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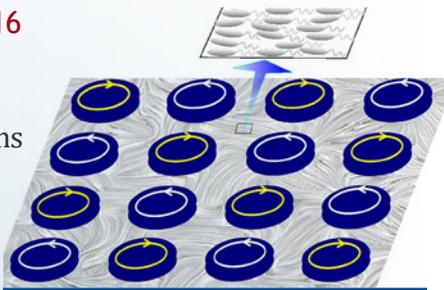
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FEATURE ARTICLES

[Scientists simulate tiny bacteria-powered 'windfarm'](#)

[PhysOrg.com](#), 08JUL2016

An international team of researchers (India, UK) uses computer simulations to demonstrate that the chaotic swarming effect of dense active matter such as bacteria can be organized to turn cylindrical rotors and provide a steady power source. Researchers say these biologically driven power plants could someday be the microscopic engines for tiny, man-made devices that are self-assembled and self-powered—everything from optical switches to smartphone microphones. [OPEN ACCESS TECHNICAL ARTICLE](#)



Bacterial suspensions develop chaotic active flows that are normally so disorderly that useful power cannot be extracted from them. But a lattice of microscopic rotors changes this—stabilizing the active chaotic flow and organizing neighboring rotors to continuously rotate in alternating directions, producing a "bacterial wind farm." Credit: Amin Doostmohammadi

[Scientists develop brain-inspired memory material](#)

[Nanowerk](#), 07JUL2016

The material that could be the basic building block for 'brain-inspired computing' is lead-zirconium-titanate (PZT): a sandwich of materials with several attractive properties. Researchers in the Netherlands added a thin layer of zinc oxide to the PZT which makes every state in between possible, not just two memory states. They discovered that switching from one state to another not only happens from 'zero' to 'one' vice versa. Multistate memories, coupled to transistors, could drastically improve the speed of pattern recognition. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Information technology, Neuroscience, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Graphene could revolutionize the internet of things](#)

[Nanowerk](#), 08JUL2016

Researchers in Switzerland have developed a graphene-based solution to replace tunable capacitors. The device "tunes" the circuits to different frequencies so that they can operate across a wide range of frequency bands. It has good performance at high frequency, miniaturization and the ability to be tuned using very little energy. The device could significantly increase the speed and efficiency of wireless communication systems. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Communications technology, S&T Switzerland

[Using light to make gold crystal nanoparticles](#)

[Nanowerk](#), 08JUL2016

When polyvinylpyrrolidone is used in the plasmon-driven synthesis, it enables scientists to better control the growth of crystals. A team of researchers in the US (University of Florida, Pacific Northwest National Laboratory, Brookhaven National Laboratory) demonstrated that visible-range and low-power light can be used in the synthesis. The discovery has major implications for industry, cancer treatment, pharmaceuticals, medical equipment and solar panels. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T, Materials science

[Compound 2-D Material Leads to a Practical Electronic Device](#)

[IEEE Spectrum](#), 07JUL2016

A team of researchers in the US (UC Riverside, University of Georgia) added a third 2D material to boron nitride and graphene: tantalum sulfide to make a voltage-controlled oscillator (VCO). These VCOs are ubiquitous, and are found in applications such as clocks, radios, and computers. They could be used as an ultralow power alternative to conventional devices

continued...

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that are now based on silicon. Because this VCO is flexible, it could be also used in wearables. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

[Imaging relativistic electrons in graphene p-n junctions](#)

Nanotechweb, 07JUL2016

An international team of researchers (USA - UC Berkeley, UC Santa Cruz, MIT, Lawrence Berkeley National Laboratory, Japan) has observed the relativistic electrons of graphene in circular p-n junctions fabricated in the carbon sheet. Being able to confine and control graphene's electrons in such a way will be important for making nanoscale devices from the material in the future, and for better understanding these exotic "Dirac fermions."

[TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Researchers demonstrate tunable wetting and adhesion of graphene](#)

Nanowerk, 07JUL2016

Researchers at the University of Illinois, Urbana-Champaign show that graphene demonstrates tunable wettability—switchable hydrophobic and hydrophilic behavior—when its electron density is changed by subsurface charged polymers and metals (a.k.a. doping). The finding opens the possibility for tunable surface coating and electrowetting displays without continuous external electric current supply, which will translate into significant energy savings. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

AUTONOMOUS SYSTEMS & ROBOTICS

[Next Generation Robotics](#)

arXiv, 29JUN2016

The National Robotics Initiative (NRI) was launched in 2011 and is about to celebrate its 5 year anniversary. In parallel with the NRI, the robotics community engaged in a series of road mapping exercises. The second updated version appeared in 2013. While not directly aligned with the NRI, the road-mapping documents have provided both a useful charting of the robotics research space, as well as a metric by which to measure progress. This report sets forth a perspective of progress in robotics over the past five years, and provides a set of recommendations for the future. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Autonomous systems & robotics, Artificial intelligence

