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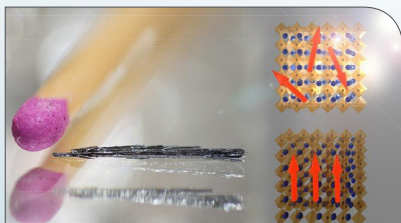
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FEATURE ARTICLES

[New perovskite could lead the next generation of data storage](#)

Science Daily, 24NOV2016



Single crystals of the perovskite developed in this study; on the right a diagram showing the melting of the ferromagnetic state. Credit: © M. Spina, E. Horváth/EPFL

An international team of researchers (Switzerland, France) synthesized a ferromagnetic photovoltaic material which combines the advantages of both ferromagnets and photoconductors. In

the new perovskite material, a simple red LED—much weaker than a laser pointer—is enough to disrupt the material's magnetic order and generate a high density of travelling electrons, which can be freely and continuously tuned by changing the light's intensity. This study provides the basis for the development of a new generation of magneto-optical data storage devices combining the advantages of magnetic storage—long-term stability, high data density, non-volatile operation and re-writability—with the speed of optical writing and reading.

[OPEN ACCESS TECHNICAL ARTICLE](#)

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

[Research Fronts 2016: The Hottest Areas in Science](#)

Thomson Reuters, 24NOV2001

For the fourth consecutive year, in cooperation with the Chinese Academy of Sciences, Clarivate Analytics is releasing a new annual roundup, [OPEN ACCESS Research Fronts 2016](#), compiling 100 of the hottest specialty areas in the sciences and social sciences, as well as 80 emerging fields in which knowledge is accumulating at a particularly rapid clip. The report includes expanded discussion of selected areas, along with specifics on the institutions and countries. Related report [Physics World special report: China](#)

Tags: [Science without borders](#), [Featured Article](#)

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Metamaterial built from gears](#)

Physorg.com, 22NOV2016

Using a new kind of metamaterial, which is rigid on one end and soft on the other, researchers in the Netherlands have mathematically devised a complex assembly of gears that sticks in one place, but operates in another. Researchers can decide which parts are soft or rigid, and the mechanism keeps working even if the gears are imperfect. Because the rigidity properties are inherent to the system, manufacturers can use the principle to build mechanical devices like watches using cheaper components, while preserving performance. According to the researchers, this may be best applicable to tracking devices, like satellite trackers that are based on geared mechanisms. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#)

[Supersonic spray yields new nanomaterial for bendable, wearable electronics](#)

Physorg.com, 22NOV2016

A team of international researchers (South Korea, USA - University of Illinois, University at Buffalo, India) sprayed silver nanowire suspensions at supersonic speed to produce self-sintered films on flexible substrates. These films displayed remarkably low sheet resistance, high transmittance and electrical conductivity. Transparent and flexible coatings can be deposited over a 100 cm² area in ≈30 s. Theoretical analysis reveals the underlying physical mechanism behind self-sintering, showing that self-sintering is enabled by the high velocity of impact in supersonic spraying. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#)

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AUTONOMOUS SYSTEMS & ROBOTICS

[Google's AI can translate language pairs it has never seen](#)

Engadget, 24NOV2016

After training the system with several language pairs like English-to-Japanese and English-to-Korean, Google's translate feature could generate reasonable Korean to Japanese translations, even though it was not taught to do so. The system developed its own "interlingua", internal representation for similar phrases or sentences. According to the researchers, the network must be encoding something about the semantics of the sentence rather than simply memorizing phrase-to-phrase translations. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Autonomous systems & robotics, Artificial intelligence

BIG DATA

[Global brain initiatives generate tsunami of neuroscience data](#)

Medical Express, 22NOV2016

Since the launch of Brain Research, a team of researchers, led by Lawrence Berkeley National Laboratory, is developing a plan for managing, analyzing and sharing neuroscience data generated by technology firms, academic institutions and scientists through the Advancing Innovative Neurotechnologies (BRAIN) Initiative. Their recommendations include standard descriptions and file formats, working with computer scientists to develop hardware and software ecosystems for archiving and sharing data. A local repository of physiological or simulation data collected or generated by groups is eventually included in "meta-repositories" are accessible to the greater neuroscience community and hosted by an open-science supercomputing facility.

