



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Researchers find the 'key' to quantum network solution](#)

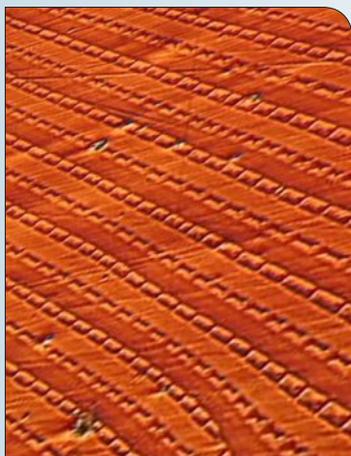
[Science Daily, 25MAY2015](#)

The problem with QKD protocols based on simple quantum systems, such as single-photon qubits, is their low key-rate, despite their effectiveness in working over long distances. An international team of researchers (UK, Canada, USA, Denmark) used continuous-variable quantum systems which allow the parallel transmission of many qubits of information while retaining the quantum capability of detecting and defeating eavesdroppers. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology, Featured Article

[Fundamental magnetism discovery: New class of swelling magnets](#)

[Science Daily, 20MAY2015](#)



Never before seen highly periodic magnetic 'cells' or 'domains' in iron-gallium alloys responsible for non-Joulian magnetism. Credit: Harsh Deep Chopra/Temple University

A team of researchers in the US (Temple University, University of Maryland) discovered a new class of magnets, they call 'Non-Joulian Magnets,' that show a large volume change in magnetic fields and possess the ability to convert energy with minimal heat loss. Since non-Joulian magnets spontaneously expand in all directions, compact omnidirectional actuators can now be easily real-

ized. [TECHNICAL ARTICLE](#)

Tags: Breakthrough technology, Advanced materials, Featured Article

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[DNA double helix does double duty in assembling arrays of nanoparticles](#)

[Science Daily, 25MAY2015](#)

A team of researchers in the US (Brookhaven National Laboratory, Stony Brook University, Harvard University, Dana-Farber Cancer Institute) put synthetic strands of the biological material to work in two ways: They used ropelike configurations of the DNA double helix to form a rigid geometrical framework, and added dangling pieces of single-stranded DNA to glue nanoparticles in place. It produced predictable clusters and arrays of nanoparticles--an important step toward the design of materials with tailored structures and functions for applications in energy, optics, and medicine. [TECHNICAL ARTICLE](#)

Tags: Advanced manufacturing, Biotechnology

[Laser technique for low-cost self-assembly of nanostructures](#)

[Science Daily, 25MAY2015](#)

An international team of researchers (China, Australia) has combined laser printing and capillary force to build complex, self-assembling microstructures using a technique called laser printing capillary-assisted self-assembly (LPCS). They demonstrated the ability of the LPCS structures to selectively capture and release micro-particles. A possible application of these structures is in on-chip micro-object trap-release systems. [TECHNICAL ARTICLE](#)

Tags: Advanced manufacturing

ADVANCED MATERIALS

[Slip sliding away: Graphene and diamonds prove a slippery combination](#)

[Nanowerk, 25MAY2015](#)

Researchers at Argonne National Laboratory combined diamond nanoparticles, small patches of graphene and a diamond-like carbon material to create superlubricity, a highly-desirable property in which friction drops to near zero. As the graphene patches and diamond particles

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rub up against a large diamond-like carbon surface, the graphene rolls itself around the diamond particle, creating something that looks like a ball bearing on the nanoscopic level. [TECHNICAL ARTICLE](#)

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

[Combining light and sound to create nanoscale optical waveguides](#)

[KurzweilAI, 24MAY2015](#)

A team of researchers in the US (MIT, IBM Watson Research Center, University of Minnesota) and Hong Kong, found that when graphene and hexagonal boron nitride (hBN) are combined in a certain way, the plasmons and phonons can couple, producing a strong resonance. The properties of the graphene allow precise control over light, while hBN provides very strong confinement and guidance of the light. Combining the two makes it possible to create new “metamaterials” that marry the advantages of both.

[TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Light-emitting, transparent flexible paper developed in China](#)

[KurzweilAI, 24MAY2015](#)

Researcher in China developed a thin, clear nanocellulose paper made from wood flour and infused it with biocompatible quantum dots made out of zinc and selenium. The paper glowed at room temperature and could be rolled and unrolled without cracking. It could lead to light, flexible portable and wearable displays.

Tags: Advanced materials, Flexible electronics

[Engineers develop ballistic wallpaper to reinforce temporary shelters](#)

[PhysOrg.com, 22MAY2015](#)

Troops often use abandoned masonry, brick or cinder-block structures for defensive purposes. Engineers at ERDC (Army Corps of Engineers’ Engineer Research and Development Center) came up with a novel idea to fortify these structures with rolls of lightweight flexible ballistic wallpaper embedded with Kevlar fiber threads. They would have adhesive backing that can be quickly put up on the inside of the walls.