BIOTECHNOLOGY

[Video: Yale unveils 3D view of the world inside of cells](#)

PhysOrg.com, 08JUL2016

Researchers at Yale University have discovered a way to view in three dimensions tiny structures within cells such

as mitochondria, the cellular power packs, and nuclear membranes that envelope DNA. In the accompanying movie, researchers recorded three-dimensional representations of 19 paternal and maternal mouse chromosomes by using colored fluorescent tags attached to proteins that bind them together. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Biotechnology, Biology

[New clues could help scientists harness the power of photosynthesis](#)

Science Daily, 07JUL2016

An international team of researchers (USA - Pennsylvania State University, Montana State University, Singapore) has identified the gene that converts chlorophyll into chlorophyll f that absorbs light in the far-red range of the light spectrum. This discovery could enable scientists to engineer crop plants that more efficiently harness the energy of the Sun. [TECHNICAL ARTICLE](#)

Tags: Biotechnology

[The debut of a robotic stingray, powered by light-activated rat cells](#)

Science Daily, 07JUL2016

An international team of researchers (Harvard University, Stanford University, South Korea) created neutrally charged gold skeletons overlaid with a thin layer of stretchy polymer. Along the top of the robotic ray, they aligned rat cardiomyocytes (muscle cells) which contract the fins downward when stimulated. For upward motion they designed the gold skeleton in a shape that stores some downward energy, which is later released as the cells relax, allowing the fins to rise. Asymmetrical pulses of light can be used to turn the robot to the left or right and different frequencies of light can be used to control its speed. [TECHNICAL ARTICLE](#)

Tags: Biotechnology

CYBER SECURITY

[Building a better computer bug finder](#)

Science Daily, 07JUL2016

Detecting bugs in computer programs is an expensive task, and there is no way of measuring their efficacy without knowing exactly how many go unnoticed. To evaluate a bug finder is to control the number of bugs in a program. A team of researchers in the US (New York University, MIT Lincoln Laboratory, Northeastern University) have developed a technique called LAVA (Large-Scale Automated Vulnerability Addition) which inserts known quantities of novel vulnerabilities that are synthetic yet possess many of the same attributes as computer bugs in the wild. In their test, the existing bug-finding software found just 2 percent of bugs inserted by LAVA.

Tags: Cyber security

“There is no adequate defense, except stupidity, against the impact of a new idea.”

PERCY WILLIAMS BRIDGMAN

ENERGY

[Graphene-based battery on a chip](#)

Nanotechweb, 08JUL2016

An international team of researchers (Germany, Brazil, Switzerland) fabricated a battery with just two monolayers of graphene (one each for cathode and anode), followed by electrodeposition of copper and zinc. The entire assembly is prepared on a single chip. The battery housing is made using a 3d printer and holds the electrolyte in a partially-gelled form. It can supply enough power to operate a macroscopic device such as a pocket calculator for several hours. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery

ENVIRONMENTAL SCIENCE

[The curious case of Earth's leaking atmosphere](#)

PhysOrg.com, 08JUL2016

More recent studies have unambiguously confirmed that Earth's atmosphere is constantly leaking. An international team of researchers (USA - University of Alaska, NASA Goddard Space Center, Dartmouth College, Vermont Technical College, China, France) has explored the process of magnetic reconnection by which the solar wind enters Earth's magnetosphere and accelerates plasma. They have linked together multiple phenomena—namely the ionospheric leak, plumes from the plasmasphere, and magnetic reconnection—to paint a better picture of Earth's magnetic environment. High-energy particles can pose a threat to space-based technology, so understanding them is important. [TECHNICAL ARTICLE 1, 2](#)

Tags: Environmental science, Space technology

IMAGING TECHNOLOGY

[Breakthrough in the formation of beam size controllable X-ray nanobeams](#)

Nanowerk, 11JUL2016

Researchers in Japan have succeeded in developing high precision X-ray deformable mirrors that can be configured as necessary. With the new system it is now possible to create light collection optical systems, which differ in numerical aperture, just by changing the configuration of the deformable mirrors. Changing the numerical aperture allows for a controlling of the focused spot size close to the diffraction limit of a lens or mirror. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Imaging technology, S&T Japan

[China completes world's largest radio telescope—raising hopes of finding new worlds and alien life](#)

The Conversation, 11JUL2016

The 500-metre Aperture Spherical Radio Telescope (FAST), which has been under construction in the Guizhou Province in south-west China since 2011, was completed on July 3. The telescope uses an ingenious mechanism based on cables and pulleys that allows it to position the entire detector cage anywhere across the face of the dish. FAST uses an advanced system of cables and actuators that deform the spherical mirror to create a parabolic shape. This allows a two to three times larger part of the sky to be accessed than is possible with Arecibo, in Puerto Rico, with its 305-metre diameter dish.

