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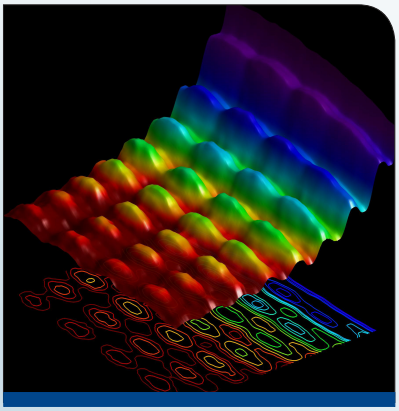
S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

FEATURE ARTICLES

The first ever photograph of light as both a particle and wave



PhysOrg.com, 02MAR2015

An international team of researchers (Switzerland, USA) spatiotemporally overlapped electron and light pulses on a single nanowire suspended on a graphene film. The resulting energy exchange between single electrons and the quanta of the photoinduced near-field is imaged synchronously with its spatial interference pattern. This methodology enables the control and visualization of plasmonic fields at the nanoscale, providing a promising tool for understanding the fundamental properties of confined electromagnetic fields and the development of advanced photonic circuits. TECHNICAL ARTICLE

Tags: Quantum science, Photonics, Featured Article

Quantum radar to detect objects which are invisible to conventional systems

Science Daily, 27FEB2015

An international team of researchers (Germany, USA, Canada, Italy, UK) found that a special converter—a double-cavity device that couples the microwave beam to an optical beam using a nano-mechanical oscillator—was the key to the new system. The device can either generate microwave-optical entanglement or convert a microwave into an optical beam. It can detect objects of low reflectivity, such as cancer cells or aircraft, with a stealth capability. TECHNICAL ARTICLE

Tags: Imaging technology, Sensors, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

Critical raw materials: the search for nanotechnology substitutes in catalysis, electronics and photonics

Nanowerk, 27FEB2015

Earlier this month, four EU projects working on substitution in catalysis, electronics and photonics presented their work at the Third Innovation Network Workshop on substitution of Critical Raw Materials hosted by the CRM_INNONET project in Brussels. The four projects are: NOVACAM, FREECATS, HARFIR, IRENA

Tags: Advanced materials, S&T EU

AUTONOMOUS SYSTEMS & ROBOTICS

Video Friday: AI Arcade, iCub on One Leg, and Robot Head in Your Kitchen

IEEE Spectrum, 27FEB2015

In a presentation at the World Economic Forum, Ken Goldberg, who knows a thing or two about robots, discusses the idea of humans and machines collaborating on making better decisions.

Tags: Autonomous systems & robotics

COMMUNICATIONS TECHNOLOGY

New filter could advance terahertz data transmission

Science Daily, 27MAR2015

Researchers at the University of Utah have discovered a new approach for designing filters capable of separating different frequencies in the terahertz spectrum, the next generation of communications bandwidth that could allow cellphone users and Internet surfers to download data a thousand times faster than today. Once the filter is designed, it can be fabricated using an off-the-shelf inkjet printer. TECHNICAL ARTICLE

Tags: Communications Technology, Terahertz technology

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'Slow motion at the speed of light'

PhysOrg.com, 02MAR2015

A team of researchers in the US (UC Los Angeles, University of Arizona) has developed a new technology capable of monitoring streaming data traffic in real time and taking action before interruptions occur. The system has achieved real-time data acquisition and processing at a record 1.2 terabits per second, about 10 times faster than currently available technology.

Tags: Communications Technology, Information technology

Researchers have achieved wireless speeds of 1 Tb per second

Science Alert (Australia), 27FEB2015

Researchers at the University of Surrey in England have achieved 5G speeds of 1 Terabit per second over 100 metres in the lab - by far the fastest wireless connection to date. The 5G mobile network will eventually replace our current 4G technology, with its comparatively poxy speeds of around 15 Mbps, and it is hoped that it will revolutionise how we use mobile devices.

Tags: Communications Technology, S&T UK

Study of atmospheric 'froth' may help GPS communications

PhysOrg.com, 27FEB2015

An international team of researchers (USA, Canada) compared turbulence in the auroral region to that at higher latitudes and gained insights that could have implications for the mitigation of disturbances in the ionosphere. One of the key findings is that there are different kinds of irregularities in the auroral zone compared to the polar cap. They found that the effects on radio signals will be different in these two locations. TECHNICAL ARTICLE

Tags: Communications Technology, Government S&T, NASA

CYBER SECURITY

QR codes with advanced imaging and photon encryption protect computer chips

Science Daily, 27MAR2015

The code, developed by researchers at the University of Connecticut, can be scaled as small as microns or a few millimeters and would replace the electronic part number that is currently stamped on most microchips. They applied an optical imaging "mask" that scrambles the QR code design into a random mass of black-and-white pixels. They added yet another layer of security through a random phase photon-based encryption. TECHNICAL ARTICLE

Tags: Cyber security

Ensuring security for networks of the future

EurekAlert, 27FEB2015

Researchers in Germany will be showing how to make SDN secure at the CeBIT trade fair in Hannover, Germany. They will show how SDN and all related components can be monitored. One of these components is visualization software, which displays the network's individual components and depicts in real time how the various applications are communicating with the controller. For example, it can show how software influences the behavior of different components in the case of an attack and how it disrupts them.

