



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[A new form of real gold, almost as light as air](#)

Science Daily, 25NOV2016



Even when it seems unbelievable: these are genuine photographs, in which nothing has been faked. E.g. the 20 carats gold foam is lighter than milk foam. Credit: Gustav Nyström and Raffaele Mezzenga / ETH Zurich

The new gold form created by researchers in Switzerland can hardly be differentiated from conventional gold with the naked eye—

the aerogel even has a metallic shine. But in contrast to its conventional form, it is soft and malleable by hand. It consists of 98 parts air and only two parts of solid material. Of this solid material, more than four-fifths are gold and less than one-fifth is milk protein fibrils. This corresponds to around 20 carat gold. The new material could be used in many of the applications where gold is currently being used. [TECHNICAL ARTICLE](#)

Tags: [Materials science](#), [S&T Switzerland](#), [Featured Article](#)

[Physicists set quantum record by using photons to carry messages from electrons almost 2 kilometers apart](#)

PhysOrg.com, 25NOV2015

To ensure that the correlation could be preserved over long distances, an international team of researchers (USA - Stanford University, UK, Japan, Germany) created a time-stamp to correlate arrival time of the photon with the electron spin, mediated “two-photon interference to entangle the photons and passed the photons through a “quantum down-converter,” which matched their wavelengths. The down-converter also shifted both photons to a wavelength that can travel farther within the fiber optic cables designed for telecommunications. [TECHNICAL ARTICLE](#)

Tags: [Communications technology](#), [Quantum science](#), [Featured Article](#)

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[New process could be white lightning to electronics industry](#)

Science Daily, 01DEC2015

A team of researchers in the US (Oak Ridge National Laboratory, New Mexico State University) has made high-quality layers of white graphene, hexagonal boron nitride, they believe can be cost-effectively scaled up to large production volumes. It has better transparency, is chemically inert, atomically smooth, has high mechanical strength and thermal conductivity, and it is an electrical insulator. Graphene on a white graphene substrate features several thousand times higher electron mobility than graphene on other substrates. That feature could enable data transfers that are much faster than what is available today. [TECHNICAL ARTICLE](#)

Tags: [Advanced manufacturing](#), [Government S&T](#)

ADVANCED MATERIALS

[Photonic ‘sintering’ may create new solar, electronics manufacturing technologies](#)

PhysOrg.com, 01DEC2015

Photonic sintering is one way to deposit nanoparticles in a controlled way and then join them together. With the concepts outlined in the new study by researchers at Oregon State University, the door is open to precise control of temperature with smaller nanoparticle sizes. An inherent “self-damping” effect was identified that has a major impact on obtaining the desired quality of the finished film. The new understanding could lead to many new advances in solar cells, flexible electronics, various types of sensors and other high-tech products printed onto something as simple as a sheet of paper or plastic. [TECHNICAL ARTICLE](#)

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

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New phase of carbon discovered: Making diamonds at room temperature

Science Daily, 30NOV2015

Researchers from North Carolina State University have discovered a new phase of solid carbon, called Q-carbon, which is distinct from the known phases of graphite and diamond and is ferromagnetic. Q-carbon's strength and low work-function make it very promising for developing new electronic display technologies. It can also be used to create a variety of single-crystal diamond objects.

TECHNICAL ARTICLE

Tags: Advanced materials

Nanocrystals convert infrared light into visible light

Nanotechweb, 27NOV2015

Researchers at MIT report that a hybrid, solid-state film made up of two non-conventional semiconductors (organic molecules and colloidal nanocrystals) can convert infrared light into visible light at modest light intensities of around just 120 "suns". Their materials could be used to improve silicon-based solar cells and cameras.

TECHNICAL ARTICLE

Tags: Advanced materials

'Material universe' yields surprising new particle

Princeton University, 25NOV2015

An international team of researchers (Switzerland, USA - Princeton University, China) has predicted the existence of a new type of particle called the type-II Weyl fermion in metallic materials. When subjected to a magnetic field, the materials containing the particle act as insulators for current applied in some directions and as conductors for current applied in other directions. This behavior suggests a range of potential applications, from low-energy devices to efficient transistors. **TECHNICAL ARTICLE**

Tags: Advanced materials

New 'self-healing' gel makes electronics more flexible

Science Daily, 25NOV2015

An international team of researchers (China, USA - UT Austin) has created a self-healing gel by combining two gels: a self-assembling metal-ligand gel that provides self-healing properties and a polymer hydrogel that is a conductor. The gel has high conductivity and strong mechanical and electrical self-healing properties. It may be possible to glue or paste the gel to junctions so that the circuits could be more robust and harder to break.

