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## FEATURE ARTICLES

### [Researchers find strong constraint on delivery of optical signals to computers](#)

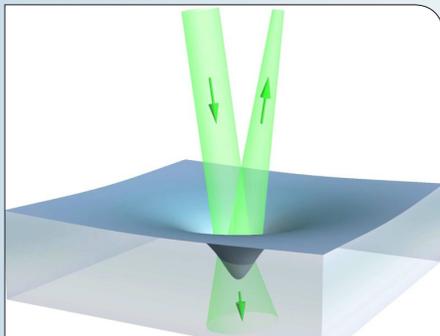
[PhysOrg.com, 09JUN2015](#)

Researchers the world over had hoped that a nonlinear isolator would allow information from beams of light to travel in only the “forward” direction, while prohibiting transmission in the “backward” direction. But Stanford University engineers have shown that there is backward leakage that no one previously recognized in this class of devices. This finding is important for designing isolators for optical chips. [TECHNICAL ARTICLE](#)

*Tags: Breakthrough technology, Communications technology, Featured Article*

### [Physicists make first observation of the pushing pressure of light](#)

[PhysOrg.com, 02JUN2015](#)



*When light impinges on the surface of a liquid, part of the light is reflected and the remaining fraction is transmitted. The new experiments show for the first time that the liquid surface bends inward, meaning that the light is pushing on the fluid in agreement with the Abraham momentum of light. Credit: Zhang, et al.*

An international team of researchers (China, Israel) showed that they could make the liquid surface bend inward, corresponding to the pushing pressure, by using a relatively wide light beam and a relatively large container. They demonstrated this pushing force in both water and oil,

which have different refractive indices, in agreement with Abraham’s theory. The results help scientists gain a better understanding of the nature of light. It may have applications in inertial confinement fusion and optical manipulation techniques, such as optical tweezers. [TECHNICAL ARTICLE](#)

*Tags: Photonics, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### [Futuristic components on silicon chips, fabricated successfully](#)

[Brightsurf, 09JUN2015](#)

A team of IBM researchers has developed a relatively simple, robust and versatile process for growing crystals made from compound semiconductor materials that will allow them to be integrated onto silicon wafers. The work may allow an extension to Moore’s Law.

[TECHNICAL ARTICLE](#)

*Tags: Advanced manufacturing*

### ADVANCED MATERIALS

#### [Moving sector walls on the nano scale](#)

[Nanowerk, 05JUN2015](#)

An international team of researchers (Switzerland, Japan, Spain, Germany) showed that the electrical conductivity of the domain walls of certain multiferroics differ from that of the material as a whole. In one material, strontium manganite, they showed that the domain walls suppress the flow of electric current. Possible applications of this study include producing electronic components in which the nanoscale domains act as tiny capacitors that could be electrically charged separately, creating a new charge-based storage medium. [TECHNICAL ARTICLE 1, 2](#)

*Tags: Advanced materials, Materials science*

#### [Solvent encapsulation is the trick: a solid material with spin-transition solution-like behaviour](#)

[Nanowerk, 05JUN2015](#)

Researchers in Spain have developed a universal encapsulation method to integrate metal complexes showing spin-transition into solid materials keeping their useful properties unaltered. This strategy is very appealing for the future fabrication of solid functional materials based on spin transition materials. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

*continued...*

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## **Cellulose becoming a supermaterial of the future**

PhysOrg.com, 04JUN2015

Design Driven Value Chains in the World of Cellulose (DWOc) 2.0 project in Finland is designing cellulose-based ecosystems to replace fossil-based raw materials in textile products, interior decoration elements and car interior materials. In the second phase of the project textile applications such as 3D printing of cellulose are being developed. [More information](#)

Tags: *Advanced materials, S&T Finland*

## **Tabletop technique maps thermal transport**

Nanotechweb, 04JUN2015

Researchers at MIT studied nanostructured metallic dots (with the smallest measuring around 30 nm across) patterned on a substrate such as silicon or silicon-germanium crystals. They developed a new technique to extract phonon mean free paths in solids. The work could help in the design of better microelectronics devices and thermoelectric materials used for converting heat into electricity. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials*

## **AUTONOMOUS SYSTEMS & ROBOTICS**

### **Team develops vision system that improves object recognition**

PhysOrg.com, 08JUN2015

The system, developed by Disney Research at Pittsburgh, builds a conceptual model of an object by using a learning algorithm to analyze a number of example images of the object. It then uses that model to identify objects, when it can, in videos. As it does, it is sometimes able to glean new information about such objects, enabling it to make its own model of the object more complex. [TECHNICAL ARTICLE](#)

Tags: *Autonomous systems & robotics, Artificial intelligence*

### **The robot that learns everything from scratch**

PhysOrg.com, 08JUN2015

Researchers in Norway have built a machine called "self" that analyses sound through a system based on the human ear, and learns to recognize images using a digital model of how nerve cells in the brain handle sensory impressions. It is designed to learn entirely from sensory input with no pre-defined knowledge database, so that its learning process will resemble that of a human child in early life.