Tags: Advanced materials, Government S&T, Military technology

[Graphene Overcomes Achilles’ Heel of Artificial Muscles](#)

[IEEE Spectrum, 22MAY2015](#)

After being exposed to air and current, the electrodes in artificial muscles would begin to crack, leaking ions and diminishing the muscle’s performance. To overcome this problem, researchers in South Korea made electrodes from a cost-effective version of graphene called hydrophobic laser-scribed reduced graphene oxide paper (HLrGOP).

Tags: Advanced materials, Biomimetics

AUTONOMOUS SYSTEMS & ROBOTICS

[Video Friday: Deep-Learning Robots, DRC Practice, and Drone Pilot Competition](#)

[IEEE Spectrum, 22MAY2015](#)

Inspired by origami, the folding drone developed by a team at EPFL and NCCR Robotics [both in Switzerland] unfurls and takes off in a third of a second. The moment it is turned on, the rotors engage, the articulated arms extend and the drone begins moving. This eager device could be quickly released in large numbers over a disaster zone in order to bring back photos and establish contact with people in need.

Tags: Autonomous systems & robotics

[New ‘deep learning’ technique enables robot mastery of skills via trial and error](#)

[UC Berkeley News, 21MAY2015](#)

Researchers at UC Berkeley have developed algorithms that enable robots to learn motor tasks through trial and error using a process that more closely approximates the way humans learn, marking a major milestone in the field of artificial intelligence.

Tags: Autonomous systems & robotics

COMMUNICATIONS TECHNOLOGY

[Physicists develop efficient method of signal transmission from nanocomponents](#)

[Nanowerk, 22MAY2015](#)

Researchers in Switzerland have developed an antireflex device for electrical signals to reduce the reflection that occurs during transmission from nanocomponents to larger circuits. By creating a special formation of electrical conductors of a certain length, which are coupled with a carbon nanotube, they were able to efficiently uncouple a high-frequency signal from the nanocomponent.

[TECHNICAL ARTICLE](#)

Tags: Communications Technology, S&T Switzerland

CYBER SECURITY

[Logjam isn’t the only reason your computer might be more vulnerable to internet threats](#)

[PhysOrg.com, 25MAY2015](#)

Logjam works by attacking a part of the security process called the “Diffie-Hellman key exchange”. The key is formed using two very large, complex and random prime numbers. The Logjam attack involves capturing the key data and then using computational power to crack its code. As a result, security experts are advising web sites that still use these keys to move to much longer versions that are harder to predict.

Tags: Cyber security

“If the facts don’t fit the theory, change the facts.”

ALBERT EINSTEIN

ENERGY

Keeping cell phone charged by recycling wasted energy back to battery

Science Daily, 26MAY2015

In the new technology, developed by researchers at Ohio State University, circuitry converts some of the radio signals emanating from a phone into direct current power, which then charges the phone’s battery. The batteries last up to 30 percent longer on a single charge. This new technology can be built into a cell phone case, without adding more than a trivial amount of bulk and weight.

Tags: Energy, Battery

Nanomachine pumps molecules ‘uphill’

Physics World, 22MAY2015

Developed by researchers at Northwestern University, the pump is based on a molecule called a rotaxane which contains a linear axle capable of restricting the motion of a ring-shaped component threaded onto it. The chemical structure of the axle is such that the rings can move in one direction via a complex mechanism that involves two one-way valves. It works on reduction-oxidation cycles and precisely organized non-covalent bonding interactions. Such machines could be important for a range of applications, including synthetic muscles, tiny robots and advanced mechanical motors. TECHNICAL ARTICLE

Tags: Energy, Advanced materials

Researchers develop method of fabricating perovskite solar cells that is more efficient, costs less

PhysOrg.com, 22MAY2015

The new process, developed by researchers in South Korea, involves placing a lead iodide–dimethylsulfoxide layer onto a formamidinium iodide solution. This causes the formation of a formamidinium lead iodide perovskite composition. The result is a more efficient cell, as it allows for gathering a broader spectrum of light with efficiencies of up to 20.2 percent. TECHNICAL ARTICLE

Tags: Energy, Advanced materials, Solar energy

Semiliquid battery competitive with both Li-ion batteries and supercapacitors

PhysOrg.com, 22MAY2015

The new battery, developed by researchers at UT Austin, uses a liquid ferrocene electrolyte, a liquid cathode, and a solid lithium anode. It shows excellent rate capability that can be fully charged or discharged almost within one minute while maintaining good energy efficiency and reasonable energy density. It was designed for

applications in two of the biggest areas of battery technology: hybrid electric vehicles and energy storage for renewable energy resources. TECHNICAL ARTICLE