TECHNICAL ARTICLE

Tags: Advanced materials, Materials science

AUTONOMOUS SYSTEMS & ROBOTICS

Computer scientists achieve breakthrough in pheromone-based swarm communications in robots

PhysOrg.com, 26NOV2015

Researchers in the UK have produced a novel artificial pheromone system that is reliable, accurate and only uses 'off-the-shelf' components. The new system called COS-phi (Communication System via Pheromone) consists of a low-cost open-hardware micro robot and an open-source localization system, which tracks the robots' trajectories and releases the artificial pheromone.

Tags: Autonomous systems & robotics

Researchers Teaching Robots How to Best Reject Orders from Humans

IEEE Spectrum, 19NOV2015

Researchers at Tufts University are trying to figure out how to develop mechanisms for robots to reject orders that it receives from humans, as long as the robots have a good enough excuse for doing so. The overall goal here is not just to teach robots when they should (and should not) follow orders, but also to provide a framework within which the robot is able to effectively communicate why it rejected an order. **TECHNICAL ARTICLE**

Tags: Autonomous systems & robotics

COMMUNICATIONS TECHNOLOGY

Researchers confirm 'realistic' answer to quantum network puzzle

PhysOrg.com, 19NOV2015

An international team of researchers (UK, Canada, USA - MIT, Denmark) reports that they have compared the state of the art in continuous variable systems (optical modes) with the standard discrete variable systems (qubits). To build a metropolitan network based on quantum cryptography you need a high-rate super-fast connection otherwise you can't compete with the classical communication infrastructure. Continuous variable systems offer the best and cheapest technology for reaching high rates over metropolitan distances and they can work at room temperature. **TECHNICAL ARTICLE**

Tags: Communications technology, Quantum science

CYBER SECURITY

How to identify cyberattacks early and limit damage

Federal Computer Week, 23NOV2015

According to a report released by the Ponemon Institute, adversaries have been so successful at implementing agile, almost hydra-headed attack patterns that an average of 35 percent of all cyberattacks go undetected. Applying real-time predictive and behavioral analytics to

“In the modern world, one of the best ways you can back business is by backing science.” **GEORGE OSBORNE**

all available enterprise and external data can help federal organizations evaluate potential threats, detect likely attacks and gather further intelligence, thereby mitigating threats before significant loss occurs.

Tags: Cyber security

ENERGY

New high-capacity battery goes with the flow

[Physics World, 27NOV2015](#)

Researchers in Singapore have developed a new type of redox-flow battery in which the cathodic tank contains lithium-iron-phosphate granules and the anodic tank contains granules of titanium dioxide. When the battery is charged, the lithium ions are transported into the reaction vessel. When the battery is discharged, the reaction runs in reverse, returning the lithium to the cathode. Because lithium is stored in solid form in both of the charged and discharged states of the battery, the energy density of the new lithium-flow battery is about 500 Wh/l. This is around 10 times that of a vanadium redox battery. [TECHNICAL](#)

[ARTICLE](#)

Tags: Energy, Battery

Adding sodium produces material that is most efficient at converting heat to electricity

[PhysOrg.com, 26NOV2015](#)

Semiconducting materials, such as silicon, have only one conduction band to work with for doping, but tin selenide is unusual and has multiple bands. An international team of researchers (China, USA - Northwestern University, University of Michigan, CalTech) showed they could use sodium to access these channels and send electrons quickly through the material, driving up the heat conversion efficiency. The discovery could lead to new thermoelectric devices with potential applications in the automobile industry, glass- and brick-making factories, refineries, coal- and gas-fired power plants, and places where large combustion engines operate continuously, such as in large ships and tankers. [TECHNICAL ARTICLE](#)

Tags: Energy, Advanced materials, Materials science

Researcher suggests storing solar energy underground for a cloudy day

[PhysOrg.com, 24NOV2015](#)

A team of researchers in the US (Stanford University, UC Berkeley) has produced a series of plans, based on huge amounts of data churned through computer models, showing how each state in America could shift from fossil fuel to entirely renewable energy. The proposed system relies on the ability to store and retrieve heat, cold and electricity in order to meet demand at all times. [TECHNICAL](#)

[ARTICLE](#)

Tags: Energy

INFORMATION TECHNOLOGY

New advanced computing systems under investigation

[Science Daily, 17NOV2015](#)

Researchers in the EU are studying how to improve the development of advanced computing systems to create faster software under the auspices of RePhrase, a new research project from the European Union Horizon 2020 program. The new techniques will make it possible to improve applications such as industrial manufacturing processes and railway traffic monitoring, as well as the diagnosis of mental illnesses.