Tags: *Autonomous systems & robotics*

### **Using Minecraft to unbuggle the robot mind**

PhysOrg.com, 08JUN2015

Researchers at Brown University are developing a new algorithm to help robots better plan their actions in complex environments. Robots don't intuitively ignore objects and actions that are irrelevant to the task at hand. Their algorithm augments standard robot planning

algorithms using "goal-based action priors"—sets of objects and actions in a given space that are most likely to help an agent achieve a given goal.

Tags: *Autonomous systems & robotics*

### **Three Teams Take Top Honors at DARPA Robotics Challenge Finals**

DARPA News, 07JUN2015

Taking first place and the \$2 million in prize money that goes with it is Team Kaist of Daejeon, Republic of Korea, and its robot DRC-Hubo. The DRC Finals competition challenged participating robotics teams and their robots to complete a difficult course of eight tasks relevant to disaster response, among them driving alone, walking through rubble, tripping circuit breakers, turning valves and climbing stairs.

Tags: *Autonomous systems & robotics*

### **New drone combines helicopter and aircraft capabilities**

Technology Org, 04JUN2015

At a drone conference in Denmark, Danish researchers unveiled the prototype of a new hybrid drone with high-precision navigation, which manoeuvres with an accuracy down to five centimetres. It is capable of flying as a traditional multirotor/helicopter, an ordinary fixed-wing aircraft and has vertical take-off and landing capability as well as flying long range at relatively high speed.

Tags: *Autonomous systems & robotics*

## **BIG DATA**

### **New study shows the dynamics of active swarms in alternating fields**

Nanowerk, 05JUN2015

An international team of researchers (Sweden, Ireland) studied the dynamics of active swarms using computer simulations and experiments on unicellular algae. The team not only found full analogy of the active motion in a field to magnetic hysteresis but also managed to quantify the controllability of the swarm and identify the signatures of collective behavior of the active agents. Researchers suggest that the laws they observed might describe the general laws of collective behaviour. [TECHNICAL ARTICLE](#)

Tags: *Big data*

### **The Emerging Science of Human Computation**

MIT Technology Review, 04JUN2015

A group of computer scientists, crowdsourcing pioneers, and visionaries have created a roadmap for research into human computation. The team points out that human computation systems have been hugely successful at tackling complex problems from identifying spiral galaxies to organizing disaster relief. [Roadmap](#)

Tags: *Big data*

“To raise new questions, new possibilities, to regard old problems from a new angle, require creative imagination and marks real advance in science.” ALBERT EINSTEIN

## BIOTECHNOLOGY

### [World's first digitally-encoded synthetic polymers](#)

PhysOrg.com, 05JUN2015

Inspired by the capacity of DNA to retain an enormous amount of genetic information, researchers in France synthesized and read a multi-bit message on an artificial polymer. Instead of using the four nitrogenous bases of DNA, researchers used three monomers. Two of these monomers represent the binary code numbers 0 and 1, and can be used interchangeably during synthesis. A third nitroxide monomer was inserted between the bits in order to facilitate the writing and reading of the coded sequence.

TECHNICAL ARTICLE

Tags: Biotechnology, Information technology, S&T France

## COMMUNICATIONS TECHNOLOGY

### [Researchers build world's first fully functioning single crystal waveguide in glass](#)

Nanowerk, 08JUN2015

An international team of researchers (USA, Japan, Canada) report that they had employed ultrafast femtosecond lasers to produce a three-dimensional single crystal capable of guiding light waves through glass with little loss of light. The 3D crystal allows light to curve and bend as it is transmitted. This gives us the potential of putting different components on different layers of glass.

