



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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

[Autonomous systems & robotics \(3\)](#)

[Biotechnology \(2\)](#)

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

[Energy \(1\)](#)

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

[Forecasting \(2\)](#)

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

[Microelectronics \(3\)](#)

[Photonics \(1\)](#)

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

[S&T policy \(1\)](#)

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

[Sensors \(3\)](#)

FEATURE ARTICLES

[Making computers reason and learn by analogy](#)

Science Daily, 21JUN2016



Using cognitive science theories, researchers at Northwestern University have developed a structure-mapping engine (SME) model that could give computers the ability to reason more like humans, even make moral decisions, solve analogical problems, including capturing the way humans spontaneously use analogies between situations to solve moral

dilemmas. SME-based systems often learn successfully from far fewer examples than deep-learning systems. The team is releasing the SME source code and a 5,000-example corpus, which includes comparisons drawn from visual problem solving, textbook problem solving, and moral decision making. [TECHNICAL ARTICLE](#)

Tags: [Autonomous systems & robotics](#), [Artificial intelligence](#), [Featured Article](#)

[Scientists engineer tunable DNA for electronics applications](#)

Science Daily, 20JUN2016

A team of researchers in the US (Duke University, Arizona State University) has been able to understand and manipulate DNA to more finely tune the flow of electricity through it. The research may provide a framework for engineering more stable and efficient DNA nanowires, and for understanding how DNA conductivity might be used to identify gene damage. [TECHNICAL ARTICLE](#)

Tags: [Biotechnology](#), [Featured Article](#)

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Black phosphorus absorbs light in the infrared](#)

Nanotechweb, 20JUN2016

Researchers in Ireland have succeeded in making few-layer black phosphorus (a 2D semiconductor with a direct bandgap that stretches across the near to the mid-infrared) using a simple and scalable liquid-phase exfoliation technique. BP has direct and small bandgap, as well as fast photoresponse. It could thus bridge the gap between graphene and the transition metal dichalcogenides. [TECHNICAL ARTICLE](#)

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

[Garnet nanofibres improve lithium batteries](#)

Nanotechweb, 17JUN2016

Researchers at the University of Maryland made the first flexible, solid-state membrane based on a 3D lithium-ion conducting ceramic nanofibre network. It has superior thermal and electrochemical stability to high voltage (greater than 6V). Its high mechanical stability allows it to block the formation of unwanted Li dendrites. The membrane could replace conventional flammable organic liquid electrolyte systems in lithium-ion batteries. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Battery](#)

[Growing graphene ribbons in one direction](#)

Nanowerk, 17JUN2016

An international team of researchers (USA - University of Wisconsin-Madison, Argonne National Laboratory, Northwestern University, Canada) has discovered how to synthesize narrow, long, semiconducting graphene nanoribbons directly on a semiconductor wafer. The extraordinarily slow growth of the two-dimensional graphene results in unidirectional growth of narrow graphene ribbons with well-defined edges—resulting in the desired transformation of the graphene from a semimetal to a semiconductor. The research may enable the integration of nanoribbons into everyday electronics

continued...

[BACK TO TOP](#)

such as transistors and future, hybrid integrated circuits.

TECHNICAL ARTICLE

Tags: Advanced materials

Laser manipulates electronic properties

Nanowerk, 17JUN2016

An internal team of researchers (USA - MIT, Harvard University, Taiwan) show the first direct evidence of lifted valley degeneracy in the monolayer transition metal dichalcogenide tungsten disulfide. By applying intense circularly polarized light, they demonstrated that the exciton level in each valley can be selectively tuned by as much as 18 meV through the optical Stark effect. The valley depth can be manipulated with light to encode information like zeroes and ones for conventional data.

TECHNICAL ARTICLE

Tags: Advanced materials

New approach to building efficient thermoelectric nanomaterials

Science Daily, 16JUN2016

By doping bismuth telluride selenide with hundreds of parts per million of sulfur, an international team of researchers (USA - Rensselaer Polytechnic Institute, University of Missouri, Germany, Switzerland) was able to increase both electrical conductivity and the Seebeck coefficient in nanocrystals as well as bulk materials made from the nanocrystals. The technique leads to large improvements in waste energy recapture.

