



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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## FEATURE ARTICLES

### [Trapped light orbits within an intriguing material](#)

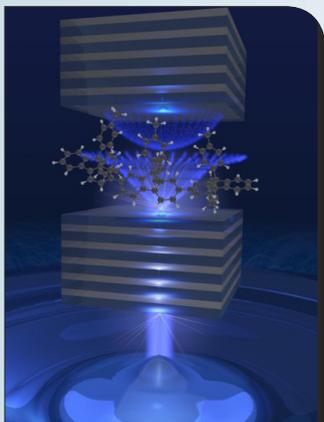
[PhysOrg.com, 16JUL2015](#)

Researchers at UC San Diego report that phonon polaritons disobey standard laws of reflection as they bounce through the granules, but their movement isn't random. Polariton rays propagate along paths at fixed angles with respect to the atomic structure of the material. The discovery could guide the development of applications such as nanoresonators for high-resolution color filtering and spectral imaging, hyperlenses for subdiffractional imaging, or infrared photon sources.

**TECHNICAL ARTICLE**

*Tags: Photonics, Featured Article*

### [World first: Significant development in the understanding of macroscopic quantum behavior](#)



[Science Daily, 14JUL2015](#)

For the first time, an international team of researchers demonstrated the wave-like behaviour of a room-temperature polariton condensate on a macroscopic length scale. Their research allows comprehensive studies of condensation to be performed in condensed matter systems under ambient conditions.

**TECHNICAL ARTICLE**

*Tags: Quantum science, Featured Article*

*To produce the room-temperature condensate, the team of researchers from Polytechnique and Imperial College first created a device that makes it possible for polaritons - hybrid quasi-particles that are part light and part matter - to exist. Credit: Konstantinos Daskalakis, Imperial College London*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### [Machines Making Machines: Printing Missiles](#) [Defense Update, 19JUL2015](#)

With commercially available high-end equipment and specially modified versions of low-cost 3-D printers, a company in the US has created nearly every component of a guided weapon using additive manufacturing, including rocket engines, fins, parts for the guidance and control systems, and more. The goal is to print more complicated circuits in three dimensions with the very high resolution and performance of silicon.

*Tags: Advanced manufacturing*

### ADVANCED MATERIALS

#### [New technique to synthesize nanostructured nanowires](#)

[Nanowerk, 20JUL2015](#)

An international team of researchers (UK, USA, Taiwan) has developed a method for growing semiconductors into nanowires or needle-shaped crystals. The technique allows two different materials to be incorporated into the same nanowire, even if the lattice structures of the two crystals don't perfectly match. Possible applications range from interconnects to single-electron transistors, high-density memories, light emission, semiconductor lasers, and tunnel diodes, along with the capability to engineer three-dimensional device structures.

**TECHNICAL ARTICLE**

*Tags: Advanced materials*

#### [Researchers demonstrated the first realization of invisible absorbers and sensors](#)

[Nanowerk, 20JUL2015](#)

An international team of researchers (Finland, Belarus, Japan) shows both theoretically and experimentally, that a thin resonant absorber, invisible in reflection in a very wide frequency range, can be realized if one and the same resonant mode of the absorbing array unit is utilized to create both electric and magnetic responses. This research will also open new venues for general light

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control and enable novel devices such as flat lenses and light beam transformers. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

### [Scientists propose 3D graphene-like ‘hyper-honeycomb’ structures](#)

[PhysOrg.com, 20JUL2015](#)

Researchers at the University of Oklahoma have proposed a new family of structures that are 3D variations of graphene. If the proposed structures can be experimentally realized, it would add to the ever-growing number of new carbon allotropes. The researchers predict that the hyper-honeycomb could potentially be even more stable than diamond. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

### [Researchers demonstrate electroluminescence from multilayer molybdenum disulfide](#)

[Nanowerk, 17JUL2015](#)

Researchers at UCLA used electric field-induced enhancement which relocates the electrons from a dark state to a luminescent state, thereby increasing the material’s ability to convert electrons into light particles. With this technique, the multilayer MoS<sub>2</sub> semiconductors are at least as efficient as monolayer ones. The discovery could lead to a new class of materials for making LEDs.

