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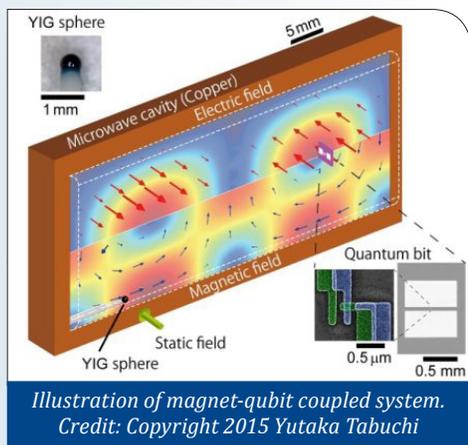
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FEATURE ARTICLES

[Quantum behavior of millimeter-sized magnets unraveled: Superconducting qubit and magnetic sphere hybrid](#)

[Science Daily, 03AUG2015](#)

Researchers in Japan demonstrated coherent coupling between a single-magnon excitation in a millimeter-sized ferromagnetic sphere and a superconducting qubit with the interaction mediated by the virtual photon excitation in a microwave cavity. The resulting coupling strength far exceeded the damping rates, thus bringing the hybrid system into the strong coupling regime. Their approach provides a versatile tool for quantum control and measurement of the magnon excitations and may lead to advances in quantum information processing. [TECHNICAL ARTICLE](#)



Tags: Quantum science, Information technology, S&T Japan, Featured Article

[Solid state physics: Quantum matter stuck in unrest](#)

[Science Daily, 31JUL2015](#)

An international team of researchers (Germany, Israel) has created and analyzed a so-called Many-Body Localized state, where despite the presence of interactions it does not thermalize. In this peculiar insulating state, the system retains a quantum memory of its initial quantum state, even for long periods of times. They represent a new class of systems. Many-body localization is of potential interest for applications in quantum information science as a means to protect the quantum information from decoherence. [TECHNICAL ARTICLE](#)

Tags: Breakthrough technology, Materials science, Quantum science, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Physicists announce graphene's latest cousin: stanene](#)

[Nature News, 03AUG2015](#)

Two years after physicists predicted that tin should be able to form a mesh just one atom thick, an international team of researchers (China, USA-Stanford University) says that they have made it. It is called stanene. But they have not been able to confirm whether the material has the predicted exotic electronic properties that have excited theorists, such as being able to conduct electricity without generating any waste heat. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Bend me, shape me, any way you want me: Scientists curve nanoparticle sheets into complex forms](#)

[Nanowerk, 02AUG2015](#)

A team of researchers in the US (University of Chicago, University of Missouri, DOE's Argonne National Laboratory) has found a simple way to curve or fold a sheet of nanoparticles into a complex three-dimensional structure. The findings open the way for scientists to design membranes with tunable electrical, magnetic and mechanical properties that could be used in electronics and may even have implications for understanding biological systems.

Tags: Advanced materials

[Sol-gel capacitor dielectric offers record-high energy storage](#)

[Science Daily, 31JUL2015](#)

A team of researchers in the US (Georgia Institute of technology, NRL) has developed a new material composed of a silica sol-gel thin film. The film contains polar groups linked to the silicon atoms and a nanoscale self-assembled monolayer of an octylphosphonic acid, which provides insulating properties. The bilayer structure blocks the injection of electrons into the sol-gel material, providing low leakage current, high breakdown strength and high energy extraction

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efficiency. It provides an electrical energy storage capacity rivaling certain batteries, with both a high energy density and high power density. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Energy, Government S&T

[Graphene supercurrents go ballistic](#)

[Science Daily](#), 29JUL2015

Researchers with Europe's Graphene Flagship have demonstrated superconducting electric currents in the two-dimensional material graphene that bounce between sheet edges without scattering. This first direct observation of the ballistic mirroring of electron waves in a 2d system with supercurrents could lead to the use of graphene-based Josephson junctions in applications such as advanced digital logic circuits, ultrasensitive magnetometers and voltmeters.

Tags: Advanced materials, S&T EU

[Like paper, graphene twists and folds into nanoscale machines](#)

[PhysOrg.com](#), 29JUL2015

With one sheet of graphene researchers at Cornell University made a soft spring, which works just like a very flexible transistor. The forces needed to bend such a spring would be comparable to forces a motor protein might exert. Entering the realm of biological forces, the experiments open up a new playground of ideas for flexible, nanoscale devices that could be placed around human cells or in the brain for sensing. Opening and closing the hinge 10,000 times, they found that it remains perfectly intact and elastic—a potentially useful quality for foldable machines and devices at that scale.