Tags: Cyber security, S&T Germany

ENERGY

Electrochemical 'fingers' unlock battery's inner potential

Nanowerk, 27FEB2015

A team of researchers in the US (Brookhaven National Laboratory, MIT, SLAC, Stony Brook University, Cornell University, Colorado School of Mines, Lawrence Berkeley Laboratory) has mapped atomic-scale reaction pathways and linked them to the battery's rate of discharge. Their model system reveals the crucial interplay between discharge rate and the lithiation pattern. The subtle patterns can help to develop superior battery architectures that accelerate lithiation penetration and improve overall performance.

Tags: Energy, Battery, Government S&T

The biobattery: Turning sewage sludge into electricity and engine oil

Science Daily, 27FEB2015

The biobattery developed by researchers in Germany is modular and consists of a pool of environmentally-friendly technologies such as biogas plants, thermal storage, carburetors and engines to produce electricity. The heart of the concept is thermo-catalytic reforming. With this, the experts convert carbons out of organic material. If further processed, they even provide basic substances for the chemical industries.

Tags: Energy, S&T Germany

IMAGING TECHNOLOGY

The super-resolution revolution

PhysOrg.com, 27FEB2015

Researchers in the UK have built the first 3D super-resolution microscope of its kind in Europe. They are using the machine to watch the organisation of cell-surface proteins at the point when an immune cell is triggered into action. They can work with normal levels of up to 10,000 proteins at a time on the cell surface. Breaking the diffraction barrier of light had seemed insurmountable until recent years. With continuing advances, biologists are beginning to look beyond imaging single cells to the possibility of moving through tissues.

Tags: Imaging technology, S&T UK

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"The difficulty lies, not in the new ideas, but in escaping the old ones"

JOHN MAYNARD KEYNES

MATERIALS SCIENCE

Graphene Research: Electrons Moving along Defined Snake States

Science Daily, 03MAR2015

An international team of researchers (Switzerland, Germany, Hungary, France) discovered that in pure graphene, electrons can move practically undisturbed along a predefined path. Combining an electrical field and a magnetic field means that the electrons move along a snake state due to the sequence of positive and negative mass which can be used as a novel switch. A nano-switch of this type in graphene can be incorporated into a wide variety of devices and operated simply by altering the magnetic field or the electrical field. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

Unified theory for skyrmion-materials

PhysOrg.com, 03MAR2015

An international team of researchers (Germany, Switzerland) succeeded in characterizing the electromagnetic properties of insulating, semiconducting and conducting skyrmion-materials and developed a unified theoretical description of their behavior. This lays the foundation for future electronic components with purpose-designed properties. TECHNICAL ARTICLE

Tags: Materials science

Important step towards quantum computing: Metals at atomic scale

PhysOrg.com, 02MAR2015

Researchers in Germany report that the surface of a topological insulator can be engraved in any arrangement, allowing channel networks to be patterned with nanometer precision. The channeled current flow enables the transport of electrons while preventing "scattering" typically associated with power consumption resulting in diminished energy losses and heat generation. The discovery could enable novel types of information processing such as spintronics or quantum computation. TECHNICAL ARTICLE

Tags: Materials science, S&T Germany

New analysis shows ion slowdown in fuel cell material

MIT News, 02MAR2015

Researchers at MIT report that atomic-level simulation of oxide ion transport has revealed that while strain caused dislocations do greatly accelerate atom transport in metals, they can have the opposite effect in metal-oxide material, and possibly in many others. TECHNICAL ARTICLE

Tags: Materials science

Ordered nanostructures from benzene could pave the way for novel nanotechnology applications

Nanowerk, 27FEB2015

Researchers in Japan have discovered a way to link benzene rings together in a highly ordered three-dimensional helical structure using a straightforward polymerization procedure. The discovery could open up new areas of nanocarbon and materials science. TECHNICAL ARTICLE

