



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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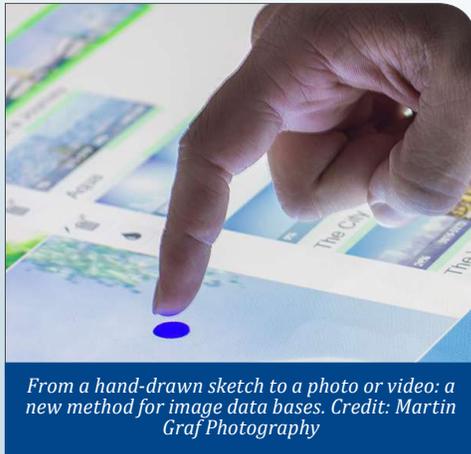
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FEATURE ARTICLES

[In a new method for searching image databases, a hand-drawn sketch is all it takes](#)



From a hand-drawn sketch to a photo or video: a new method for image data bases. Credit: Martin Graf Photography

[PhysOrg.com](#), 31MAY2016

Researchers in Switzerland have developed a system known as 'vitivr', which allows a search for images and videos by means of a sketch. The user creates a sketch of the desired object

on a tablet or interactive paper, and the program delivers the images and video clips that most resemble it. For videos, the user can even specify on the sketch in which direction an object is moving in the searched sequence.

Tags: Information technology, S&T Switzerland, Featured article

[Optics breakthrough to revamp night vision](#)

[Science Daily](#), 24MAY2016

Researchers in Australia have demonstrated a dramatic increase in the absorption efficiency of light in a layer of semiconductor that is only a few hundred atoms thick—to almost 99 percent light absorption from the current inefficient 7.7 percent. By etching thin grooves in the film, light is directed sideways and almost all of it is absorbed, despite the small amount of material. The findings did not rely upon a particular material but could be applied to many naturally occurring weak absorbers.

TECHNICAL ARTICLE

Tags: Photonics, Military technology, S&T Australia, Featured article

[Researchers create 'rewritable magnetic charge ice'](#)

[PhysOrg.com](#), 19MAY2016

A team of researchers in the US (Argonne National Laboratory, University of Notre Dame, Northern Illinois University, University of Illinois at Chicago) decoupled the lattice structure of magnetic spins and the magnetic charges and tuned the magnetic charge ice to any of eight possible charge configurations. They demonstrated the material's local write-read-erase multi-functionality at room temperature. With potential applications involving data storage, memory and logic devices, magnetic charge ice could someday lead to smaller and more powerful computers or even play a role in quantum computing.

TECHNICAL ARTICLE

Tags: Information technology, Featured article

S&T NEWS ARTICLES

ADVANCED MATERIALS

['Weak' Materials Offer Strong Possibilities for Electronics](#)

[Newswise](#), 31MAY2016

Because of the special property of weak topological insulators, they are difficult to design. An international team of researchers (USA - UT Dallas, China) has devised a new way to make a weak topological insulator, one that involves a relatively simple mix of two chemical elements: a crystal composed of bismuth combined with either iodine or bromine. Their findings could lead to significant advances in technology, especially in electronics and quantum computing. **TECHNICAL ARTICLE**

Tags: Advanced materials, Materials science

continued...

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New compound switches between liquid, solid states when exposed to light or heat

Science Daily, 27MAY2016

Researchers in Japan proposed that if they could control the binding process between metal ions and organic molecules using heat and light, they could create a material that drastically changes its properties when exposed to external stimuli. By applying light and heat, the group realized a reversible transformation between an ionic liquid and a solid coordination polymer -- two substances with completely different structures and different chemical properties. The substance can potentially be applied to printed circuit boards, 3D printing, and adhesives. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials, S&T Japan*

Automating DNA origami opens door to many new uses

MIT News, 26MAY2016

The DNA origami technique is limited to a small group of experts because it is designed by hand. A team of researchers in the US (MIT, Baylor College, Arizona State University) has developed an algorithm that starts with a simple, 3-D geometric representation of the final shape of the object, and then decides how it should be assembled from DNA. The technique can be used to develop nanoparticles for a much broader range of applications, including scaffolds for vaccines, carriers for gene editing tools, and in archival memory storage. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials*