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

### [A most singular nano-imaging technique](#)

[Science Daily, 16JUL2015](#)

A multi-institutional team of researchers led by the DOE’s Lawrence Berkeley National Laboratory has developed a new technique called “SINGLE” (3D Structure Identification of Nanoparticles by Graphene Liquid Cell Electron Microscopy) that provides the first atomic-scale images of colloidal nanoparticles. Nanoparticles can serve as the basic building blocks for next generation materials.

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Government S&T*

### [On the way to breaking the terahertz barrier for graphene nanoelectronics](#)

[Science Daily, 16JUL2015](#)

Researchers in Germany discovered that electrical conduction in graphene on the picosecond timescale is governed by the same basic laws that describe the thermal properties of gases. This much simpler thermodynamic approach to the electrical conduction in graphene will allow scientists and engineers not only to better understand but also to improve the performance of graphene-based nanoelectronic devices. [TECHNICAL ARTICLE](#)

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

### [Innovative substrate engineering for high quality 2D nanomaterials](#)

[Nanowerk, 15JUL2015](#)

An international team of researchers (UK, Hungary) found a way to engineer the substrate in a way that results in a significant improvement in the morphology of graphene flakes. Furthermore, the growth rate increases by more than an order of magnitude—about 120 μm per minute – compared to the typically reported techniques.

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

### [Nonmagnetic elements form unique magnet](#)

[Science Daily, 14JUL2015](#)

Titanium and gold are not magnetic. Researchers at Rice University found that when the two are combined in the right way they resulted in an itinerant antiferromagnetic metal. Magnetic order appears in TiAu only when the metal is cooled to 36 kelvins. This is the first time such an antiferromagnetic material has been discovered. The finding gives a deeper understanding of magnetism.

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

## AUTONOMOUS SYSTEMS & ROBOTICS

### [Video Friday: Bacteria Driving Robot, Drone With Gun, and Freaky Snakebot](#)

[IEEE Spectrum, 17JUL2015](#)

Mobile robots harbor living colonies of bacteria that direct the robots’ behavior. Researchers are building real-world robots that will have the ability to read bacterial gene expression levels in *E. coli* using miniature fluorescent microscopes.

*Tags: Autonomous systems & robotics*

### [Model for robots with bacteria-controlled brains](#)

[Science Daily, 16JUL2015](#)

Researchers at Virginia Tech used a mathematical model to demonstrate that bacteria can control the behavior of an inanimate device like a robot. Their approach revealed unique decision-making behavior by a bacteria-robot system. The model also revealed higher order functions in a surprising way. In one instance, as the bacteria were directing the robot toward more food, the robot paused before quickly making its final approach—a classic predatory behavior of higher order animals that stalk prey.

[TECHNICAL ARTICLE](#)

*Tags: Autonomous systems & robotics*

“It is the responsibility of scientists never to suppress knowledge, no matter how awkward that knowledge is.” **CARL SAGAN**

## BREAKTHROUGH TECHNOLOGY

### [After 85-year search, massless particle with promise for next-generation electronics found](#)

[PhysOrg.com](#), 18JUL2015

An international team led by Princeton University has discovered Weyl fermions, an elusive massless particle theorized 85 years ago. The particle could give rise to faster and more efficient electronics because of its unusual ability to behave as matter and antimatter inside a crystal. If applied to next-generation electronics, Weyl fermions could allow for a nearly free and efficient flow of electricity in electronics, and thus greater power.

**TECHNICAL ARTICLE**

*Tags: Breakthrough technology, Particle physics*

## COMMUNICATIONS TECHNOLOGY

### [Engineered structures that can alter the speed of light could benefit optical communication systems](#)

[Science Daily](#), 16JUL2015

Researchers in Singapore considered a structure in which two different materials are layered on top of each other. Instead of using a third material with a dielectric constant midway between the two to obtain two different periodicities, they developed a mathematical technique to combine two materials in such a way that the dielectric profile in the stacking direction is almost the same as in the more complicated three-material structure. They identified a broad range of wavelengths known as the strong coupling region that has a high density of slow modes. **TECHNICAL ARTICLE**

**ARTICLE**

*Tags: Communications technology*

## CYBER SECURITY

### [Cyber Intelligence Report July 15, 2015](#)

[Defense Update](#), 20JUL2015

This edition includes the following topics: Israel-US to Cooperate on Cybersecurity; Israel Police, Defense Ministry mulled buying spyware, Hacking Team leak reveals; Cyber security company SafeBreach raises \$4m; and more.

