Volume 6, Issue 10 ■ 4MAR2016

S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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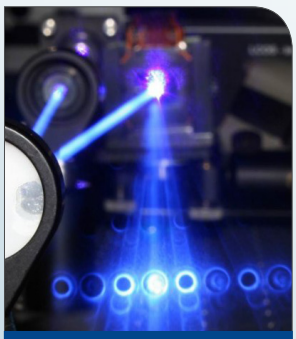
FEATURE ARTICLES

Three 'twisted' photons in three dimensions

Science Daily, 28FEB2016



Long-exposure photo of laser beams with a twisted wave-front. The beams have holes in the middle due to destructive interference at the center of the twists. Credit: Copyright: Faculty of Physics, University of Vienna

An international team of researchers (Austria, Spain, Switzerland) created a three-photon entangled state by combining two pairs of high-dimensionally entangled photons in such a manner that it became impossible to ascertain where a particular photon came from. Besides serving as a test bed for studying many fundamental concepts in quantum mechanics, multi-photon entangled states have applications ranging from quantum computing to quantum encryption. They have developed a new type of quantum cryptographic protocol using their state that allows different layers of information to be shared asymmetrically among multiple parties with unconditional security. TECHNICAL ARTICLE

Tags: Quantum science, Featured Article

Metallic Mesh Becomes Invisible to Antenna Signals

IEEE Spectrum, 16FEB2016

An international team of researchers (China, USA - MIT) created a sheet of metallic mesh consisting of arrays of tiny copper cubes all connected together by thin, square-shaped copper rods. The copper array was sandwiched between two polysulfone covers that act as a dielectric material coating, creating a solid slab of material. The new material has freedom and flexibility for antenna designs by providing support functions without concerns about affecting the antenna signal. A radome made from the "invisible" mesh could even selectively allow the antenna or radar signals to pass through while screening out other electromagnetic signals. TECHNICAL ARTICLE

Tags: Advanced materials, Sensors, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

Physicist discovers new 2-D material that could upstage graphene

Science Daily, 29FEB2016

Developed by an international team of researchers, the new material (Greece, Germany, USA - University of Kentucky) is made up of silicon, boron and nitrogen—all light, inexpensive and abundantly available elements—and is extremely stable. The material is metallic, but can be made semiconducting easily by attaching other elements on top of the silicon atoms. TECHNICAL ARTICLE

Tags: Advanced materials

Stretchable electronics that quadruple in length (w/video)

Nanowerk, 29FEB2016

Researchers in Switzerland developed stretchable biphasic conductors by physical vapor deposition of gallium onto an alloying metal film. The properties of the photolithography-compatible thin metal films are highlighted by low sheet resistance (0.5 Ω sq−1) and large stretchability (400%). This novel approach to deposit and pattern liquid metals enables extremely robust, multilayer and soft circuits, sensors, and actuators. It is ideal for artificial skin on prosthetics. TECHNICAL ARTICLE

Tags: Advanced materials, S&T Switzerland

Pulling water from thin air

Nanowerk, 25FEB2016

The new system, developed by researchers at Harvard University, was inspired by the bumpy shell of desert beetles, the asymmetric structure of cactus spines and slippery surfaces of pitcher plants. The material harnesses the power of these natural systems, plus Slippery Liquid-Infused Porous Surfaces technology (SLIPS) to collect and direct the flow of condensed water droplets. This approach is promising not only for harvesting water but also for industrial heat exchangers. TECHNICAL ARTICLE

Tags: Advanced materials, Biomimetics

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Quantum dot solids: This generation's silicon wafer?