Strength and ductility for alloys

Nanowerk, 25MAY2016

Ideally, steels and steel-related alloys should be both ductile and strong. An international team of researchers (Germany, USA - MIT) searched for a material that is, on the one hand, as strong as a high-entropy alloy, but, like particularly ductile steels, has two coexisting crystal structures. The search produced an alloy made from 50 per cent iron, 30 per cent manganese and 10 per cent respectively of cobalt and chrome. According to the researchers with further improvement of the microstructure and composition, they can further enhance the strength and ductility. [TECHNICAL ARTICLE](#)

Tags: *Advanced materials, Materials science*

AUTONOMOUS SYSTEMS & ROBOTICS

Fun LoL to Teach Machines How to Learn More Efficiently

DARPA News, 26MAY2016

Current machine learning techniques result in learned concepts that aren't easily generalized to solve related problems or that can't be leveraged to learn more complex

concepts. Very little is known about the limits of what could be achieved for a given learning problem or even how such limits might be determined. DARPA recently announced its [Fundamental Limits of Learning \(Fun LoL\)](#) program. The objective of Fun LoL is to investigate and characterize fundamental limits of machine learning with supportive theoretical foundations to enable the design of systems that learn more efficiently.

Tags: *Autonomous systems & robotics, Artificial intelligence*

Making AI decision-making accountable

Science Daily, 25MAY2016

Machine-learning algorithms increasingly make decisions about credit, medical diagnoses, among other things, but exactly how they make decisions remains a mystery. Quantitative Input Influence (QII) measures developed by researchers at Carnegie Mellon University can provide the relative weight of each factor in the final decision. Generating QII measures requires access to the system, but doesn't necessitate analyzing the code or other inner workings of the system. It also requires some knowledge of the input dataset that was initially used to train the machine-learning system.

Tags: *Autonomous systems & robotics, Artificial intelligence*

COMMUNICATIONS TECHNOLOGY

Satellite communication of the future

PhysOrg.com, 01JUN2016

In disasters, rescuers usually communicate via satellite if phone and mobile telecommunication are out. But that has drawbacks: Once the data lines are overloaded, the connection disconnects. Researchers in Germany have developed a new antenna system which reliably transmits data via satellite with a high-bandwidth and which is suitable for mobile use. They have developed a special modem and changed the data processing so that the data rate changes depending on the situation.

Tags: *Communications technology, S&T Germany*

NYU WIRELESS study predicts trouble and solution for 5G cellular

EurekAlert, 25MAY2016

An international team of researchers (USA - New York University, Denmark) reports that their study suggests that the three-parameter "alpha-beta-gamma" (ABG) model used in the past by 3GPP for predicting signal coverage might spell trouble at frequencies above 6 gigahertz (GHz). They argue for a better, simpler, alternative model that uses just a single parameter, the "path loss exponent," which can be used as a global standard for predicting signal coverage. It offers greater predictive accuracy over use-cases that were never measured in the first place. [TECHNICAL ARTICLE](#)

Tags: *Communications technology*

“The important thing is not to stop questioning.” ALBERT EINSTEIN

COUNTER WMD

Amid terror threats, new hope for radiation antidote

Science Daily, 01JUN2016

A team of researchers in the US (University of Virginia, University of Pittsburgh) screened a library of more than 3,400 existing drugs, vitamins and other compounds to identify ones that might help cells withstand the effects of radiation exposure. After they identified potential leads they created 3D computer models to compare the substances' chemical structures. That analysis identified a cluster of promising compounds with similar structures.

TECHNICAL ARTICLE

Tags: Counter WMD

ENERGY

Researchers use strain to engineer first high-performance, two-way oxide catalyst

PhysOrg.com, 30MAY2016

A team of researchers at Oak Ridge National Laboratory and Argonne National Laboratory made a thin film of transition metal oxide through heteroepitaxy, which grows one material on a substrate with different lattice spacing. The lattice mismatches introduce strain into the system. The strain changed the film's electronic structure without altering its chemical composition, creating a catalyst better at driving chemical reactions. The discovery may guide the development of new material systems for electrochemistry, energy storage devices and rechargeable batteries.