Tags: Imaging technology, S&T China, Space technology

[Are Face Recognition Systems Accurate? Depends on Your Race.](#)

MIT Technology Review, 06JUL2016

Researchers at Michigan State University state that in the several years since these studies, the accuracy of commercial algorithms has improved significantly in many areas and the performance gaps between different genders and races may have narrowed. But so little testing information is available, it is hard to know. Newer approaches to face recognition, such as the deep learning systems Google and Facebook have developed, can make the same sort of mistakes if the training data is imbalanced.

Tags: Imaging technology, Pattern recognition

INFORMATION TECHNOLOGY

[Researchers use Minecraft for AI research](#)

PhysOrg.com, 11JUL2016

Microsoft has made [Project Malmo](#) available on GitHub via an open-source license. It is a platform that uses the world of Minecraft as a testing ground for advanced artificial intelligence research. It is primarily designed to help researchers develop sophisticated, more general AI.

Tags: Information technology, Artificial intelligence

[Democratizing databases](#)

MIT News, 08JUL2016

Usually, the organization already owns all the data it wants to put in the database. But writing complex queries in database scripting language to pull data from many different sources requires expertise that few organizations have in-house. Researchers at MIT have developed

software that makes databases much easier for lay people to work with. The program's home screen looks like a spreadsheet, but it lets users build their own database queries and reports by combining functions familiar to any spreadsheet user. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Information technology

[Researchers break record for DNA data storage](#)

[PhysOrg.com](#), 08JUL2016

A team of researchers in the US (University of Washington, Microsoft) stored 200MB of data. The experiment led to several important breakthroughs that improved our ability to manipulate more complex pools of synthetic DNA. It allowed us to better understand what kinds of errors crop up and how to deal with them. To read the data, the DNA is re-suspended and read by a DNA sequencer. They also wrote error-correcting codes and a method for random access.

Tags: Information technology, Biotechnology

FEATURED RESOURCE

[The Conversation](#)

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[Science on the verge of creating 'emotional' computer](#)

[PhysOrg.com](#), 08JUL2016

Researchers in Russia are developing an intelligent agent called Virtual Actor that has both narrative and emotional intellect. It is expected to be online within the next year and a half. It will have both an emotional and a narrative intellect, understand the context of what is going on, as well as unfolding scenarios. Based on this information, it will make plans and set targets. One of its capabilities is to be an actor.

Tags: Information technology, Artificial intelligence, S&T Russia

[Major energy savings when computers learn to share](#)

[PhysOrg.com](#), 06JUL2016

Computer servers spend a lot of time waiting around for search requests to come in. Researchers in Australia have developed a tweak to share resources by exploiting in a new way a feature of hardware called Simultaneous Multithreading. Many companies turn off this feature because without the tweak, sharing wrecks havoc

with the responsiveness of interactive services, such as searches. A key to streamlining the operating system was analysing server and application performance in great detail, so that the extra processes could be slipped into the gaps. It has the potential to make large data centres 25 per cent more efficient.

Tags: Information technology, Energy, S&T Australia

MATERIALS SCIENCE

[Atomic bits despite zero-point energy?](#)

[Science Daily](#), 08JUL2016

Researchers in Germany investigated how quantum effects influence magnetic stability in transition metals and established guidelines for the development of stable nanomagnets with low levels of quantum fluctuations. Their chart showing the suitability of different elements should serve as a construction kit for combining complex nanomagnets made from several different atoms. The research is of great technical interest for the magnetic storage of data. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T Germany

[New ferromagnetic superconductor—CsEuFe₄As₄](#)

[PhysOrg.com](#), 08JUL2016

Researchers in China succeeded in replacing every alternate Eu layer by a non-magnetic Rb/Cs layer, yielding twin compounds RbEuFe₄As₄ and CsEuFe₄As₄. In the twin materials, researchers observed both bulk superconductivity and full ferromagnetism simultaneously. The observation of robust superconductivity (SC) and ferromagnetism (FM) in (Rb/Cs)EuFe₄As₄ strongly suggests that the expected mutual suppression between SC and FM can be minimized via a certain mechanism, which may shed light on the mechanism of iron-based SC.