Science Daily, 25FEB2016

Researchers at Cornell University have fashioned two-dimensional superstructures out of single-crystal building blocks. Through a pair of chemical processes, the lead-selenium nanocrystals are synthesized into larger crystals, then fused together to form atomically coherent square superlattices. The electrical properties of these superstructures potentially are superior to existing semiconductor nanocrystals, with anticipated applications in energy absorption and light emission. TECHNICAL ARTICLE

Tags: Advanced materials, Microelectronics

Breakthrough for lab-on-a-chip material

PhysOrg.com, 24FEB2016

Researchers in Sweden developed the off-stoichiometry thiol-enes (OSTE) polymer to meet the need for a material suitable for both experimental prototyping and large-scale manufacturing of labs-on-a-chip. Upon exposure to UV light, the molecules of the polymer arrange themselves in a manner that significantly enhances photostructuring. The technology opens new possibilities for medical diagnostics, biophotonics and 3D printing. TECHNICAL ARTICLE

Tags: Advanced materials, Biotechnology, S&T Sweden

AUTONOMOUS SYSTEMS & ROBOTICS

Automatic programming makes swarm robots safer and more reliable

Science Daily, 25FEB2016

An international team of researchers (UK, Brazil) applied an automated programming method to experiments using up to 600 of their 900-strong robot swarm. The program uses a form of linguistics. The robots use their own alphabet to construct words, with the 'letters' of these words relating to what the robots perceive and to the actions they choose to perform. The supervisory control theory helps the robots to choose only those actions that eventually result in valid 'words'. Hence, the behaviour of the robots is guaranteed to meet the specification. TECHNICAL ARTICLE

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

Chemists combine biology, nanotechnology to create alternate energy source

Nanowerk, 29FEB2016

A team of researchers in the US (Syracuse University, Connecticut College) have demonstrated high-efficient energy transfer between semiconductor quantum rods and luciferase enzymes which are biomaterials. When combined correctly, these materials produce green, orange, red, or near-infrared color bioluminescence. Controlling the enzyme location and bioluminescence polarization may lead to novel 'light switches.' TECHNICAL ARTICLE

Tags: Biotechnology

Microrobots learn from ciliates

Nanowerk, 25FEB2016

An international team of researchers (Germany, UK, Switzerland, Italy) has built a ciliate-inspired model using a material that combines the properties of liquid crystals and elastic rubbers, rendering the body capable of self-propelling upon exposure to green light. The light-powered materials take the form of tiny medical assistants at the end of an endoscope. TECHNICAL ARTICLE

Tags: Biotechnology, Biomimetics

Nano-hinge—lubricated by light

PhysOrg.com, 25FEB2016

An international team of researchers (Germany, Japan, USA - Ohio University) have now presented a possible component which could be used to specifically move and control a nanomachine. They have developed a nanoplasmonic system in the form of a pair of scissors that they can open using UV light. As soon as they irradiate the nanostructure with visible instead of UV light, it closes again. TECHNICAL ARTICLE

Tags: Biotechnology, Materials science

BREAKTHROUGH TECHNOLOGY

Focus: Landmarks—The Charming Debut of a New Quark

American Physical Society Focus, 26FEB2016

Landmarks articles feature important papers from the archives of the Physical Review journals.

Tags: Breakthrough technology, Science without borders

COMMUNICATIONS TECHNOLOGY

Wi-Fi achieved at 10,000 times lower power

Science Daily, 23FEB2016

Researchers at the University of Washington decoupled the digital and analog operations involved in radio transmissions. The Passive Wi-Fi architecture assigns the analog, power-intensive functions to a single device in the network that is plugged into the wall. An array of sensors produces Wi-Fi packets of information using very little power by simply reflecting and absorbing that signal using a digital switch. The technology could enable entirely new types of communication.

Tags: Communications technology, Information technology

CYBER SECURITY

Device 'fingerprints' could help protect power grid, other industrial systems

EurekAlert, 28FEB2016

Researchers at the Georgia Institute of Technology propose

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"My favorite things in life don't cost any money. It's really clear that the most precious resource we all have is time." STEVE JOBS

two device type fingerprinting methods designed to augment existing intrusion detection methods in industrial control system environments. The first method measures data response processing times to develop accurate fingerprints, while the second method uses the physical operation times to develop a unique signature for each device type. The technique could help address the unique security challenges of the electrical grid and other cyber-physical systems. The approach has been successfully tested in two electrical substations. TECHNICAL ARTICLE

Tags: Cyber security

ENERGY

Proven one-step process converts CO2 and water directly into liquid hydrocarbon fuels