ARTICLE

Tags: Advanced materials

New see-through material for electronics

Nanowerk, 16JUN2016

A team of international researchers (USA - Pacific Northwest National Laboratory, Binghamton University, Germany) made a new material by chemically substituting strontium for up to 25 percent of the lanthanum in lanthanum chromium oxide and grew strontium titanate film on it. The new material offers great promise for integration into and enhanced performance of electronics based only on perovskite oxides.

TECHNICAL ARTICLE

Tags: Advanced materials

Electromagnetic metamaterials with zero-refractive index for sub-wavelength photonics

PhysOrg.com, 15JUN2016

A hyperbolic metamaterial (HMM) behaves either like a metal or dielectric depending on the frequency of the incident light. An international team of researchers (USA - Purdue University, Japan) analytically demonstrated the transition between these two types of states induced by the non-local topological transition. They found that in response to incoming light at the critical state, an HMM exhibits peculiar optical properties such that its effective refractive index is zero and the refraction becomes conical.

The team will apply the finding to develop novel nanophotonic elements and photonic integrated circuits.

TECHNICAL ARTICLE

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

Video Friday: Marty the Robot, Dancing With Drones, and Deep Learning for Cars

IEEE Spectrum, 17JUN2016

The video demonstrates the Optimus Robot performing manipulation tasks using shared autonomy. A human operator performs the task planning with assisted perception and assisted motion planning. The robot has no previous knowledge about the tasks and objects have no fiducials. Only on-board sensing is used.

Tags: Autonomous systems & robotics

Story time: Researchers create 'human user manual' for robots

PhysOrg.com, 16JUN2016

Researchers at the Georgia Institute of Technology have created an artificial intelligence software program named Quixote to teach robots to read stories, learn acceptable behavior and understand successful ways to conduct themselves in diverse social situations. They plugged the data into Quixote to create a virtual agent. As the virtual agent completed a game, it earned points and positive reinforcement for emulating the actions of protagonists in the stories. In tests, Quixote displayed proper social interactions more than 90 percent of the time.

Tags: Autonomous systems & robotics, Artificial intelligence

BIOTECHNOLOGY

Versatile method yields synthetic biology building blocks, body

PhysOrg.com, 15JUN2016

An international team of researchers (Germany, France) has developed a high-throughput method based on microfluidics for creating stable vesicles of controlled size. The method is novel in that it works for both liposomes and polymersomes, without having to change the design of the microfluidic device or the combination of liquids.

TECHNICAL ARTICLE

Tags: Biotechnology, Biology, Synthetic biology

COMMUNICATIONS TECHNOLOGY

Twisted light beams sent 143 km across the sea

Physics World, 17JUN2016

An international team of researchers (Austria, Canada) sent laser beams encoded with orbital angular momentum a record-breaking 143 km between two islands in the Canaries. This distance is 50 times further than their previous record. The team says that the results show that it should be possible to encode data using the orbital

continued...

“The technologies which have had the most profound effects on human life are usually simple” FREEMAN DYSON

angular-momentum states of light for both classical and quantum communications, including the transmission of data to and from satellites. [TECHNICAL ARTICLE](#)

Tags: Communications technology

[Researchers break bandwidth record for data communication using laser-based visible light](#)

[PhysOrg.com, 15JUN2016](#)

Researchers in Saudi Arabia developed a new VLC color converter that has a bandwidth that is 40 times greater than that of commercial converters. They combined a conventional phosphor with perovskite nanocrystals and showed that the addition of perovskite nanocrystals to conventional phosphor decreases the photoluminescence lifetime to just 7 nanoseconds. As a result, the new color converter has a bandwidth of nearly 500 MHz and can transmit data at a high rate of 2 Gbits/second. [TECHNICAL ARTICLE](#)