Tags: Big data, Neuroscience

BIOTECHNOLOGY

[Biologist discusses a synthetic metabolic pathway that fixes carbon dioxide and synthetic biology](#)

Physorg.com, 25NOV2016

Researchers in Germany developed a synthetic metabolic pathway that converts CO₂ from the atmosphere into organic matter more efficiently than plants can through photosynthesis. One of the researchers discusses the significance this process could have for climate protection, the hurdles the research team had to overcome to achieve their goal, and looks at the new perspectives that synthetic biology opens up. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, S&T Germany, Synthetic biology

[Living cells bind silicon and carbon for the first time](#)

Nature News, 24NOV2016

Researchers at Caltech showed that a natural enzyme from a bacterium that lives in hot springs can form C-Si bonds inside living Escherichia coli cells—when the cells are fed the right silicon-containing compounds. By engineering the enzyme, the researchers created a biological catalyst that performs the reaction more efficiently than any artificial one. They introduced mutations into the active region of the enzyme and selected the bacteria that showed an improvement. A few generations were sufficient to enhance the yields. The research opens entirely new opportunities in pharmaceutical research and may lead to the discovery of new drugs. [TECHNICAL ARTICLE](#)

Tags: Biotechnology

COUNTER WMD

[Highlights from CBRNe World Convergence](#)

Global Biodefense, 21NOV2016

CBRNe World Convergence took place in San Diego earlier this month. Presentations from experts from across the world covered the full spectrum of CBRNe-related topics, from forensics to EOD, and food defense through to the situation in Syria. Several new products were launched live at the show, including a new casualty isolation unit, a new handheld networked radiation detector, and a mobile gas chromatograph mass spectrometer for chemical threat identification. CBRNe Convergence Europe is scheduled to take place in London in 2017.

Tags: Counter WMD

CYBER SECURITY

[Innovative technique to curtail illegal copying of digital media](#)

Physorg.com, 22NOV2016

The watermarking system, developed by researchers in China, is based on single-shot ptychography encoding (SPE) that uses multiple partially-overlapping beams of light to generate a diffraction pattern from a complex object. Unlike other methods, SPE can encode the optical watermark in a single exposure with no mechanical scanning. SPE is less prone to error than other methods and uses a simpler optical setup. Prior to embedding the watermark into a host image, they used computer processing to remove repeated data and scramble the diffraction pattern to improve security. The spot size can be reduced to smaller than 10 microns, which helps prevent degradation of the host image. Once a watermark is embedded into digital media, there are multiple ways to detect it to check for authenticity. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Cyber security, S&T China

“Science can give mankind a better standard of living, better health and a better mental life, if mankind in turn gives science the sympathy and support so essential to its progress.”

VANNEVAR BUSH

ENERGY

[New Smart Phone Battery Charges in Seconds](#)

[R&D Magazine, 22NOV2016](#)

An international team of researchers (USA - University of Central Florida, South Korea) has developed supercapacitors composed of millions of nanometer-thick wires coated with shells of two-dimensional materials. Having a highly conductive core facilitates fast electron transfer for fast charging and discharging and uniformly coated shells of two-dimensional materials yield high energy and power densities. It can be recharged more than 30,000 times without degrading. The capacitor could be used in phones and other electronic devices, electric vehicles and wearable technology because of its flexibility. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery

FORECASTING

[Hacking epidemics in a hyper-connected world](#)

[Physorg.com, 29NOV2016](#)

Traditional simulations use a “discrete time/continuous activity” approach, which typically requires extensive and lengthy simulations. An international team of researchers (Italy, USA - New York University) has developed a model that accounts for heterogeneities and variations in activities among people. Their approach permits nuanced modeling of different illnesses—from a highly contagious airborne virus such as influenza to a virus like HIV, which has a long latency period and slower transmission rate. They claim that their models have infinite possibilities to see the impact of interventions. [TECHNICAL ARTICLE](#)

Tags: Forecasting, Medical sciences

[The Simple Economics of Machine Intelligence](#)

[Harvard Business Review, 17NOV2016](#)

As the cost of prediction falls, not only will activities that were historically prediction-oriented become cheaper, we will use prediction to tackle other problems for which prediction was not historically an input. As machine intelligence improves, the value of human prediction skills will decrease because machine prediction will provide a cheaper and better substitute for human prediction. However, this does not spell doom for human jobs, as many experts suggest. That’s because the value of human judgment skills will increase. Using the language of economics, judgment is a complement to prediction and therefore when the cost of prediction falls demand for judgment rises. We’ll want more human judgment.