EurekAlert, 22FEB2016

Researchers at UT Arlington demonstrated that the one-step conversion of carbon dioxide and water into liquid hydrocarbons and oxygen can be achieved in a photothermochemical flow reactor operating at 180 to 200 C and pressures up to 6 atmospheres. The hybrid photo-chemical and thermochemical catalyst used for the experiment was based on titanium dioxide. TECHNICAL ARTICLE

Tags: Energy

FORECASTING

Researchers grow cyberforests to predict climate change

Science Daily, 24FEB2016

Researchers at Washington State University have developed a computer simulation called LES that grows realistic forests down to the branches, leaves and roots of individual trees. They are using the simulation to determine how drought, warmer weather, more frequent wildfires and other climate-related changes will affect forests across North America. They have already used the computer model to predict increases in fire rates and plant growth in Quebec hardwood forests due to rising CO2 levels and warmer temperatures. TECHNICAL ARTICLE

Tags: Forecasting, Climatology, Simulation and modeling

INFORMATION TECHNOLOGY

World's first parallel computer based on biomolecular motors

PhysOrg.com, 26FEB2016

An international team of researchers (USA - UC Berkeley, UK, Sweden, Germany, the Netherlands, Canada) reports that a new parallel-computing approach based on a combination of nanotechnology and biology can solve combinatorial problems. The approach is scalable, error-tolerant, energy-efficient, and can be implemented with existing technologies. TECHNICAL ARTICLE

Tags: Information technology

MATERIALS SCIENCE

Artificial control of exciplexes opens possibilities for new electronics

Nanowerk, 26FEB2016

Researchers in Japan were able to widely vary the emission color and efficiency of organic light-emitting diodes based on exciplexes simply by changing the distance between key molecules in the devices by a few nanometers. This new way to control electrical properties by slightly changing the device thickness instead of the materials could lead to new kinds of organic electronic devices with switching behavior or light emission that reacts to external factors. TECHNICAL ARTICLE

Tags: Materials science, S&T Japan

Beyond invisibility—engineering light with metamaterials

PhysOrg.com, 26FEB2016

Engineers are now creating metamaterials with dynamic response, meaning its properties can be "tuned" depending on how much electricity is passing through it, or what light is aimed at it. The same mathematics that predicts the structure needed to produce these effects for light can be applied to the interaction of materials with any type of waves. A group in Germany has successfully created a thermal cloak, preventing an area from heating by bending the heat flow around it.

Tags: Materials science, Metamaterials

New molecular property may mean more efficient solar and opto-electronic devices

Science Daily, 25FEB2016

Researchers at UMass Amherst report that they have identified directional intrinsic charge separation, in crystalline nanowires of an organic semiconductor known as 7,8,15,16-tetraazaterrylene (TAT). The structure will make it easier to use this molecule for new applications such as in devices that use polarized light input for optical switching. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

Physicists promise a copper revolution in nanophotonics

Science Daily, 25FEB2016

It was previously believed that only gold and silver components have the required properties for use in nanophotonic

continued...

and plasmonic components. Now an international team of researchers (Russia, Denmark) has experimentally demonstrated that copper nanophotonic components can operate successfully in photonic devices. The fabrication process is compatible with the CMOS technology, which is the basis for all modern integrated circuits. TECHNICAL ARTICLE

Tags: Materials science

Team offers new, simpler law of complex wrinkle patterns

PhysOrg.com, 25FEB2016

An international team of researchers (USA - UMass Amherst, UK) describes a more general law for predicting the wavelength of complex wrinkle patterns, including those found on curved surfaces, plus experimental results to support it. The work is expected to help materials scientists to use wrinkles to sculpt surface topography, or to use the wrinkles on surfaces to infer the properties of the underlying materials such as textiles and biological tissues. TECHNICAL ARTICLE

Tags: Materials science

How to make electrons behave like a liquid

Nanowerk, 22FEB2016

An international team of researchers (USA - MIT, Israel, Russia) found that electrons can sometimes cooperate to turn resistance on its head, producing vortices and backward flow of electric current. One surprising implication of this work is that heat can ride atop of charge flow and propagate in a wave-like fashion much faster than under ordinary conditions—perhaps as much as 10 to 100 times faster. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