Tags: Information technology

MATERIALS SCIENCE

Totally repellent: Quick and easy coating process makes surfaces omniphobic

[PhysOrg.com, 27NOV2015](#)

Researchers at UMass Amherst have developed a simple method for the production of SOCAL surfaces (SOCAL = slippery, omniphobic, covalently attached liquid) which contains a siloxane monomer ($\text{Me}_2\text{Si}(\text{OMe})_2$) and sulfuric acid in isopropanol. When an object is dipped in the liquid, a thin film of liquid forms on the surface and polymerizes as it dries. The firmly anchored coating is very homogenous. Both aqueous and organic liquids roll off of coated slides without leaving a trace. [TECHNICAL ARTICLE](#)

Tags: Materials science

Turning metals into insulators and back again

[Nanowerk, 25NOV2015](#)

A laser pulse gives energy to electrons in the superconductor, making “holes” in the material that transform it into a metallic conductor. However, researchers in Japan found that shortly after the light pulse, the material actually became less conductive. By using multiple laser pulses it was possible to rapidly switch the superconductor between its conducting and insulating states. The technique is useful for making ultrafast optoelectronic devices for advanced computing applications. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T Japan

Nanomagnets: Creating order out of chaos

[Science Daily, 23NOV2015](#)

Researchers in Germany have fabricated nanomagnets in a wafer-thin layer of iron-aluminum for the first time without the use of masks. Using a highly focused ion beam as a magnetic stylus, they generated prototypes of complex magnetic geometries. The nanomagnets are embedded in an electrically conductive layer which facilitates the development of spintronic components. They successfully

continued...

imaged the ion-generated magnets, revealing their suitability for device applications. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T Germany

NEUROSCIENCE

[How does our brain form creative and original ideas?](#)

Science Daily, 19NOV2015

Researchers in Israel hypothesized that for a creative idea to be produced, the brain must activate a number of different -- and perhaps even contradictory -- networks. They found increased brain activity in an “associative” region among participants whose originality was high. For the answer to be original, the administrative control region worked in collaboration with the associative region.

Tags: Neuroscience

FEATURED RESOURCE

[SciCentral](#)

Breaking research news from the most reputable and reliable sources. Only content freely accessible to online readers is considered.

PHOTONICS

[Tapping particles of light](#)

Nanowerk, 30NOV2015

Researchers in Israel have managed to ‘pluck’ a single photon out of a pulse of light. Their mechanism relies on a physical effect that they call single-photon Raman interaction, or SPRINT, which is based on a single atom, or atom-like system. SPRINT is completely passive -- it does not require any control fields, just the interaction between the atom and the optical pulse. The atom becomes a tap rather than a switch, snatching one photon from the flow and then turning itself off. Single photons are likely to be the backbone of future quantum communication systems. [TECHNICAL ARTICLE](#)

Tags: Photonics, Quantum science

QUANTUM SCIENCE

[Scientists design a QKD-based quantum private query with no failure](#)

PhysOrg.com, 30NOV2015

Researchers in China proposed a new Quantum private query (QPQ) protocol based on the differential phase-shift (DPS) quantum key distribution (QKD). Their research revealed that it is the randomness in the dilution of the oblivious key, one of the main processes in such protocols

that caused the possible failure of previous QKD-based QPQ. By utilizing the features of DPS, their protocol successfully avoids the process of dilution. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology, S&T China

[Quantum insulation](#)

Nanowerk, 25NOV2015

In experimental and theoretical work, researchers at the University of Maryland show that two physical phenomena, localization and ergodicity-breaking, are conjoined. This exotic phase of matter provides one scenario for the localization transition of a quantum system. Since thermalization is one of the leading causes of quantum decoherence, exploiting non-ergodic systems—whether the constituent particles were localized or extended—might help in the storage of quantum information. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology

[Enroute to a quantum computer](#)

Nanowerk, 24NOV2015

An international team of researchers (Germany, USA - Los Alamos National Laboratory, Stanford University) was able to probe the various mechanisms that lead to the loss of quantum information and show that stored information can nevertheless be maintained by applying external magnetic fields. Semiconductor based approaches can be integrated perfectly into semiconductor devices such as those used in optoelectronics and classical information technologies. They can be controlled optically with the help of ultrafast lasers and also controlled and switched using voltage pulses.