TECHNICAL ARTICLE

Tags: Energy, Battery, Government S&T

New concept turns battery technology upside-down

MIT News, 25MAY2016

All previous versions of liquid batteries have relied on complex systems of tanks, valves, and pumps. The new version, proposed by researchers at MIT, replaces all that plumbing with a simple gravity-fed system. In principle, it functions like an old hourglass or egg timer, with particles flowing through a narrow opening from one tank to another. The flow can then be reversed by turning the device over. The rate of energy production can be adjusted simply by changing the angle of the device, thus speeding up or slowing down the rate of flow. TECHNICAL ARTICLE

Tags: Energy, Battery

Truck turns its own heat into power

PhysOrg.com, 25MAY2016

Researchers in Sweden have been testing semi-trucks equipped with a system that converts exhaust heat into power through thermoelectric generation. The voltage produced by the system can power the truck and reduce the strain on the engine. Some 30 percent of this unused energy is lost as heat from the exhaust pipes. A truck that generates 440kW would see about 132kW of energy disappear in the form of heat coming out of the exhaust pipes which is enough to power a typical passenger vehicle.

Tags: Energy, S&T Sweden

ENVIRONMENTAL SCIENCE

Cloud-seeding surprise could improve climate predictions

Nature News, 25MAY2016

An international team of researchers (Germany, Switzerland, Finland, UK, Austria, France, Portugal, USA - CalTech, Carnegie Mellon University, Russia, Sweden) report that molecules released by trees can seed clouds. Their study runs contrary to an assumption that the pollutant sulphuric acid is required for a certain type of cloud formation—and suggest that climate predictions may have underestimated the role that clouds had in shaping the pre-industrial climate. TECHNICAL ARTICLE 1, 2.

Tags: Environmental science, Climatology

IMAGING TECHNOLOGY

Transforming ordinary photos into clean, high-resolution 3D worlds

PhysOrg.com, 30MAY2016

Researchers in Austria are developing algorithms that can be used to generate three-dimensional worlds much more easily, using existing image data not necessarily collected for this purpose. Even the development of these worlds over time can be studied on the computer in this way. This type of software solution can be applied to a range of different fields, from archaeology to flood research.

Tags: Imaging technology

Designer nanomaterials caught by laser octopus

Nanowerk, 27MAY2016

Researchers in Germany explain how two-dimensional nanomaterials, called platelet micelles, can be identified using super resolution imaging. They report that these micelles have a highly controllable structure and are easily assembled into larger structures. The fact that they are easily functionalised, makes them a potential tool for a wider range of uses, including therapeutic applications and catalysis. [TECHNICAL ARTICLE](#)

Tags: Imaging technology, S&T Germany

Beating the limits of the light microscope, one photon at a time

PhysOrg.com, 26MAY2016

The resolving power of a traditional microscope is constrained by diffraction limit. Researchers at Colorado State University developed a method for multiphoton superresolved imaging that does not place such restrictions on the sample and allows for simultaneous super-resolved imaging of both coherent and incoherent signal light. Combined with single-element detection, this technique may allow for significant advances in multimodal multiphoton imaging of highly scattering biological tissues. [TECHNICAL ARTICLE](#)

Tags: Imaging technology

FEATURED RESOURCE**Futurism**

Futurism covers breakthrough technologies that will shape humanity's future. Our mission is to empower our readers and drive the development of these transformative technologies towards maximizing human potential. [RSS](#)

Coherent terahertz radiation created in laser plasmas

Physics World, 25MAY2016

Coherent terahertz radiation can be created using quantum-cascade lasers, but the best devices today are relatively low power. An international team of researchers (China, UK) used 30 fs-long pulses of infrared light each delivering 2 J of energy. They found that the plastic targets with microns-thick metal coatings generated about 10 times more terahertz radiation than did similar size bare plastic targets. The new technique could lead to the development of compact yet intense terahertz sources with a wide range of applications, including condensed-matter physics, biomedical imaging and even wireless communications. [TECHNICAL ARTICLE](#)