Tags: Forecasting, Artificial intelligence

FOREIGN S&T

[China successfully fires radical 300+ mile range hypersonic missile that would put key parts of US air operations at risk](#)

[Next Big Future, 25NOV2016](#)

The missile is about 28 percent of the length of the J-16, which measures 22 meters (about 72 feet), about 19 feet long and roughly 13 inches in diameter. The missile appears to have four tailfins. Reports are that the size would put it into the category of a very long range air to air missile (VLRAAM) with ranges exceeding 300 km (roughly 186 miles), likely max out between 250 and 310 miles. This missile would easily outrange any American (or other NATO) air-to-air missile. The rocket engine will push it to Mach 6 speeds, which will increase the no escape zone (NEZ) against even supersonic targets like stealth fighters.

Tags: Foreign S&T, Military technology, S&T China

[European Commission Announces Funding for Third Flagship on Quantum Technologies](#)

[Networked Quantum Technologies, 22NOV2016](#)

The European Commission presented its European Cloud Initiative for a digital single market, with cloud-based services and world-class data infrastructure, including €1 billion for a large-scale EU-wide quantum technologies flagship. A set of measures will support and link up national initiatives for the digitisation of industry and related services across all sectors and boost investment through strategic partnerships and networks.

Tags: Foreign S&T, S&T EU, S&T Policy

[Germany’s Nanotechnology 2020 Action Plan Nanowerk, 22NOV2016](#)

[OPEN ACCESS](#) The Action Plan Nanotechnology 2020 is geared towards the priorities of the Federal Government’s new High-Tech Strategy, which has as its objective the solution of societal challenges by promoting research. It lays out the strategic goals of the Federal Government and describes the status of nanotechnology in Germany with a list of major players. The report also contains an overview of funding programs with a list of specialist federal government programs, funding structures, research organizations and departmental research institutes. Motivating start-ups and research facilities, even at an early stage of innovation is a key focus.

Tags: Foreign S&T, S&T Germany, S&T Policy

MATERIALS SCIENCE

[New clues emerge in 30-year-old superconductor mystery](#)

Science Daily, 21NOV2016

To study electron ordering in the pseudogap, an international team of researchers (USA - Caltech, Wellesley College, Johns Hopkins University, Canada) used a new laser-based method called nonlinear optical rotational anisotropy in which a laser is pointed at crystals of yttrium barium copper oxide. As soon as the system entered the pseudogap region, either as a function of temperature or the amount of oxygen in the compound, there was a loss of inversion and rotational symmetries, clearly indicating a transition into a new phase of matter. They are looking into the role this ordering of electrons in the pseudogap plays in inducing high-temperature superconductivity—and how to make it happen at even higher temperatures. [TECHNICAL ARTICLE](#)

Tags: Materials science

FEATURED RESOURCE

[Digital Trends](#)

Digital Trends helps their audience make informed decisions that allows them to maximize the potential of technology and help integrate it into to everyday life. [RSS](#)

MICROELECTRONICS

[Engineers create prototype chip just three atoms thick](#)

Nanowerk, 29NOV2016

Researchers at Stanford University have demonstrated that monolayer MoS₂ grown by chemical vapor deposition has transport properties comparable to those of the best exfoliated devices over a wide range of carrier densities and temperatures. They have the highest current density reported to date. Research results are an important step towards large-area electronics based on monolayer semiconductors. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Microelectronics, Advanced materials

[Programmable plasmons by strain engineering](#)

Nanowerk, 29NOV2016

Although narrow optical resonances and tailoring of the plasmonic resonance have been achieved independently, they have not yet been demonstrated within a single system. Researchers at Northwestern University used hexagonal aluminum nanoparticle arrays to both realize narrow resonances and tune the resonance across

the visible range. They found a new type of quadrupolar lattice mode with much narrower linewidth than the classic dipolar lattice mode. The research could find applications in achieving real-time tunable substrates for plasmon-enhanced molecular sensing and plasmonic nanolasers and open a diverse range of possibilities by integrating with flexible electronics. [TECHNICAL ARTICLE](#)