[TECHNICAL ARTICLE](#)

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

[GE describes its vision of next generation robots](#)

[Next Big Future](#), 28JUL2015

According to GE the big challenge is going to be in building more sophisticated robot perception, more accurate manipulation for the robot, and how the robot can validate and verify autonomous systems. It is easy to do this where you can control the environment, but open this up and it becomes more difficult to validate and verify.

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

[Researchers build bacteria's photosynthetic engine](#)

[PhysOrg.com](#), 29JUL2015

Purple bacteria possess simpler photosynthetic organelles, specialized cellular subunits called chromatophores. Researchers at the University of Illinois at

Urbana-Champaign constructed and simulated a single chromatophore to understand the fundamental process of photosynthesis. One day this basic research could lead to better solar energy technology. Of particular interest: how hundreds of proteins work together to capture light energy at an estimated 90 percent efficiency. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Energy

COMMUNICATIONS TECHNOLOGY

[Researchers clear the way for fast plasmonic chips](#)

[Science Daily](#), 03AUG2015

Researchers in Russia have developed a new method of electric pumping of plasmonic waveguides based on the metal-insulator-semiconductor (MIS) structure. The results show that the passage of relatively weak pump currents through the nanoscale plasmonic waveguides make it possible to fully compensate the surface plasmon propagation losses. This means that it is possible to transmit a signal over long distances (in chip standards) with no losses. [TECHNICAL ARTICLE](#)

Tags: Communications Technology, Microelectronics, S&T Russia

[Facebook getting close to 10 gigabit per second internet delivered from solar powered drones with 737 wingspan](#)

[Next Big Future](#), 02AUG2015

Facebook's Aquila is a very lightweight, very large wingspan aircraft capable of flying above normal airliners, above 60,000 feet, for up to three months at a time. It beams down Internet connectivity from the sky. Project Loon is a project being developed by Google with the mission of providing Internet access to rural and remote areas. The project uses high-altitude balloons placed in the stratosphere at an altitude of about 32 km (20 mi) to create an aerial wireless network with up to 3G-like speeds.

Tags: Communications Technology

[Researchers announce another 5G breakthrough](#)

[PhysOrg.com](#), 31JUL2015

Researchers working on the EU sponsored project POINT (iP Over ICN- the betTer IP) have developed a truly unique demonstration which is able to use standard IP end-points and translate the IP flow into an IP-over-ICN abstraction, where a single hop within the ICN network used SDN switches with pre-installed forwarding rules for the ICN flows. ICN allows for content to be fetched from multiple servers and caches, securing the content, allowing operators to apply traffic engineering rules.

Tags: Communications Technology, S&T EU

“Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.” —MARIE CURIE

‘Plasmonic’ material could bring ultrafast all-optical communications

PhysOrg.com, 30JUL2015

An international team of researchers (USA-Purdue University, UK) has shown how an optical material made of aluminum-doped zinc oxide (AZO) is able to modulate how much light is reflected by 40 percent while requiring less power than other “all-optical” semiconductor devices. The AZO also makes it possible to “tune” the optical properties of metamaterials, an advance that could hasten their commercialization. [TECHNICAL ARTICLE](#)

Tags: *Communications Technology, Advanced materials*

CYBER SECURITY

Report: Attacks will happen, so reduce the time to detection

Defense Systems, 03AUG2015

According to Cisco’s “Mid-Year Security Report” as hackers get shiftier, more agile and nastier, organizations trying to defend their networks need to realize they’re not going to prevent every intrusion and focus on shortening the amount of time it takes to detect one. The report details the rise of exploit kits, the return of Flash attacks and the increasingly slippery evasive tactics cyber criminals and other bad actors are using to cover their tracks.

Tags: *Cyber security*

Securing Today’s Data Against Tomorrow’s Quantum Computers

MIT News, 03AUG2015

Quantum computers are still a distant prospect. But some researchers think we should be planning to upgrade our encryption so life can continue normally in a quantum-computing era. An international team of researchers (USA-Microsoft, Australia) is testing a quantum-computer-proof version of the transport layer security protocol that online banking sites and others use to encrypt online data.