Tags: Energy, Battery

A little drop will do it: Tiny grains of lithium can dramatically improve the performance of fusion plasmas

Princeton University, 21MAY2015

A team of researchers in the US (General Atomics, University of Wisconsin-Madison, Princeton PPPL, UC San Diego, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory) injected grains of lithium measuring some 45 millionths of a meter in diameter into a tokamak. While the plasma was relatively calm, the plasma remained basically unaltered. When the plasma was undergoing a kind of turbulence known as a “bursty chirping mode,” the injection of lithium doubled the pressure at the outer edge of the plasma, and the length of time that the plasma remained at high pressure rose by more than a factor of 10. TECHNICAL ARTICLE

Tags: Energy, Government S&T, Nuclear energy

Getting rid of dangling bonds in thin-film photovoltaics

Nanotechweb, 21MAY2015

The dangling bonds in inorganic materials such as silicon, gallium arsenide, cadmium telluride, indium phosphide and the perovskites used to make solar cells degrade device performance. An international team of researchers (China, Canada) report that if properly oriented, dangling bonds do not exist in thin-film Sb_2Se_3 . It has a bandgap of around 1.1 eV, which is ideal for absorbing a broad range of solar light wavelengths. TECHNICAL ARTICLE

Tags: Energy, Solar energy

EXPLOSIVES

Researchers use seismic signals to track above-ground explosions

PhysOrg.com, 21MAY2015

Researchers at the Lawrence Livermore National Laboratory developed a method to characterize underground explosions based on regional amplitude envelopes across a broad range of frequencies. By allowing the methodology to consider shallow, uncontained events just below, at, or even above the Earth’s surface, they make the method relevant to new classes of events including mining events, military explosions, industrial accidents, plane crashes or potential terrorist attacks. TECHNICAL ARTICLE

Tags: Explosives, Government S&T

continued...

INFORMATION TECHNOLOGY

[Spin currents endure at room temperature in germanium](#)

Nanotechweb, 22MAY2015

An international team of researchers (Japan, UK) reports that currents of electron spin can travel more than half a micron through germanium at room temperature. This is the best measurement yet of its ability to transport spin at room temperature. The results suggest that the semiconductor could be used to create spintronic devices, which make use of the spin magnetic moment of the electron to store and process information. [TECHNICAL ARTICLE](#)

Tags: Information Technology

FEATURED RESOURCE

[MIT World](#)

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MATERIALS SCIENCE

[Nano-electromechanical rotation of graphene in a liquid crystal platform](#)

Nanowerk Spotlight, 25MAY2015

Due to the anisotropic nature of graphene's conductivity, graphene flakes have potential applications in nanoscale switches and nano-electromechanical systems. Researchers at the US Naval Academy have developed a technique to control the orientation of graphene flakes at the nanoscale by using a nematic liquid crystal (LC) platform and have demonstrated that in the presence of monolayer graphene flakes the nematic LC exhibits a giant enhancement of dielectric anisotropy. [TECHNICAL ARTICLE](#)

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

MICROELECTRONICS

[One step closer to a single-molecule device](#)

Science Daily, 25MAY2015

Researchers at Columbia University have developed molecular diodes that perform 50 times better than all prior designs. They have shown that single-molecules attached to metal electrodes (single-molecule junctions) can be made to act as a variety of circuit elements, including resistors, switches, transistors, and, indeed, diodes. [TECHNICAL ARTICLE](#)

Tags: Microelectronics

[Can we build a computing device that works without any energy input?](#)

Nanotechweb, 21MAY2015

In the last forty years, the semiconductor industry has been driven by its ability to scale down the size of the CMOS-FET. It has also increased computing capability density up to a point where the power dissipated in heat during computation has become a serious limitation. In this article researchers in Italy review state-of-the-art zero-power computing, with special attention paid to the aspects of energy dissipation at the micro- and nanoscales. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Information technology

NEUROSCIENCE

[Research road map for brain-computer interfaces](#)

Science Daily, 26MAY2015

Under the auspices of Graz University of Technology, a BCI road map has been developed for BCI research in the coming ten years for the Horizon 2020 EU funding programme. The road map gives a global perspective on BCI research, demonstrates potentials and challenges, and articulates the present gaps between current and future applications. [REPORT](#)

Tags: Neuroscience, S&T EU

[The coming merge of human and machine intelligence](#)

Medical Express, 25MAY2015

As the Internet revolution unfolds, we are seeing not merely an extension of mind but a unity of mind and machine, two networks coming together as one. Our smaller brains are in a quest to bypass nature's intent and grow larger by proxy. It is not a stretch of the imagination to believe we will one day have all of the world's information embedded in our minds via the Internet.

