needs and future ways of living. Northumbria University (UK) will engage in a design-led exploration of emerging materials and technologies in, on and around the human body in the 21st Century.

Tags: *Biotechnology*

## ENERGY

### **MASSIVE advances in aerodynamics**

PhysOrg.com, 03SEP2012

Engineers in Australia are closer to understanding, and therefore manipulating, invisible aerodynamic drag forces, that cause an estimated 50 per cent of transportation fuel to be lost before we can use it. Once we understand this, we can design surface control strategies that manipulate the turbulent boundary layer to minimise drag which will result in more efficient vehicles, and less energy losses in the transport of liquids and gas in pipes. This will also reduce the amount of CO<sub>2</sub> we produce.

Tags: *Energy*

## ENVIRONMENTAL SCIENCE

### **Amazon Seeds Its Own Rain**

Science Magazine, 03SEP2012

A new study finds that microscopic bits of potassium-rich salt spewed skyward by trees and fungi may be seeding much of the region's precipitation. Because aerosols also scatter light back into space, they can cool Earth's surface as well. The findings may also help explain how secondary organic aerosols form in other parts of the world, although in many of those regions the cores of those particles are presumed to be dust, soot, or manmade pollutants.

Tags: *Environmental science, Climatology*

### **Computer model seeks best carbon 'sponge'**

Futurity.org, 03SEP2012

According to researchers in the US a new computer model can identify the best molecular candidates for removing carbon dioxide, molecular nitrogen, and other greenhouse gases from power plant flues. The model is the first computational method to provide accurate simulations of the interactions between flue gases and a special variety of the gas-capturing molecular systems known as metal-organic frameworks (MOFs).

Tags: *Environmental science, Materials science*

## EXPLOSIVES

### **Powerful new explosive could replace today's state-of-the-art military explosive**

EurekaAlert, 05SEP2012

Borrowing a technology used to improve the effectiveness of drugs, scientists are reporting discovery of a new explosive more powerful than the current state-of-the-art explosive used by the military. Mixing two parts CL-20 with one part HMX, however, produced a new explosive with a blast wave that would travel almost 225 miles per hour faster than that of the purest form of HMX, meaning a much more powerful blast. The new explosive, however, was as stable and resistant to accidental detonation as HMX.

### **TECHNICAL ARTICLE**

Tags: *Explosives, Military technology*

## FORECASTING

### **CSIRO defines six 'megatrends' that will change our lives**

The Conversation, 05SEP2012

CSIRO has defined six megatrends that will substantially change the way people live, as part of a trends database it's been building since 2010 to help industry and government plan for the next 20 years. **REPORT**

Tags: *Forecasting*

“Technology is the knack of so arranging the world that we do not experience it.”

MAX FRISCH

## GOVERNMENT S&T

### [Fantastic New Video Shows Huge Eruption on the Sun](#)

Wired, 03SEP2012

This video by NASA's Solar Dynamics Observatory captures a dramatic filament eruption on Aug. 31. Shown in the video in extreme ultraviolet light, the filament collapsed and exploded in spectacular fashion. The segment shown in red covers nearly 3 hours. The NOAA spaceweather prediction center estimates the resulting cloud of radiation will reach Earth on Sep. 3, but will only create a minor to moderate geomagnetic storm. [VIDEO](#)

Tags: Government S&T, NASA

## INFORMATION TECHNOLOGY

### [Integrated silicon optical transmitter to carry large volumes of data between CPUs](#)

PhysOrg.com, 03SEP2012

Using the same structure to make a prototype optical transmitter that integrates the light source and optical modulator on the same silicon chip, researchers in Japan demonstrated that it could achieve optical modulation signals at speeds of 10 Gbps at temperatures ranging from 25°C to 60°C without a thermal control mechanism. This technology enables compact, low-power optical transceivers to be mounted directly in CPU packaging.

Tags: Information Technology

## MATERIALS SCIENCE

### [Using magnetism to understand superconductivity](#)

Science Daily, 04SEP2012

Using a unique device, the Brookhaven team created a layer just a single atom thick. Then, despite the material's extreme thinness, the PSI scientists were able to use an ultrasensitive instrument to measure the magnetic dynamics of the atoms. EPFL (Switzerland) provided the final piece of the puzzle, with mathematical models to analyze the measurements. One day it may be possible to transmit electricity from an offshore wind turbine to land-based users without any loss of current.