TECHNICAL ARTICLE

Tags: Communications Technology, Optical communication

## ENERGY

### [Stable perovskite solar cells developed through structural simplification](#)

Nanowerk, 08JUN2015

Researchers in Japan created perovskite solar cells with a simplified structure while strictly eliminating moisture and oxygen. They are stable and there is no hysteresis in the current-voltage curve. The perovskite solar cell material also serves as an excellent semiconductor with ideal diode properties.

TECHNICAL ARTICLE

Tags: Energy, S&T Japan, Solar energy

## EXPLOSIVES

### [Counterintuitive math of high speed impacts](#)

PhysOrg.com, 04JUN2015

A team of researchers in the US (Duke University, New Jersey Institute of Technology) report that if the area of impact has a granular structure, speed can actually impede penetration. The study could help to make

“bunker busting” weapon systems more effective with respect to targets relatively deep in the ground and lead to the development of better materials for protecting against certain types of impact.

TECHNICAL ARTICLE

Tags: Explosives, Military technology

## INFORMATION TECHNOLOGY

### [The future for antiferromagnetic information storage](#)

PhysOrg.com, 05JUN2015

A review article authored by researchers in Switzerland compiles the approaches that have been employed for reading and storing information in antiferromagnets and answers the question about how to write on antiferromagnetics successfully.

TECHNICAL ARTICLE

Tags: Information Technology, S&T Switzerland

### [Quest for buried knowledge continues with new computer software tool](#)

PhysOrg.com, 04JUN2015

Researchers at the University of Kentucky have built a software tool called the Volume Cartographer that allows researchers to map the surface of the scroll and then allow the user to pull out pages and scan for letters. Currently the software is working to reveal text from a Herculaneum scroll which was carbonized almost 2,000 years ago.

Tags: Information Technology

## MATERIALS SCIENCE

### [Ultrafast heat conduction can manipulate nanoscale magnets](#)

PhysOrg.com, 08JUN2015

Researchers at the University of Illinois at Urbana-Champaign have uncovered physical mechanisms allowing the manipulation of magnetic information with heat. These new phenomena rely on the transport of thermal energy, in contrast to the conventional application of magnetic fields, providing a new and highly desirable way to manipulate magnetization at the nanoscale.

TECHNICAL ARTICLE

Tags: Materials science

### [Researchers Discover Electron Pairing without Superconductivity](#)

NRL News, 05JUN2015

A team of researchers in the US (University of Pittsburgh, University of Wisconsin-Madison, U.S. Naval Research Laboratory) created and measured 58 quantum dots of strontium titanate with varying dimensions and barriers between the quantum dots and the leads. The new pairing phase was observed in all of the dots. The discovery

*continued...*

provides clues about the mechanisms causing superconductivity in strontium titanate, which may eventually help the discovery of a material that superconducts at room temperature.

*Tags: Materials science, Government S&T*

### [Friction of a single atom measured with light](#) Nature News, 04JUN2015

Ions trapped in a vacuum have simulated the friction of surfaces down to the scale of single atoms, and in the process have demonstrated how some surfaces can slide past each other with almost no energy loss. Researchers in Italy hope that harnessing such ‘superlubricity’ —a counterintuitive phenomenon of almost frictionless sliding—could bring enormous savings by reducing friction between the moving parts of machines.

*Tags: Materials science, S&T Italy*

### [Visualising nanoscale changes in the electronic properties of graphene](#) Nanowerk, 04JUN2015

An international team of researchers (UK, Poland) showed that the insertion of hydrogen molecules between epitaxial graphene and SiC promotes a dramatic change in the electronic properties of the material, leading to the change of the carrier type and significant increase in carrier mobility. [TECHNICAL ARTICLE](#)

*Tags: Materials science*

## FEATURED RESOURCE

### [Perimeter Institute](#)

Perimeter Institute trains the next generation of physicists through innovative programs and educational outreach in foundational theoretical physics. [PIRSA](#) (Perimeter Institute Recorded Seminar Archive) is a permanent, free, searchable, and citable archive of recorded seminars from relevant bodies in physics. [RSS](#)

### [High-temperature superconductivity in atomically thin films](#)

PhysOrg.com, 02JUN2015

Researchers in Japan have succeeded in fabricating an atomically thin, high-temperature superconductor film with a superconducting transition temperature of up to 60 K (-213°C). They also established the method to control/tune the  $T_c$ . This finding not only provides an ideal platform for investigating the mechanism of superconductivity in the two-dimensional system, but also paves the way for the development of next-generation nano-scale superconducting devices. [TECHNICAL ARTICLE](#)