Tags: Microelectronics

[Spray-printed crystals to move forward organic electronic applications](#)

Nanowerk, 22NOV2016

An international team of researchers (UK, Spain) has demonstrated a low-cost, scalable spray-printing process to fabricate high-quality isolated organic single crystals by combining the advantages of antisolvent crystallization and solution shearing. The crystals' size, shape and orientation are controlled by the spray angle and distance to the substrate, which govern the spray droplets' impact onto the antisolvent's surface. The research has a direct impact on printed electronic applications for flexible circuits, advanced photodetector arrays, chemical and biological sensors, robotic skin tensile sensors, x-ray medical detectors, light emitting transistors and diodes, and miniature lasers. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Microelectronics, Advanced materials

NEUROSCIENCE

[Our brains have a basic algorithm that enables our intelligence](#)

Science Daily, 21NOV2016

Intelligence is about dealing with uncertainty and infinite possibilities. An international team of researchers (USA -Augusta University, China) proposes that a relatively simple mathematical logic underlies our complex brain computations. At the heart of their Theory of Connectivity is the algorithm which defines how many cliques are needed for functional connectivity motifs to handle the uncertainties and infinite possibilities. According to the researchers, this simple mathematical logic can account for brain computation across the entire evolutionary spectrum, ranging from the simplest neural networks to the most complex. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Neuroscience

PHOTONICS

[Scientists develop new optical circuit components to manipulate light](#)

Physorg.com, 28NOV2016

Researchers in South Korea constructed an optical transistor by interconnecting the silver nanowire to a flake of MoS₂. Light shone on the device is converted to surface plasmon. Wavelength multiplexing devices were realized in a similar way using an array of three different 2D semiconductor

continued...

materials emitting light at different wavelengths. The propagating optical signals along the silver nanowire can be transformed and detected as electrical signals by an optical signal detector. They demonstrated that it is possible to complete the circle going from plasmons to excitons and back to plasmons. Using this concept, they created optical transistors and multiplexors. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Photonics

[New optical device absorbs just one photon](#) [Physics World, 25NOV2016](#)

At the heart of the device developed by researchers in Germany is a micron-sized diffuse cloud of rubidium atoms cooled to near-absolute-zero temperature. One rubidium atom in the cloud absorbs a single photon to become the first Rydberg atom and overlaps with all the other atoms in the cloud, changing their electronic structures. Because no other atoms can absorb photons, the cloud becomes transparent. Applications of the device could be to absorb single photons from a quantum network and precise photon counters which could be made by putting several of the devices in series. [TECHNICAL ARTICLE](#)

Tags: Photonics, S&T Germany

[Capturing an elusive spectrum of light](#) [Physorg.com, 24NOV2016](#)

A way to harness the potential of the mid-infrared spectral window is to use optical cavities, which are micro-devices that confine light for extended amounts of time. An international team of researchers (Switzerland, Russia) used alkaline earth metal fluoride crystals to make ultra-high quality microcavities. They developed uncoated chalcogenide tapered fibers to efficiently couple mid-infrared light from a continuous wave Quantum Cascade Laser into their crystalline microcavities and demonstrated ultra-high quality resonators deep in the mid-infrared spectral range. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Photonics, Sensors

QUANTUM SCIENCE

[Quantum particles form droplets](#) [Science Daily, 24NOV2016](#)

An international team of researchers (Austria, Germany) produced a Bose-Einstein condensate of erbium atoms at extremely low temperatures and controlled the particle interaction by using an external magnetic field. They realized a controlled crossover from a Bose-Einstein condensate, which behaves like a superfluid gas, into a single giant liquid-like quantum droplet of 20,000 atoms. Alongside helium, a quantum droplet is the only liquid-type superfluid system known. In the long term, this phase of matter could lead to new insights relevant

for studies of supersolidity, which is superfluid condensed matter. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Quantum science

[Technical Roadmap for Quantum Computing Networked Quantum Technologies, 24NOV2016](#)

The report was written by researchers in the UK working under the UK National Quantum Technologies Program. It provides an overview of the subject, and review of leading technologies needed to build a fully functional quantum computer, estimate resources needed to solve real world problems and addresses the most common concerns. It provides possible applications in fields such as physics and chemistry simulations, encryption, and optimisation.