Tags: Materials science

### [ANSI nanotechnology panel to review standards in October meeting](#)

Nanowerk, 03SEP2012

ANSI president and CEO S. Joe Bhatia said, "Nanotechnology is a growing and vital field that has the potential to change current industries and pave the way

to new ones. The ANSI-NSP looks forward to building on its record as a coordinator and facilitator of responsive nanotechnology standardization activities that keep pace with the field's advancement."

Tags: Materials science, Nanotechnology

### [Unique porous carbon spheres made by ultrasonic spray pyrolysis](#)

Nanowerk Spotlight, 03SEP2012

Researchers at the University of Illinois already demonstrated the use of carbon microspheres as supercapacitors. Now, the team has expanded the aerosol synthesis of porous carbon materials by the use of energetic carbon precursors. Some of the resulting porous carbon spheres exhibit unique and unprecedented morphologies.

Tags: Materials science

### [After the Higgs: The new particle landscape](#)

Nature News, 29AUG2012

Is the particle a Higgs boson of maximum simplicity, as predicted by the 40-year-old standard model of particle physics? Or is it something more complex and interesting that will point towards a deeper, more complete theory? Physicists hope and expect that the LHC will give them some answers over the next few years. But they are already honing their sales pitches for a machine to follow the LHC—a 'Higgs factory' that would illuminate such a theory with measurements far more precise than the LHC can provide.

Tags: Materials science, Science without borders

## MICROELECTRONICS

### [Silicon chip based new approach to quantum computing](#)

Nanowerk, 04SEP2012

The Bristol-led team (UK) have developed quantum chips from silicon. However, unlike conventional silicon chips that work by controlling electrical current, these circuits manipulate photons to perform calculations. They exploit strange quantum mechanical effects such as superposition and entanglement. The technology developed uses the same manufacturing techniques as conventional microelectronics, and could be economically scaled for mass-manufacture.

Tags: Microelectronics, S&T UK

### [Researchers develop new, less expensive nanolithography technique](#)

EurekaAlert, 31AUG2012

Researchers from North Carolina State University have developed a new nanolithography technique that is less

*continued...*

expensive than other approaches and can be used to create technologies with biomedical applications. The new technique relies on cantilevers, which are 150-micron long silicon strips. The cantilevers can be tipped with spheres made of polymer or with naturally occurring spores. The spheres and spores are coated with ink and dried. The spheres and spores are absorbent and will soak up water when exposed to increased humidity.

*Tags: Microelectronics, Nanotechnology*

## NEUROSCIENCE

### [Mathematics or memory? Study charts collision course in brain](#)

[Science Daily](#), 03SEP2012

You already know it's hard to balance your checkbook while simultaneously reflecting on your past. Now, researchers can tell us how this impasse arises. The researchers at Stanford University showed that groups of nerve cells in a structure called the posterior medial cortex, or PMC, are strongly activated during a recall task but just as strongly suppressed when you're engaged in solving a math problem.

*Tags: Neuroscience*

## FEATURED RESOURCE

### [Futurity](#)

Futurity features the latest discoveries by scientists at top research universities in the US, UK, Canada, and Australia. The nonprofit site, which launched in 2009, is supported solely by its university partners.

[RSS](#)

## PHOTONICS

### [Flexible and tunable silicon photonic circuits on plastic substrates](#)

[Nature Scientific Reports](#), 03SEP2012

Here we demonstrate a flexible form of silicon photonics using the transfer-and-bond fabrication method. Photonic circuits including interferometers and resonators have been transferred onto flexible plastic substrates with preserved functionalities and performance.

*Tags: Photonics, Flexible electronics*

### [Scientists develop new technique for laser micro-machining](#)

[Nanowerk](#), 31AUG2012

Researchers at Liverpool were able to successfully demonstrate a flexible and cost-effective way of producing radial

and azimuthal polarisation modes using a Hamamatsu Spatial Light Modulator. This device or 'magic mirror' can rotate the polarisation at any point in the laser beam to any desired direction. They used a 100 femtosecond-pulse laser source, together with a spatial light modulator and a wave-plate, to demonstrate laser micro-machining with these new modes of polarisation which alter the interaction of the laser with any material.