*Tags: Cyber security*

### [Secure PIN transactions with photons](#)

[PhysOrg.com](#), 16JUL2015

By combining the scattering of light with the quantum properties of photons, researchers in the Netherlands developed a method to equip bank cards with secure 'keys' that are impossible to duplicate. A card can be

equipped with a wafer-thin layer of dry, white paint containing millions of nanoparticles. If you shoot a light particle into the paint layer, it will bounce around between the nanoparticles until it escapes. If a bank generates photons with a complex and unique pattern of bright spots (the 'question'), the photons that escape from the nanoparticles show a new unique pattern of bright spots (the 'answer'), which can then be checked.

*Tags: Cyber security*

## ENERGY

### [New technology beats current solar panel technology in life-cycle energy assessment](#)

[Science Daily](#), 20JUL2015

In a cradle-to-grave life cycle assessment, a team of researchers in the US (Northwestern University, Argonne National Laboratory, University of Chicago) traced a product from the mining of its raw materials until its retirement in a landfill. They determined silicon-based panels usually need about two years to return this energy investment. But for technology made with perovskites, the energy payback time could be as quick as two to three months. **TECHNICAL ARTICLE**

*Tags: Energy, Advanced materials*

## FORECASTING

### [Putting research in the spotlight](#)

[MIT News](#), 17JUL2015

On July 15, research leaders gathered at the National Press Club at the "All Things Research" media roundtable to tell stories of exciting opportunities on the horizon. They spoke of exploration beyond our solar system, advanced materials to enable clean and abundant fusion energy, the development of drought resistance plants to ensure a secure food supply, optical technologies to detect cancer, and more. **VIDEO**

*Tags: Forecasting, Emerging technology, S&T Policy*

## INFORMATION TECHNOLOGY

### [Brain-inspired algorithms may make for optimized computational networks](#)

[KurzweilAI](#), 19JUL2015

By thinking computationally about how the brain develops, a team of researchers from the US (Carnegie Mellon University, Salk Institute) developed an algorithm based on the brain pruning approach. Using simulations and theoretical analysis they found that the neuroscience-based algorithm produced computer networks that were much more efficient than the current engineering

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methods. The flow of information was more direct, and provided multiple paths for information to reach the same endpoint, minimizing the risk of network failure.

#### TECHNICAL ARTICLE

*Tags: Information Technology*

### Fastest-ever flexible diode provides 'last missing piece' needed to realize bendable phones

PhysOrg.com, 15JUL2015

An international team of researchers (UK, China) has developed a flexible Schottky diode that achieves a speed of 6.3 GHz. It is also the first flexible diode to reach the "benchmark speed" of 2.45 GHz, which covers the principal frequency bands used in most current wireless communications, with the exception of 4G and the newest 5G Wi-Fi channels. TECHNICAL ARTICLE

*Tags: Information Technology, Flexible electronics*

## FEATURED RESOURCE

### Science News Sources

Collection of news sources for science and technology.

## MATERIALS SCIENCE

### Spintronics: Molecules stabilizing magnetism

Science Daily, 21JUL2015

In their study, an international team of researchers (Germany, France) applied three molecular layers of the dye phtalocynine to the surface of ferromagnetic cobalt. The molecules form an antiferromagnetic arrangement. The magnetic orientation remains relatively stable even in the presence of external magnetic fields or cooling. This could help to manufacture information storage systems in a more simple, flexible and cheaper way. TECHNICAL ARTICLE

*Tags: Materials science*

### Aluminum clusters shut down molecular fuel factory

Nanowerk, 15JUL2015

An international team of researchers (USA, the Netherlands, Germany) located spots within zeolites where chemical reactions take place and showed that the spots help rip apart and rearrange molecules as they pass through nanometer-sized channels, like an assembly line in a factory. This knowledge could help devise how to keep the factory running longer, so to speak, and improve catalysts that help produce fuel, biofuel and other chemicals. TECHNICAL ARTICLE

*Tags: Materials science*

### Solving mysteries of conductivity in polymers

Nanowerk, 15JUL2015

Conjugated polymers have been seen as very promising candidates for electronics applications, including capacitors, photodiodes, sensors, organic light-emitting diodes, and thermoelectric devices. Nobody has been able to explain just how electrical conduction worked in these materials, or predict how they would behave when used in such devices. A team of researchers in the US (MIT, Brookhaven National Laboratory) has explained how electrical charge carriers move in these compounds, potentially opening up further research on such applications. TECHNICAL ARTICLE