Tags: Imaging technology, Communications technology, Terahertz technology

INFORMATION TECHNOLOGY**A cross-language search engine enables English monolingual researchers to find relevant foreign-language documents**

PhysOrg.com, 30MAY2016

Researchers at MIT Lincoln Laboratory are automating language processing tasks so that the limited number of linguists available for analyzing text and spoken foreign languages can be used more efficiently. With Human Language Technology, an equivalent of 20 times more foreign language analysts are at your disposal. The research will benefit the intelligence and law enforcement communities. [TECHNICAL ARTICLE](#)

Tags: Information technology, Artificial intelligence

Automatic bug finder

MIT News, 25MAY2016

Symbolic execution is a powerful software-analysis tool that can be used to automatically locate and even repair programming bugs. A team of researchers in the US (University of Maryland, MIT) has taken an important step toward enabling symbolic execution of applications written using programming frameworks, with a system that automatically constructs models of framework libraries. Through testing, they demonstrated that their new model plugged several holes in the hand-coded one. [TECHNICAL ARTICLE](#)

Tags: Information technology

MATERIALS SCIENCE**Electrical properties of superconductor altered by 'stretching'**

Nanowerk, 27MAY2016

An international team of researchers (USA - Cornell University, Stanford University, UK, Germany) has shown the ability to alter the electrical properties of the superconductor strontium ruthenate (Sr_2RuO_4 , or SRO) through the application of strain, stretching thin films of SRO on top of a single-crystal substrate. That quality makes SRO intriguing for possible applications in quantum computation. [TECHNICAL ARTICLE](#)

Tags: Materials science

Diamonds closer to becoming ideal semiconductors

Science Daily, 25MAY2016

A team of researchers in the US (University of Wisconsin-Madison, UT Arlington) bonded a single-crystal diamond with a piece of silicon doped with boron and heated it. The boron atoms migrated from the silicon to diamond. Carbon atoms from the diamond will fill vacancies in silicon, leaving empty spots for boron atoms. This technique also allows for selective doping. The new method only works for P-type doping. [TECHNICAL ARTICLE](#)

Tags: Materials science, Semiconductors

continued...

Making some of the world's most durable materials corrosion-resistant[Science Daily, 25MAY2016](#)

An international team of researchers (USA - Drexel University, UK, Sweden) combined molybdenum-boron lattice with a double layer of aluminum to produce a material that is durable enough to resist oxidation at greater than 1400 degrees Celsius temperatures. The key to this remarkable characteristic is the material's nanolaminated structure with alternating layers of molybdenum boride and aluminum. [TECHNICAL ARTICLE](#)

*Tags: Materials science***Using solid-state materials with gold nanoantennas for more durable solar cells**[PhysOrg.com, 25MAY2016](#)

Using atomic layer deposition, an international team of researchers (Japan, Taiwan) deposited a thin film of nickel oxide onto a single crystal of titanium dioxide. Gold nanoparticles were introduced between the two layers to act like an antenna that harvests visible light. Photocurrent generation was successfully observed on the all-solid-state photoelectric conversion device. The device was found to be highly durable and stable because, unlike some solar cells, it does not contain organic components. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Solar energy***PHOTONICS****Engineers discover a new gatekeeper for light**[Nanowerk, 27MAY2016](#)

Researchers at State University of New York at Buffalo show that when you sandwich a non-periodic material between two boundary layers of material that have a periodic shape, the set-up will be transparent to certain wavelengths of light and opaque to others, and engineers can quickly alter which wavelengths are allowed through by simply moving one of the periodic boundaries. It enables the blocking of a larger range of wavelengths simultaneously than previously known effects described by Bragg's law. Applications that could take advantage of this broader "band gap" range include white light lasers and a new type of fast-switching transistor. [TECHNICAL ARTICLE](#)

*Tags: Photonics***QUANTUM SCIENCE****Quantum thermal transistor can control heat currents**[PhysOrg.com, 31MAY2016](#)

Researchers in France have designed a quantum thermal transistor that can control heat currents, in analogy to the way in which an electronic transistor controls electric current. The quantum thermal transistor can

control, amplify, and switch the heat on and off. The transistor could be used to control thermal currents in a variety of nanostructures made of quantum objects. In the future, for instance, the device could in principle be fabricated with quantum dots embedded in nanoparticles.