*Tags: Photonics, Materials science, S&T UK*

### [Photonic interactions at the atomic level](#)

[Science Daily](#), 30AUG2012

By measuring the unique properties of light on the scale of a single atom, researchers from Duke University and Imperial College, London, believe that they have characterized the limits of the ability of metals to be used in devices that rely on the enhancement of light.

TECHNICAL ARTICLE

*Tags: Photonics, Materials science*

## QUANTUM SCIENCE

### [Experimental Quantum Error Detection](#)

[Nature Scientific Reports](#), 04SEP2012

Arbitrary unknown polarization states of single photons and entangled photons are converted into time bins deterministically via a modified Franson interferometer. Noise arising in both 10 m and 0.8 km fiber, which induces associated errors on the reference frame of time bins, is filtered when photons are detected. The demonstrated resource efficiency and state independence make this protocol a promising candidate for implementing a real-world quantum communication network.

*Tags: Quantum science*

### [Watching quantum mechanics in action: Researchers create world record laser pulse](#)

[Science Daily](#), 04SEP2012

A research team has created the world's shortest laser pulse and in the process may have given scientists a new tool to watch quantum mechanics in action -- something that has been hidden from view until now.

*Tags: Quantum science*

### [New record in quantum communications](#)

[Australian National University](#), 30AUG2012

Researchers at the Australian National University have developed a technique that allows for quantum information to travel at higher bandwidth using a beam of light and entanglement. They were able to entangle eight quantum modes of light within one laser beam, a practice that used to require eight separate beams.

*Tags: Quantum science, S&T Australia*

## SCIENCE WITHOUT BORDERS

**A long-term view of critical materials: From coal to ytterbium**

R&amp;D Magazine, 03SEP2012

More than 90% of the world's rare earth elements are now mined in China, and worldwide demand is anticipated to grow from 136,100 metric tons in 2010 to 185,000 metric tons in 2015. However, at Lawrence Berkeley National Laboratory scientists believe that taking a long-term view is vital for addressing both the current shortage as well as avoiding future shortages of materials that are crucial to U.S. industry.

*Tags: Science without borders, Government S&T*

**International Collaborations of Scientists and Engineers in the United States**

NSF News, 03SEP2012

In 2006, one in six U.S. scientists and engineers reported working with individuals in other countries. International collaboration was more likely to occur among persons working in the for-profit sector, men, and those with higher levels of educational attainment. [PDF version](#)

*Tags: Science without borders, NSF*

**The Global Brain Trade**

IEEE Spectrum, 01SEP2012

Researchers at the National Bureau of Economic Research, in Massachusetts, conducted a Web-based survey of over 17,000 published scientists in 16 countries. (China wasn't surveyed: The researchers tried but were unsuccessful in administering the survey to scientists there.) While the United States is, unsurprisingly, a popular destination for scientists from around the world, Switzerland actually has the highest percentage of immigrant scientists. On the other side of the coin, Japan is the most insular country surveyed, exchanging relatively little scientific talent with the rest of the world.

*Tags: Science without borders*

## SENSORS

**Terahertz Microfluidic Sensing Using a Parallel-plate Waveguide Sensor**

Journal of Visualized Experiments, 31AUG2012

The procedure for implementing a refractive index sensor for terahertz frequencies based on a grooved parallel-plate waveguide geometry is described here. The method yields a measurement of the refractive index of a small volume of liquid through monitoring of the shift in the resonant frequency of the waveguide structure.

*Tags: Sensors, Terahertz technology*

**High-resolution remote-sensing for structures and objects, using optical fibers**

KurzweilAI, 29AUG2012

A research team in Switzerland has developed a technology that improves the resolution of measurements taken by optical fibers embedded in structures such as nuclear reactors, bridges, dams and buildings, or in smaller objects, providing valuable information about a structure's heat or state of fatigue and wear. [TECHNICAL ARTICLE](#)

*Tags: Sensors, S&T Switzerland ■*

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