*Tags: Materials science, S&T Japan*

## MICROELECTRONICS

### [Liquid droplets create logic circuits](#) Physics World, 08JUN2015

Researchers at Stanford University have created circuits made by interacting droplets of magnetic fluid which move through a matrix of interconnected tracks while under the influence of an applied magnetic field. The research could provide a new platform for creating lab-on-a-chip technologies, as well as provide insights into the fundamental physics of collective behaviour. [TECHNICAL ARTICLE](#)

*Tags: Microelectronics*

### [Smart clocking for error-resilient straintronic multiferroic logic](#)

Nanotechweb, 08JUN2015

‘Nanomagnetic logic’ (NML), where nanomagnets replace transistors, perform a similar function to transistor switches, but could end up dissipating much less energy. A team of researchers in the US (University of Alabama, Virginia University, Virginia Commonwealth University) demonstrates how to increase the computational reliability of a particularly energy-efficient version of NML: straintronic multiferroic logic. Here, magnets are switched with electrically generated mechanical strain. [TECHNICAL ARTICLE](#)

*Tags: Microelectronics*

## PHOTONICS

### [New heterogeneous wavelength tunable laser diode for high-frequency efficiency](#)

PhysOrg.com, 02JUN2015

Through a combination of silicon photonics and quantum-dot (QD) technology, researchers in Japan have developed an ultra-compact heterogeneous wavelength tunable laser diode and demonstrated a wide-range tuning-operation. QD has large optical gains of around 1000 -1300 nm wavelength, and silicon photonics provide a promising platform for highly integrated photonics devices.

*Tags: Photonics, S&T Japan*

## S&T POLICY

### [Web Science Institute: The era of ‘big data analytics’](#)

EurekAlert, 04JUN2015

The WSI brings together world-leading multidisciplinary expertise from across the University to tackle the most pressing global challenges facing the World Wide Web and wider society today. It focuses on the analytical power of researchers from disciplines as diverse as sociology and computer science, economics and psychology, law and humanities to understand and explain the Web.

*Tags: S&T policy, Big Data*

## SCIENCE WITHOUT BORDERS

**[Air Force scientists are working on hypersonic air vehicle](#)****[PhysOrg.com](#), 07JUN2015**

The US Air Force is developing a hypersonic weapon based on an experimental scramjet program. Supersonic combustor ramjet, has very few moving parts and relies on an air-breathing propulsion system to travel faster than the speed of sound. Researchers predict scramjet speeds could reach 15 times the speed of sound. The Air Force and DARPA plan to have a new and improved hypersonic air vehicle by 2023.

*Tags: Science without borders, Military technology*

## SENSORS

**[Physicists develop ultrasensitive nanomechanical biosensor](#)****[Science Daily](#), 09JUN2015**

Researchers in Russia have developed an ultracompact highly sensitive nanomechanical sensor which is an optomechanical chip. It consists of two parts: a photonic nanowave guide to control the optical signal, and a cantilever hanging over the waveguide. Unlike similar devices, the new sensor has no complex junctions and can be produced through a standard CMOS process technology used in microelectronics. [TECHNICAL ARTICLE](#)

*Tags: Sensors, S&T Russia*

**[Ultrasensitive magnetoplasmonic sensors with nano-antennas](#)****[Nanowerk](#), 09JUN2015**

An international team of researchers (Spain, Finland, Sweden) has discovered a new way of optical sensing, using the magneto-optical Kerr and Faraday effects in ferromagnetic nanoantennas. They show how designed phase compensation in the electromagnetic response of magnetoplasmonic nanostructures enables them to act as ultrasensitive label-free molecular-level sensors with high figures of merit, viz. great sensing performances with extraordinary signal to noise ratio. [TECHNICAL ARTICLE](#)

*Tags: Sensors*

**[IAI Unveils a UHF Radar that Tracks Stealth Aircraft from Hundreds of Kilometers Away](#)****[Defense Update](#), 07JUN2015**

Israel Aerospace Industries is unveiling an advanced, UHF, Active Electronically Scanned Array (AESA) Radar at the Paris Air Show. It is designed to search, detect and track 'air breathing targets,' including low-observable (stealth) aircraft, missiles, UAVs and ballistic missile targets at very long range, providing operating early warning. [Paris Air Show \(June 19 -21\)](#)

*Tags: Sensors, Emerging technology, Military technology* ■

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