Tags: Quantum science, S&T Policy, S&T UK

S&T POLICY

[Climate model predictions are telling a consistent story](#)

[Science Daily, 23NOV2016](#)

An international team of researchers shows that with a 1 °C global temperature increase, global wheat yield is projected to decline between 4.1% and 6.4%. Projected relative temperature impacts from different methods were similar for major wheat-producing countries China, India, USA and France, but less so for Russia. Point-based and grid-based simulations, and to some extent the statistical regressions, were consistent in projecting that warmer regions are likely to suffer more yield loss with increasing temperature than cooler regions. By combining several models, they were able to improve the confidence of the estimates in relation to climate change impact on global food security.

Tags: S&T policy, Climatology

SCIENCE WITHOUT BORDERS

[Theory that challenges Einstein's physics could soon be put to the test](#)

[Physorg.com, 25NOV2016](#)

Some researchers have suggested that the speed of light could have been much higher in this early universe. An international team of researchers (Canada, UK) has made a prediction that this could be used to test the validity of Einstein's theory, that the speed of light is constant, and always has been, which underpins many theories in physics, such as Einstein's theory of general relativity. While this means the speed of light and the other laws of physics as we know them are preserved, it requires the invention of an 'inflation field'—a set of conditions that only existed at the time. [TECHNICAL ARTICLE](#)

Tags: Science without borders

[Rallies, protests, and Black Friday: Physics](#)

finds dangers hiding in plain sight

Physorg.com, 22NOV2016

The computational tools, developed by an international team of researchers (Sweden, USA - Harvard University) to predict large-scale collective motion in simulated mass gatherings, takes an approach developed for jammed granular media and identifies Goldstone modes, soft spots, and stochastic resonance as structurally driven mechanisms for potentially dangerous emergent collective motion. Physical body-to-body contacts are the foundation for potentially dangerous collective motion. Their work shows how to identify the emergent risks based on which persons are touching each other.

TECHNICAL ARTICLE*Tags: Science without borders***SENSORS****Graphene enables fully flexible near-field communication antennas**

Nanowerk, 29NOV2016

By combining material characterization and computer modelling, researchers in Italy working on the EU Graphene Flagship have designed a flexible antenna that could exchange information with near-field communication devices such as a mobile phone, matching the performance of conventional metallic antennas. The antennas are chemically inert, highly resistant to thousands of bending cycles and can be deposited on different standard polymeric substrates or silk tissues. According to the researchers, this technology could be developed further within the field of flexible electronics and communication technology.

*Tags: Sensors, Communications technology, Flexible electronics, S&T Italy***Mood ring materials - a new way to detect damage in failing infrastructure (w/video)**

Nanowerk, 22NOV2016

To monitor structures, researchers at Vanderbilt University propose incorporating fluorescent nanoparticles into the material that react to stress by changing their optical properties. They embedded cadmium selenide quantum dots in optically clear epoxy composite matrix and monitored changes in the emission spectra for the material before, during and after the application of external loads. The strength of the quantum dot emissions gave them a permanent record of the level of stress that a material has experienced. **TECHNICAL ARTICLE**

*Tags: Sensors, Advanced materials***Neural Network Learns to Identify Criminals by Their Faces**

MIT Technology Review, 22NOV2016

The effort aimed at identifying criminals from their mugshots raises serious ethical issues about how we should use artificial intelligence. Researchers in China used a variety of machine-vision algorithms to test if the algorithms could tell the difference between criminals and non-criminals. They took ID photos of 1856 Chinese men between the ages of 18 and 55 with no facial hair. Half of these men were criminals. They used 90 percent of the images to train a convolutional neural network to recognize the difference and then tested the neural net on the remaining 10 percent of the images. According to the researchers the neural network could correctly identify criminals and noncriminals with an accuracy of 89.5 percent. **OPEN ACCESS TECHNICAL ARTICLE**

*Tags: Sensors, Artificial intelligence, S&T China ■***ABOUT THIS PUBLICATION**

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