*Tags: Materials science, Government S&T*

## MEDICAL SCIENCES

### Miniature brains made from patient skin cells reveal insights into autism

Nanowerk, 16JUL2015

Instead of starting from genetics, researchers at Yale University started with the biology of the disorder itself to try to get a window into the genome. When they analyzed the patient organoids, they uncovered altered expression networks for genes controlling neuronal development. The success of the approach suggests that similar methods might be used to gain important insights into other human developmental diseases. TECHNICAL ARTICLE

*Tags: Medical Sciences, Biotechnology, Neuroscience*

## MICROELECTRONICS

### Physicists build universal optics chip

Physics World, 20JUL2015

Researchers in the UK have made a silica-on-silicon device designed to fit onto a 6 inch wafer, comprising 15 interferometers and 30 electrically controlled phase shifters. The input is from six single-photon channels and the chip sends its output to an array of 12 single-photon counters. Christened a universal linear optical processor, or LPU (in analogy with a CPU), the LPU is completely reprogrammable and can be switched from one experiment to another in milliseconds. It can be used to carry out any kind of linear optics operation. TECHNICAL ARTICLE

*Tags: Microelectronics, S&T UK*

### Researchers Build a Transistor from a Molecule and a Few Atoms

NRL News, 13JUL2015

An international team of researchers (Germany, USA, Japan) used a scanning tunneling microscope to create a minute transistor consisting of a single molecule and a small number of atoms. The observed transistor action is markedly different from the conventionally expected behavior and could be important for future device technologies as well as for fundamental studies of electron transport in molecular nanostructures. TECHNICAL ARTICLE

*Tags: Microelectronics, Government S&T*

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## NEUROSCIENCE

**Non-invasive brain stimulation technique could transform learning**

Science Daily, 16JUL2015

Researchers in Australia discovered a new technique called transcranial pulsed current stimulation (tPCS) which is a non-constant form of stimulation with “on” and “off” periods or pulsing between the two electrodes. They discovered that this new treatment produced larger changes in the brain and that the interval between pulses also had an effect. The shorter the interval between pulses the larger the excitability effect in the brain. [TECHNICAL ARTICLE](#)

Tags: Neuroscience, S&amp;T Australia

## PHOTONICS

**Two Great Photovoltaic Materials Brought Together Make Better LEDs**

IEEE Spectrum, 16JUL2015

Researchers in Canada developed a way to embed the quantum dots in the perovskite so that electrons are funneled into the quantum dots, which then convert electricity into light. With the perovskite directing the electrons into the quantum dots, a kind of hyper-efficient LED technology is possible that promises applications in light bulbs and new types of displays. [TECHNICAL ARTICLE](#)

Tags: Photonics, Advanced materials, S&amp;T Canada

## QUANTUM SCIENCE

**Sending Quantum Messages Through Space**  
American Physical Society - Viewpoint, 20JUL2015

Researchers in Italy show that photons—acting as carriers of quantum information—preserve their state, on which such information is encoded, even after having been reflected by satellites located more than a thousand kilometers away from Earth. Crucially, the researchers demonstrate that, back on Earth, different encoded states can be faithfully told apart; this is indispensable for the secure transmission of messages. The results suggest that global quantum communication may be within reach in the foreseeable future. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology, S&amp;T Italy

**Spintronics just got faster**

Science Daily, 20JUL2015

Using ultrafast measurements, researchers in Switzerland have now shown for the first time that electrons can cross spins at least 100,000 times faster than previously thought. Aside from its enormous implications for fundamental physics, the finding can also propel the field of spintronics forward. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&amp;T Switzerland

## S&amp;T POLICY

**THE FUTURE POSTPONED - Why Declining Investment in Basic Research Threatens a U.S. Innovation Deficit**

MIT News, 17JUL2015

A report by the MIT Committee to Evaluate the Innovation Deficit highlights 15 exciting opportunities in research with great potential for innovation. Because we can't know the answer to a certain problem in advance, we have to cast a wide net and invest broadly in science and engineering. We must support creative, interdisciplinary research—such as the convergence of the life and physical sciences—and invest in all fields of science to address society's most pressing challenges and drive the next big discoveries.

Tags: S&amp;T policy, Emerging technology, Forecasting ■

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