Featured Resource

Kurzweil AI

Leading visionaries represented on this site cover and examine the trends that are profoundly impacting science, economics, the arts, politics, government, warfare, medicine, health, education, disabilities, behavior, and society. RSS feeds

MEDICAL SCIENCES

Zeroing in on 'super spreaders,' other hidden patterns of epidemics

Science Daily, 25FEB2016

A team of researchers in the US (Emory University, NIH) proposes a framework that moves beyond investigations of single sources of heterogeneity and accounts for the complex couplings between conditions that have potential synergistic impacts on disease transmission. This framework aims to uncover whether there is a hidden, unified process underlying the significant levels of heterogeneity for any infectious disease. TECHNICAL ARTICLE

Tags: Medical Sciences

PHOTONICS

New laser achieves wavelength long sought by laser developers

Science Daily, 24FEB2016

Researchers in the UK have created a new kind of laser capable of pulsed and continuous mid-infrared (IR) emission between 3.1 and 3.2 microns, a spectral range that has long presented a major challenge for laser developers. The achievement could aid in the development of new uses for mid-IR lasers, which are currently used in applications such as spectroscopy, environmental sensing and detecting explosives. TECHNICAL ARTICLE

Tags: Photonics, S&T UK

QUANTUM SCIENCE

Upper limit found for quantum world

PhysOrg.com, 26FEB2016

The quantum world and our world of perception obey different natural laws. Because the laws are completely different in both worlds, a clear boundary might exist between them. According to a certain quantum mechanical model, you can describe a particle's position with a probability distribution that sometimes spontaneously collapses. An international team of researchers (Italy, the Netherlands) has determined an upper limit on these parameters of 31 collapses per year per atomic mass unit with a margin around 10 nanometers, to 1 collapse per 100 years with a margin of 1 micron. TECHNICAL ARTICLE

Tags: Quantum science, Science without borders

Drive-Thru Quantum Gate

American Physical Society Spotlight, 24FEB2016

Trapped ions are promising qubit candidates. However, for standard gate techniques, a major problem is generating identical gate operations for ions at different locations in a larger trap array. Researchers in Switzerland have now demonstrated a possible solution: use the "mobility" of the ions to pass them through a static laser beam that acts as a logic gate. By reflecting the laser beam with mirrors, the team simultaneously performed chosen gate operations on two trapped ions. TECHNICAL ARTICLE

Tags: Quantum science, S&T Switzerland

S&T POLICY

Three Ontario universities receive funding to create Advanced Manufacturing Consortium

EurekAlert, 25FEB2016

The consortium of three universities in Canada is meant to advance manufacturing in the broadest sense, including in

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emerging sectors like next-generation additive manufacturing, digital components and devices, across a variety of sectors with the potential to make significant impact on a global scale. The three partner institutions have already established a significant critical mass of infrastructure, talent and know-how.

Tags: S&T policy, Advanced manufacturing, S&T Canada

SCIENCE WITHOUT BORDERS

Future generations

Nature, 24FEB2016

A special issue examines whether researchers today consider the world of tomorrow—and why they should. As we change our planet, ourselves and, potentially, our descendants, in ever more dramatic ways, this issue of Nature takes stock: do we have the brains and the tools to understand and account for the future and, if not, what should be done?

Tags: Science without borders

Negative citations important to scientific progress should be tracked, says new study

Science Daily, 23FEB2016

According to an international team of researchers (USA - MIT, Georgia Institute of Technology, Canada) negative citations are not necessarily a bad thing. Tracking those citations can reveal where there is particular "vitality" in a research area, especially when there is controversy among scientists active in it. On the one hand, it might be that a particular study is just of poor quality and reliability, on the other hand, maybe it is good science that can be improved and so criticisms are more constructive. That's the way science evolves and becomes better. TECHNICAL ARTICLE

Tags: Science without borders, Bibliometrics ■

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