Tags: *Cyber security, Quantum science*

Shoring up Tor: Researchers mount successful attacks against popular anonymity network—and show how to prevent them

Science Daily, 29JUL2015

The all-volunteer Tor network is the world’s most popular system for protecting Internet users’ anonymity. Researchers at MIT have demonstrated vulnerability in Tor’s design. They show that an adversary could infer a hidden server’s location, or the source of the information reaching a given Tor user, by analyzing the traffic patterns of encrypted data passing through a single computer.

Tags: *Cyber security*

ENERGY

Computing at full capacity

PhysOrg.com, 02AUG2015

A company in the US offers businesses a new tool for cutting data center and cloud costs while improving resource utilization. It manages existing enterprise applications by automatically wrapping them in the company-managed Docker containers, and intelligently deploying them across all available resources using automated real-time deployment, monitoring, and analytics algorithms. As the resource utilization profile changes for each server or different parts of the network and storage, it elastically scales its utilization in real-time.

Tags: *Energy*

FORECASTING

Warfare 2050: robots, augmented humans and force fields

Defense Systems, 29JUL2015

For the military, projecting what the battlefield of the future will look like is a key part of its planning. A spring workshop sponsored by the Army Research Lab, with participants from the military, media, academia and industry, looked forward to what it could be in 2050. Some of the things they foresee in their recently released “report”: Robots, humans with superhero-like powers, extreme precision targeting and even an actual force field.

Tags: *Forecasting, Emerging technology, Government S&T, Military technology*

INFORMATION TECHNOLOGY

Light switches on a DVD

Nanowerk, 31JUL2015

The storage mechanism in DVDs is based on the fact that laser pulses rearrange the structure of the material, switching it from a transparent to a non-transparent state. An international team of researchers (Germany, Spain, Singapore) has discovered that the optical properties change much faster than the structure, which could be used in designing new types of photonic components. They report that the material comprised of germanium, antimony and tellurium, in which data media store information, may also be suitable as an extremely fast light switch for optical communication or data processing. [TECHNICAL ARTICLE](#)

Tags: *Information technology*

continued...

Physicists close in on world's most sensitive resonators

PhysOrg.com, 29JUL2015

Researchers at Cornell University have developed a novel method of manipulating mechanical resonators to be sensitive enough to work at the quantum scale. Their prototype resonator is a small silicon nitride drumhead, from which vibrations can be regarded as localized sound waves or "tones." They use one tone of this drum to manipulate another, akin to how physicists use light to manipulate light in the field of quantum optics. [TECHNICAL ARTICLE](#)

Tags: Information technology

Intel and Micron have new class of non-volatile memory that is 1000 times faster and 10 times denser than NAND Flash memory.

Next Big Future, 28JUL2015

3D XPoint™ technology is a non-volatile memory that has the potential to revolutionize any device, application or service that benefits from fast access to large sets of data. Now in production, 3D XPoint technology is a major breakthrough in memory process technology and the first new memory category since the introduction of NAND flash in 1989.

Tags: Information technology

FEATURED RESOURCE

American Physical Society Spotlight

Provides daily news and commentary about a selection of papers from the APS journal collection. [RSS](#)

MATERIALS SCIENCE

Predicting emerging structures and bulk properties of new materials

Science Daily, 31JUL2015

Recipes for creating gel like materials exist, but scientists do not always understand why they work. An international team of researchers (USA-Los Alamos National Laboratory, Japan) has found the golden combination among the attractive and repulsive forces at the molecular level, that is, they have uncovered a previously unknown mathematical interrelationship among them that allows the structure and bulk properties of the resulting material to be predicted. The discovery has significant technological implications in manufacturing new functional materials. [TECHNICAL ARTICLE](#)

Tags: Materials science

How to look for a few good catalysts

Science Daily, 30JUL2015

Two key physical phenomena take place at the surfaces of materials: catalysis and wetting. A catalyst enhances the

rate of chemical reactions; wetting refers to how liquids spread across a surface. Now an international team of researchers (USA (MIT, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory), Italy) has found that these two processes, which had been considered unrelated, are in fact closely linked. The discovery could make it easier to find new catalysts for particular applications, among other potential benefits. [TECHNICAL ARTICLE](#)

Tags: Materials science

Nature has more than one way to grow a crystal

Science Daily, 30JUL2015

The findings, by an international team of researchers (USA, the Netherlands, England, Germany), have implications for decades-old questions in science and technology regarding how animals and plants grow minerals into shapes that have no relation to their original crystal symmetry, and why some contaminants are so difficult to remove from stream sediments and groundwater. The insights may also help in the design of novel materials. [TECHNICAL ARTICLE](#)