Tags: Communications technology

[Air Force nearing completion of satellite communications system](#)

[Defense Systems, 14JUN2016](#)

The Advanced Extremely High Frequency (AEHF) satellite communications system, which will provide secure, high-data-rate, jam-resistant global communications for high-priority assets of the United States and some international partners, is ready for full operational capability. AEHF satellites, which replace the Milstar constellation, reduce costs, boost connectivity, each satellite provides greater capacity than the entire Milstar constellation, and they provide a five-fold increase in transmissions. The system also serves U.S. allies, including Canada, the Netherlands and the United Kingdom.

Tags: Communications technology, Government S&T, Military technology

ENERGY

[Researchers find new ways to make clean hydrogen and rechargeable zinc batteries](#)

[Nanowerk, 17JUN2016](#)

An international team of researchers (USA - Stanford University, SLAC, Japan, Singapore) deposited silicon nanocone arrays on a thin film of bismuth vanadate and placed both layers on a solar cell made of perovskite. When submerged in water, the three-layer tandem device immediately began splitting water at a solar-to-hydrogen conversion efficiency of 6.2 percent. In a second study, the team developed a new battery design with electrodes made of zinc and nickel. They solved the dendrite problem by simply redesigning the battery. [TECHNICAL ARTICLE 1, 2](#)

Tags: Energy, Battery

ENVIRONMENTAL SCIENCE

[‘Space tsunami’ causes the third Van Allen Belt](#)

[PhysOrg.com, 20JUN2016](#)

A new discovery, led by an international team of researchers (Canada, USA - NASA Goddard Spaceflight Center, University of Colorado at Boulder, University of New Hampshire, Los Alamos National Laboratory, industry partner, UK, Greece), shows for the first time how the puzzling third Van Allen radiation belt is created by a “space tsunami.” Intense ULF plasma waves, which are excited on the scale of the whole magnetosphere, transport the outer part of the belt radiation harmlessly into interplanetary space and create the previously unexplained feature of the third belt. [TECHNICAL ARTICLE](#)

Tags: Environmental science, Satellite technology, Space technology

[MIT Lincoln Laboratory is leading a team to develop a constellation of mini weather satellites](#)

[MIT Lincoln Laboratory, 13JUN2016](#)

MIT Lincoln Laboratory and partners from academia and the U.S. government have been selected to develop and launch a constellation of 12 CubeSats. When the mission is fully implemented, the CubeSats equipped with microwave radiometers will be placed in three low-Earth orbital planes to measure temperature and water vapor profiles, precipitation intensity, and cloud properties of tropical cyclones. The use of this constellation of sensors will enable the collection of data as often as every 21 minutes.

Tags: Environmental science, Climatology, Satellite technology

FORECASTING

[Analyzing how ISIS recruits through social media](#)

[Science Daily, 16JUN2016](#)

A team of researchers in the US (University of Miami, Harvard University) applied a generalized a mathematical equation commonly used in physics and chemistry to the development and growth of ad hoc pro-ISIS groups and witnessed the daily interactions that drove online support for these groups, or “aggregates,” and how they coalesced and proliferated prior to the onset of real-world campaigns. According to the researchers, by concentrating on relatively few groups of serious followers, cyber police and other anti-terrorist watchdogs could monitor their buildup and transitions and thwart the potential onset of a burst of violence. [TECHNICAL ARTICLE](#)

Tags: Forecasting

continued...

[McKinsey had four global growth scenarios out to 2025](#)

McKinsey Global Institute, 16JUN2016

McKinsey believes three sets of forces will shape the global economy over the coming decade. The first two are stimulus policies and shifting energy markets. The next two forces, urbanization and aging, are powerful, inexorable trends aggravating ongoing structural challenges. Finally, two forces are of uncertain and variable magnitude: technological innovation and global connectivity. All of these trends could intermittently disrupt and transform sectors. [McKinsey article](#)

Tags: *Forecasting, Disruptive technology*

FEATURED RESOURCE

[Nature Index](#)

The Nature Index tracks the affiliations of high quality scientific articles published in 68 science journals. The Index presents research outputs of approximately 9,000 parent institutions worldwide. It is a global indicator of high-quality research. Access is free. Register to create your own profile, and create your own indexes.