Tags: Neuroscience, Science without borders

PHOTONICS

[Shedding Light on Untapped Information in Photons](#)

DARPA News, 22MAY2015

DARPA's Revolutionary Enhancement of Visibility by Exploiting Active Light-fields (REVEAL) program aims to develop a comprehensive theoretical framework to enable maximum information extraction from complex scenes by using all the photon pathways of captured light and leveraging light's multiple degrees of freedom. The goal is for this framework to guide the development of new imaging hardware and software technologies. [BAA](#)

Tags: Photonics, DARPA, Government S&T

HELLADS Laser Achieves Acceptance For Field Testing

DARPA News, 21MAY2015

Ground-based field testing of the HELLADS laser is expected to begin this summer as an effort jointly funded by DARPA and the Air Force Research Laboratory. Following the field-testing phase, the goal is to make the system available to the military Services for further refinement, testing or transition to operational use.

Tags: Photonics, Government S&T, Military technology

QUANTUM SCIENCE

Protocol corrects virtually all errors in quantum memory, but requires little measure of quantum states

PhysOrg.com, 26MAY2015

A team of researchers in the US (MIT, Google, Cornell University), along with researchers from Australia, have developed a new code that can correct errors afflicting a specified fraction of a computer's qubits, not just the square root of their number. And that fraction can be arbitrarily large, although the larger it is, the more qubits the computer requires. [TECHNICAL ARTICLE](#)

Tags: Quantum science

'Squeezed quantum cats' and 'stable cats' for quantum computers

Science Daily, 26MAY2015

Researchers in Switzerland caught a single electrically charged calcium ion in a tiny cage made of an electric field and cooled it down until it could hardly move. By shining laser light on it until the ion's wave function is literally squashed, they get a better idea of where the ion is located in space, but the uncertainty in its velocity has increased proportionately. Together, with state-dependent forces, they are able to produce a "squeezed Schrödinger cat." The stability could be exploited in order to realize quantum computers. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T Switzerland

S&T POLICY

China's Military Strategy

US Naval Institute, 26MAY2015

This is the first public Chinese Military Strategy white paper outlining a new policy of "active defense," released by the Chinese Ministry of National Defense on May 26, 2015.

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

A better way to deliver innovation to the world

MIT News, 24MAY2015

In the past two decades, and especially the past five years, the United States has undergone a profound shift in how it develops, adopts and capitalizes on innovation. Today, our highly optimized, venture-capital-driven innovation system is simply not structured to support complex, slower-growing concepts that could end up being hugely significant—the kind that might lead to disruptive solutions to existential challenges in sustainable energy, water and food security, and health. The United States needs a more systematic way to help its bottled-up new-science innovators deliver their ideas to the world. That calls for accelerating a two-stage process: from idea to investment, and from investment to impact.

Tags: S&T policy

Russian Supercarrier design has two electromagnetic launchers

Next Big Future, 23MAY2015

According to a scale model of the carrier known as 23000 "Storm," developed by Krylovsky State Research Center (KRSC), it can carry 90 deck-based aircraft for various combat missions. The carrier has two ramps and two electromagnetic catapults to launch aircraft from its deck.

Tags: S&T policy, Military technology, S&T Russia

SCIENCE WITHOUT BORDERS

Like Sleeping Beauty, some research lies dormant for decades, study finds

PhysOrg.com, 25MAY2015

A study by researchers at Indiana University provides empirical evidence that a paper can truly be 'ahead of its time.' The disciplines with the highest rate of delayed recognition were physics, chemistry, multidisciplinary science, mathematics, and general and internal medicine, with several papers experiencing hibernation periods upwards of 70 years. [TECHNICAL ARTICLE](#)

Tags: Science without borders

SENSORS

Iris scanners can now identify us from 40 feet away

The Conversation, 21MAY2015

Researchers at Carnegie Mellon University have demonstrated they were able to use their iris recognition technology to identify drivers from an image of their eye captured from their vehicle's side mirror. As well as improving security, the technology will be more convenient for the individuals being identified. By using measurements of physiological characteristics, people no longer need security tokens or cumbersome passwords to identify themselves.

Tags: Sensors

SWEEPER Demonstrates Wide-Angle Optical Phased Array Technology

DARPA News, 21MAY2015

Freed from the traditional architecture of gimbaled mounts, lenses and servos, DARPA's Short-range Wide-field-of-view Extremely agile Electronically steered Photonic EmitteR (SWEEPER) technology has demonstrated that it can sweep a laser back and forth more than 100,000 times per second, 10,000 times faster than current state-of-the-art mechanical systems. SWEEPER research is drawing to a close and DARPA is seeking potential transition partners.

Tags: Sensors, Government S&T ■

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