Tags: Materials science

MICROELECTRONICS

Better together: Graphene-nanotube hybrid switches

Science Daily, 03AUG2015

A team of researchers in the US (Michigan Technological University, Oak Ridge National Laboratory, Sandia National Laboratory) has created digital switches by combining graphene and boron nitride nanotubes. Because the materials are respectively so effective at conducting or stopping electricity, the resulting switching ratio is high, several orders of magnitude greater than current graphene switches. In turn, this speed could eventually quicken the pace of electronics and computing. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Government S&T

Compact optical data transmission

Nanowerk, 03AUG2015

One component serving energy-efficient data exchange between electronic chips is the Mach-Zehnder modulator (MZM) which is able to convert electronic signals into optical signals. An international team of researchers (Switzerland, Germany, USA-University of Washington) has developed a plasmonic MZM of only 12.5 micrometers length which converts digital electrical signals into optical signals at a rate of up to 108 gigabit per second. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Communications technology

Small tilt in magnets makes them viable memory chips

PhysOrg.com, 03AUG2015

Researchers at UC Berkeley found that a slight tilt of the magnets makes them easy to switch without an external magnetic field. This opens the door to a memory system that can be packed onto a microprocessor, a major step toward the goal of reducing energy dissipation in modern electronics. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics*

Making the new silicon

MIT News, 29JUL2015

A company in the US has developed GaN transistors which have at least one-tenth the resistance of silicon-based transistors. This allows for much higher energy-efficiency, and orders-of-magnitude faster switching frequency. The company is using its transistors to enable power electronics that will make data centers less energy-intensive, electric cars cheaper and more powerful, and laptop power adapters one-third the size—or even small enough to fit inside the computer itself. It can cut energy usage in consumer devices by 10 to 20 percent worldwide by 2025.

Tags: *Microelectronics, Materials science*

Meet the high-performance single-molecule diode

Nanowerk, 29JUL2015

A team of researchers in the US (DOE's Lawrence Berkeley National Laboratory, Columbia University) used a combination of gold electrodes and an ionic solution to create a single-molecule diode that outperforms the best of its predecessors by a factor of 50. Researchers believe their new approach provides a general route for tuning nonlinear nanoscale-device phenomena that could be applied to systems beyond single-molecule junctions and two-terminal devices. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Government S&T*

PHOTONICS

Innovations from the wild world of optics and photonics

PhysOrg.com, 02AUG2015

Researchers at Princeton University have been experimenting with a variety of optics and photonics-based applications, creating systems to carry hidden messages, detect malicious cyber-attacks and improve the quality and capacity of wireless communications using light. They are even exploring whether it may be possible to create a network of photonic “neurons” to perform functions our brain does well, like pattern recognition but significantly faster.

Tags: *Photonics, Emerging technology*

QUANTUM SCIENCE

Plan for supersized entanglement is unveiled by physicist

PhysOrg.com, 03AUG2015

Researchers in Germany have proposed an experiment that could lead to the quantum-mechanical entanglement of everyday objects in the form of two 100 g mirrors. If successful, the mirrors would be by far the largest objects ever to be entangled, and the experiment would confirm that quantum physics applies to large and heavy objects, not just tiny particles. It could also test a prediction made in 2010 about how the mutual gravitational attraction of the mirrors affects their entanglement. [TECHNICAL ARTICLE](#)

Tags: *Quantum science, S&T Germany*

S&T POLICY

China building 40000 ton super large amphibious assault ship similar to USA Wasp Class helicopter carriers

Next Big Future, 01AUG2015

China displayed the model of its 40,000-ton super large amphibious assault ship, known as M1, at an equipment exhibition held in Beijing in April. Unlike the 28,000-ton Izumo-class, designed with five helicopter landing spots on its flight deck, the M1 has six. While the Izumo can carry a total number of 14 aircraft, how many the M1 can carry remains a mystery.

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

STEM

NSF invests in science and engineering infrastructure across the nation

NSF News, 03AUG2015

Through its Experimental Program to Stimulate Competitive Research (EPSCoR) program for the production of world-class research and scientific resources, NSF has awarded four jurisdictions with grants. Each award will support fundamental research, education in science, technology, engineering, and mathematics (STEM) fields, as well as workforce development in areas relevant to the jurisdictions' economic and other vital interests.

Tags: *STEM, S&T Policy*

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