MATERIALS SCIENCE

[Change an atom, change a material](#)

Nanowerk, 19JUN2016

A team of researchers in the US (UC Berkeley, University of Tennessee, Lawrence Livermore National Laboratory, Argonne National Laboratory) combined two materials: lanthanum, strontium, manganese, and oxygen (LSMO) which is ferromagnetic and strontium, iridium, and oxygen (SIO) which is paramagnetic. They grew it in a special sequence which resulted in a LSMO crystal with intercalated SIO layers. This confinement allowed for manipulation of magnetism, owing to a novel spin-orbit coupling state that developed in the SIO layers. An all oxide platform allows integrating these materials for multifunctional devices. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

[Graphene-based thermal modulators](#)

Science Daily, 16JUN2016

Researchers in Singapore showed that clamping graphene between two other graphene sheets will, with only moderate pressure, reduce thermal conductivity by a third. Adding more clamps and varying the pressure allows the heat flow to be tuned, creating a 'thermal modulator'. Heat is diverted toward components that can dissipate it or even turn it into electricity. The effect relies on graphene's two-dimensional nature and will not work in bulk materials. Clamping does not change the crystal

structure and is fully reversible. [TECHNICAL ARTICLE](#)

Tags: *Materials science, Advanced materials*

[Tiny droplets... lead to exotic properties](#)

Science Daily, 16JUN2016

A team of researchers in the US (University of Chicago, University of Wisconsin, Argonne National Laboratory) found that confinement of defect structures within droplets enables a much finer degree of control over its color, morphology, and stability than previously thought possible. The extraordinary sensitivity points to new strategies for three-dimensional assembly of responsive, adaptable materials, and controls optical properties for sensing or tunable photonic crystals. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

MICROELECTRONICS

[Parallel programming made easy](#)

MIT News, 20JUN2016

Researchers at MIT have developed a new chip design called Swarm, which should make parallel programs more efficient and easier to write. They compared Swarm versions of six common algorithms with the best existing parallel versions. The Swarm versions were between three and 18 times as fast, but they generally required only one-tenth as much code—or even less. Swarm's extra circuitry time-stamps tasks according to their priorities and begins working on the highest-priority tasks in parallel. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Information technology*

[Circuit technology that resolves issues with high-frequency piezoelectric resonators](#)

Science Daily, 17JUN2016

Using a silicon CMOS process, researchers in Japan fabricated a prototype resonator with a minimum line width of 65 nm, and a maximum frequency output of approximately 9 GHz with a phase fluctuation of only 180 femtoseconds. Power consumption was 12.7 mW. This performance is equivalent to a phase locked loop's Figure of Merit of -244 dB, and it has the world's top-class performance as a fractional-N PLL. This can contribute to the realization of compact, low-cost, high-speed radio communication systems.

Tags: *Microelectronics, S&T Japan*

[World's first 1,000-processor chip](#)

Science Daily, 17JUN2016

Researchers at UC Davis have designed a microchip containing 1,000 independent programmable processors. The energy-efficient 'KiloCore' chip has a maximum computation rate of 1.78 trillion instructions per second and contains 621 million transistors. Applications already developed for the chip include wireless coding/decoding, video processing, encryption, scientific data applications and datacenter record processing.

Tags: *Microelectronics*

continued...