[TECHNICAL ARTICLE](#)

Tags: Quantum science

[Quantum algorithms: an overview](#)

arXiv, 13NOV2015

Researchers in the UK briefly survey known quantum algorithms, with an emphasis on a broad overview of their applications rather than their technical details. They include a discussion of recent developments and near-term applications of quantum algorithms. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T UK

[Quantum Memristors](#)

arXiv, 06NOV2015

An international team of researchers (Spain, USA - UC San Diego) introduces the concept of a quantum memristor as a quantum dissipative device, whose decoherence mechanism is controlled by a continuous-measurement feedback scheme, which accounts for the memory. They provide numerical simulations showing that memory effects actually persist in the quantum regime. The quantization method, specifically designed for superconducting circuits, may be extended to other quantum platforms, allowing for memristor-type constructions in different quantum technologies. [TECHNICAL ARTICLE](#)

Tags: Quantum science

S&T POLICY

UK science funding protected from cuts

Physics World, 26NOV2015

UK's science budget will be protected in real terms until 2020, dispelling fears among many scientists that it would be cut. The government re-affirmed that the UK will invest a further £6.9bn in capital spending on science over the course of the parliament, which runs until 2020. The government claims that by inflation-proofing the budget, the total spend on science will be more than £500m higher by 2020 than in 2015.

Tags: *S&T policy, S&T UK*

Next-generation fuel cells are ready for low-emission electricity production

R&D Magazine, 25NOV2015

The key development areas of the INNO-SOFC project funded by the EU are to address the short service life and high price of fuel cell technology which have hindered their widespread adoption. Compared with competing systems, for example generators powered by a combustion engine, fuel cell systems exhibit a high efficiency level, low emissions, low noise and low vibration levels.

Tags: *S&T policy, Battery, Energy, S&T EU*

China may have made breakthroughs with aircraft carrier electromagnetic launch and railgun technology

Next Big Future, 23NOV2015

An early November 2015 news broadcast stated that Chinese researchers have made breakthroughs in electromagnetic aircraft launch systems (EMALS) and railguns, in areas from power storage to tougher barrel materials. EMALS catapults could be installed on Chinese aircraft carriers in the next decade, improving the performance of Chinese naval aircraft. It is suggested that the PLAN hopes to test its own operational railgun in the next couple of years.

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

SCIENCE WITHOUT BORDERS

Liquid acoustics half way to the earth's core

Science Daily, 24NOV2015

An international team of researchers (Japan, UK) has succeeded in measuring the speed of sound in mixtures of liquid iron and carbon in extreme conditions, allowing limits to be set on the core composition. The research suggests that only about 1.2% of the core, by weight, is carbon. There must also be some other light elements, such as silicon, oxygen, sulfur or hydrogen. TECHNICAL ARTICLE

Tags: *Science without borders*

SENSORS

Nano-antennas assist in improving spatial resolution of terahertz microscopy

Nanowerk, 25NOV2015

To advance resolution capabilities of near-field scanning probe microscopy with terahertz waves, researchers in the UK developed a nano-scale structure, consisting of an array of optical nano-antennas and a distributed Bragg reflector. When illuminated by a short optical pulse, this structure traps optical photons within a small region and activates a small terahertz detector, which allows sampling terahertz waves on the scale over 100 times smaller than the terahertz wavelength. They monolithically integrated the terahertz detector with sub-wavelength scale apertures, as small as 2 μm , creating high-resolution near-field terahertz probes. TECHNICAL ARTICLE

Tags: *Sensors, Terahertz technology*

'Intelligent' quantum sensor detects weak magnetic fields

Nanotechweb, 23NOV2015

An international team of researchers (the Netherlands, Australia, UK) has made the first "intelligent" quantum sensor based on the spin of a single electron trapped in a diamond nitrogen-vacancy centre. The device can measure magnetic fields at the very limits allowed by quantum physics, and if made to work at room temperature could be used to rapidly image the structure of single molecules, something that will be useful for medical diagnostics or developing new pharmaceuticals. It may also be able to map the weak magnetic fields generated by currents in micro and nanoelectronics devices, which could help in the design of better integrated circuits. TECHNICAL ARTICLE

Tags: *Sensors, Quantum science* ■

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