[TECHNICAL ARTICLE](#)

Tags: Materials science, S&T China

QUANTUM SCIENCE

[Researchers blur the line between classical and quantum physics by connecting chaos and entanglement](#)

[PhysOrg.com](#), 12JUL2016

Using a small quantum system consisting of three superconducting qubits, a team of researchers in the US (UC Santa Barbara, Boston University) has uncovered a link between aspects of classical and quantum physics thought to be unrelated: classical chaos and quantum entanglement. Their findings suggest that it would be possible to use controllable quantum systems to investigate certain fundamental aspects of nature. [TECHNICAL ARTICLE](#)

Tags: Quantum science

Probing quantum phenomena in a tiny transistor

Nanowerk, 07JUL2016

Heterogeneous silicon-germanium nanowire is a one-dimensional nanowire with a core of silicon atoms sheathed by shell of germanium atoms. Researchers at Michigan Technological University report that the close-packed alignment of pz-orbitals between the germanium atoms enable quantum tunneling. This creates a much higher electrical current when the material is switched on. The finding could improve efficiency in electronic devices that maximize existing silicon-based technology.

TECHNICAL ARTICLE*Tags: Quantum science***Quantum processor for single photons**

Science Daily, 07JUL2016

Photons usually do not interact at all but pass each other undisturbed. This makes them ideal for the transmission of quantum information, but less suited for its processing. Researchers in Germany brought an ancillary third particle into play as a mediator: a single rubidium atom which is trapped in an optical resonator made of two high-reflectivity mirrors. The rubidium atom forms a strongly coupled system with the resonator. The resonator amplifies the light field of the impinging photon at the position of the atom enabling a direct atom-photon interaction. **TECHNICAL ARTICLE**

*Tags: Quantum science, Communications technology, S&T Germany***SCIENCE WITHOUT BORDERS****Mathematical framework that prioritizes key patterns in networks aims to accelerate scientific discovery**

Nanowerk, 09JUL2016

A team of researchers in the US (Stanford University, Purdue University) working on DARPA's Simplifying Complexity in Scientific Discovery (SIMPLEX) program developed algorithms based on a framework for identifying and clustering "motifs". They help to unravel the complexity of diverse scientific and engineering systems, and for accelerating discovery by highlighting which avenues of research could potentially yield better results. **TECHNICAL ARTICLE**

*Tags: Science without borders, Mathematics***Setting a satellite to catch a satellite**

ESA, 08JUL2016

The vision underpinning ESA's e.Deorbit project is to remove a large piece of space junk—if it is given the initial go-ahead. The basic idea is simple: set a satellite to catch a satellite. e.Deorbit will rendezvous with, grapple and hard-capture the drifting satellite, then push the pair down to burn up harmlessly in the atmosphere. The chaser satellite requires extremely sophisticated guidance, navigation and control to synchronise motion and then capture its target, guided in turn by advanced image processing, blending inputs from optical and multispectral cameras as well as 'laser radar' lidar to derive a precise, reliable sense of the target and its motion.

*Tags: Science without borders, S&T EU, Satellite technology, Space technology***Why important innovations stall**

Science Daily, 06JUL2016

Drawing on nearly 600 years of controversies, the study by researchers at Harvard University presents in-depth case studies of opposition to innovation, including printing of the Koran by the Ottomans, alternating current, refrigeration, recorded music, and, more recently, robotics, artificial intelligence and agricultural biotechnology. The study says that in many cases objections and social responses to innovation fall into one or more of four categories: intuition, vested interests, intellectual arguments, and psychological factors. People are more likely to accept the risks of new technologies if they have been part of the process of deciding on their use.

*Tags: Science without borders***SENSORS****Russia putting up short range radar that can detect the F-35 and other stealth planes 310 miles away**

Next Big Future, 10JUL2016

The radar is capable of detecting sea surface and air objects at a maximum distance of 500 kilometers at different altitudes in the line of sight and over the horizon. The Podsolnukh can simultaneously detect, track and classify up to 300 sea and 100 aerial targets in an automatic mode. Russia plans to deploy several of these systems in the Arctic, as well as on Russia's southern and western borders.

Tags: Sensors, Military technology, S&T Russia

New record in microwave detection

Science Daily, 08JUL2016

Researchers in Finland have developed a new detector making use of tiny pieces of superconducting aluminum and a golden nanowire. Using positive feedback, they achieved fourteen fold energy resolution of thermal photodetection. This design guarantees both efficient absorption of incoming photons and very sensitive readout. The whole detector is smaller than a single human blood cell. The discovery may lead to ultrasensitive cameras and accessories for the emerging quantum computer. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Sensors, S&T Finland*

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