PHOTONICS

World's most efficient nanowire lasers

Science Daily, 16JUN2016

A team of researchers in the US (Columbia University, University of Wisconsin) demonstrated that methyl ammonium lead halide perovskites ($\text{CH}_3\text{NH}_3\text{PbX}_3$) have exceptional solar cell performance, the lowest lasing thresholds, near 100% quantum yield, and broad tunability of emissions covering the near infrared to visible wavelength region. These nanowires could advance applications in nanophotonics, optoelectronic devices, fiber optic communications and advance pollution characterization from space. **TECHNICAL ARTICLE**

Tags: Photonics

QUANTUM SCIENCE

Physicists deploy magnetic vortex to control electron spin

Science Daily, 15JUN2016

Researchers at Case Western Reserve University fabricated magnetic micro-disks that have no north and south poles but magnetize into a vortex. A magnetic field emanates from the vortex core perpendicular to the disk. The vortices are coupled with diamond nanoparticles in which several individual spins are trapped inside nitrogen vacancies. They use a pulse from a laser to initialize the spin. By applying microwaves and a weak magnetic field, they can move the vortex in nanoseconds, shifting the central point, which can cause an electron to change its spin. The technology offers a possible alternative strategy for building quantum computers that are far faster and more powerful. **TECHNICAL ARTICLE**

Tags: Quantum science

Scaling up quantum technologies: The rare case when 1+1 is just 2

Science Daily, 16JUN2016

Researchers in Japan found that by using two additional traps to the right of the trap containing the particle and moving the farthest right trap closer to the middle trap, then the farthest left trap also closer to the middle trap, a single particle can be fully transferred to the rightmost trap with very high reliability. They also found that for a large range of interactions both particles were simultaneously transported to another trap. **TECHNICAL ARTICLE**

Tags: Quantum science, S&T Japan

S&T POLICY

New Baylor research identifies keys to managing innovators

EurekaAlert, 20JUN2016

A study by researchers at Baylor University suggests that leaders who understand how to manage their employees' commitment to both their organizations and professions may be most successful at motivating and retaining innovators. Suggestions from the study include: Making sure the innovators know that their personal goals align with organizational goals; Emphasizing small wins and victories, and simulating organizational success in other ways; Protecting innovators from bureaucracy. When bureaucracy cannot be minimized, managers might compensate by providing administrative support and protection from bureaucratic processes.

Tags: S&T policy

SCIENCE WITHOUT BORDERS

Nature distilled

Nature News, 15JUN2016

To help scientists keep better track of the rest of science other than their own field, Nature revisited 15 recently published Nature papers and asked the authors to produce two-page summaries of each. The summaries remain technical but they try to communicate both the research advance and why it matters. The first three summaries are published online this week. The rest will be released in the coming weeks. Pick a topic that you expect to struggle with—and then fill in the online survey to let them know what you think.

Tags: Science without borders

SENSORS

Diamond-based resonators might become highly sensitive detectors

Nanowerk, 21JUN2016

Researchers in Russia have mathematically modelled diamond-based microstructures for producing compact high sensitivity sensors. They proposed a mathematical model and experimentally studied acoustic waves in the piezoelectric layered structure, described their dispersion and proposed a number of ways of decreasing the effects of spurious peaks. In the future, diamond crystal based structures may be used as high sensitivity sensors to detect pressure, acceleration, temperature, and the thickness of ultrathin films. **TECHNICAL ARTICLE**

Tags: Sensors, S&T Russia

Directional Infra-Red Counter Measure tricks missile targeting

Next Big Future, 18JUN2016

SPREOS (Self Protection Radar Electro-Optic System), one of the exhibits at Eurosatory 2016, combines a radar based sensor (verification) and an active laser (DIRCM), and provides enhanced protection against the immediate threat of Man-portable air defense systems (MANPADS).

Tags: Sensors, Military technology, S&T EU

A new form of hybrid photodetectors with quantum dots and graphene

Nanowerk, 17JUN2016

Researchers in Spain have developed a hybrid photodetector capable of attaining concomitantly better performance features in terms of speed, quantum efficiency and linear dynamic range, operating not only in the visible but also in the near infrared (700-1400nm) and SWIR range (1400-3000nm). This technology is based on materials that can be monolithically integrated with Si CMOS electronics as well as flexible electronic platforms. **TECHNICAL ARTICLE**

Tags: Sensors ■

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