[TECHNICAL ARTICLE](#)*Tags: Quantum science, S&T France***Silicon quantum computers take shape in Australia**[Nature News, 24MAY2016](#)

Efforts to harness the element to build a quantum processor are taking off in Australia. One team has demonstrated a system with qubits, only in a single atom. Useful computations will require linking qubits in multiple atoms. The team is aiming for ten qubits in five years. Google and IBM are already approaching this with superconducting systems. In five years, Google plans to have ramped up to hundreds of qubits. A second group in Australia has a less robust silicon design that has already demonstrated calculations that link up two qubits, a building block that paves the way for creating more-complex devices.

*Tags: Quantum science, S&T Australia***S&T POLICY****Europe announces that all scientific papers should be free by 2020**[Science Alert, 30MAY2016](#)

The EU ministers responsible for research and innovation decided unanimously to provide open access to scientific publications on the results of research supported by public and public-private funds to everyone. It must be possible to optimally reuse research data. To achieve that, the data must be made accessible, unless there are well-founded reasons for not doing so. [Press release](#)

*Tags: S&T policy, S&T EU, Science without borders***SCIENCE WITHOUT BORDERS****Position Detector Approaches the Heisenberg Limit**[American Physical Society Spotlight, 26MAY2016](#)

Tracking the exact location of an object is important in gravitational-wave detectors and optical cooling techniques. However, quantum physics imposes certain limits on the measurement precision. Researchers in Switzerland have devised an optomechanical device that measures the displacement of a tiny vibrating bar at room temperature with an uncertainty near the so-called Heisenberg limit. The precision of the sensor is nearly 10,000 times smaller than the zero-temperature fluctuations (zero-point motion) of the bar. With some improvement, the device could enable quantum feedback protocols that allow a mechanical system to be prepared in a desired quantum state. [TECHNICAL ARTICLE](#)

*Tags: Science without borders, S&T Switzerland**continued...*

[Award-winning academic research search engine metaBUS launches in June](#)

EurekAlert, 25MAY2016

An international team of researchers (Canada, USA - University of Virginia) has coded nearly one million journal findings, dating back to 1980, into metaBUS in the fields of organizational psychology and human resources. By using metaBUS, summarizing research will now only take minutes rather than years and puts the focus on curating new knowledge rather than trying to sift through past findings. MetaBUS, to be launched in June, is free for registered users and includes some data from journal articles that are currently locked behind subscription paywalls.

Tags: Science without borders

[Has a Hungarian physics lab found a fifth force of nature?](#)

Nature News, 25MAY2016

Researchers in Hungary spotted an anomaly in radioactive decay that could be the signature of a previously unknown fifth fundamental force of nature. The theorists showed that the data didn't conflict with any previous experiments – and concluded that it could be evidence for a fifth fundamental force. Researchers should not have to wait long to find out whether a 17-MeV particle really does exist. The DarkLight experiment at the Jefferson Laboratory is designed to search for dark photons with masses of 10–100 MeV, by firing electrons at a hydrogen gas target.

Tags: Science without borders, Particle physics

SENSORS

[Novel multi-field invisible sensor designed by scientists](#)

Science Daily, 27MAY2016

Researchers in Singapore created an ideal invisible sensor by covering it with a thin shell which is made of pure copper. The shell is designed to drastically reduce the perturbation of heat flux and electric current simultaneously. The thickness of the shell is fabricated based on detailed calculations to allow precise manipulation of external multi-physical fields to insulate the sensor and hence render it invisible and yet allows it to receive incoming signals from outside. The object under camouflage becomes truly invisible as its shape and position cannot be detected in terms of both thermal and electric images.

Tags: Sensors ■

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