Tags: Materials science, S&T Japan

Polarized light pushes graphene plasmons

Nanotechweb, 26FEB2015

Applying circularly polarized light to a monolayer of graphene dramatically changes how plasmons disperse along the carbon sheet. This new result from an international team of researchers (Sweden, the Netherlands) could not only be important for studying how charge carriers move in graphene, but could also help build graphene-based elements for the rapidly developing field of "metamaterials." TECHNICAL ARTICLE

Tags: Materials science, Advanced materials

Research team bends highly energetic electron beam with crystal

PhysOrg.com, 26FEB2015

An international team of researchers working at the Department of Energy's SLAC National Accelerator Laboratory has demonstrated that a bent silicon crystal can bend the paths of focused, very energetic electron beams much more than magnets used today. The method could be of interest for particle accelerator applications such as next-generation X-ray lasers that will help scientists unravel atomic structures and motions in unprecedented detail.

Tags: Materials science, Particle physics

NEUROSCIENCE

MGH study identifies neurons that help predict what another individual will do

Brightsurf, 27FEB2015

Researchers at Massachusetts General Hospital have discovered two groups of neurons that play key roles in social interactions between primates—one group that is activated when deciding whether to cooperate with another individual and another group involved in

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predicting what the other will do. Their eventual hope is to better understand how these complex, multifaceted interactions are encoded within the human brain and use this understanding to develop new, targeted treatment for disorders such as autism.

Tags: Neuroscience

How does the human brain tackle problems it did not evolve to solve?

Science Daily, 25FEB2015

In a new article, researchers at Dartmouth College review the latest social neuroscience literature and argue that our ability to respond to the challenges of a fast-changing culture comes from our brains' ability to flexibly combine and repurpose the neural resources that evolution provided us.

Tags: Neuroscience

Featured Resource

WorldWideScience.org

WorldWideScience.org, developed and maintained by the DOE's Office of Scientific and Technical Information, is a global science gateway comprised of national and international scientific databases and portals.

PHOTONICS

Breakthrough in OLED technology

PhysOrg.com, 02MAR2015

An international team of researchers (Japan, USA) shows that OLEDs made with finely patterned structures can produce bright, low-power light sources, a key step toward making organic lasers. The key finding is to confine charge transport and recombination to nanoscale areas. This caused suppression of Joule heating and partial separation of polarons and excitons, so the charge density where the electroluminescent efficiency decays to half of the initial value was significantly improved. TECHNICAL ARTICLE

Tags: Photonics

Looking into the light

EurekAlert, 26FEB2015

Researchers at UC Santa Barbara will focus on examining the complex optical properties of organic materials such as plastics. Their findings could in turn lead to developments that could enhance the performance of organic photonic devices. Additionally, the research could open new doors to the manufacture of low-cost, lightweight and flexible semiconductors that can harness and manipulate light for various applications.

Tags: Photonics

QUANTUM SCIENCE

Two quantum properties teleported together for first time

Physics World, 27MAR2015

Researchers in China have transferred spin and orbital angular momentum of a photon onto another photon via quantum teleportation. The work is a crucial step forward in improving our understanding of the fundamentals of quantum mechanics and the result could also play an important role in the development of quantum communications and quantum computers. TECHNICAL ARTICLE

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

Physicists find a new form of quantum friction

PhysOrg.com, 26FEB2015

Researchers at Yale University demonstrate a new type of quantum friction called a two-dimensional quantum steady-state manifold. This will allow scientists to redundantly encode quantum information and to do error correction within the manifold. TECHNICAL ARTICLE

Tags: Quantum science

S&T POLICY

Lithium from the coal in China

Science Daily, 26MAR2015

Researchers in China report that lithium has been found dispersed and even anomalously enriched in coal deposits and is potentially extractable. They reviewed two techniques for lithium extraction. The first method involves sulfur sintering the coal ash and acid leaching the metal from the solution to obtain lithium carbonate in a yield of 95.6 percent. The second approach, alkali sintering avoids the need for the sulfur step but has a lower yield at 85.3 percent and a recovery of 55 percent. TECHNICAL ARTICLE

Tags: S&T policy, Materials science, S&T China

Army Research Laboratory Releases Comprehensive S&T Plan

DODlive, 01MAR2015

This comprehensive document provides an in-depth view of major research thrusts that will be critical to future unified land operations. The new guidance includes an overarching strategy first published last year. The implementation plan adds greater clarity to the challenges and areas where the laboratory will devote significant in-house investment.

Tags: S&T policy, Government S&T

Horizon2020: New Commission, New Agenda

EU Research, 28FEB2015

One year after the launch of the Horizon 2020 programme, Science and Business will bring together applicants, project holders, industry executives and key policy makers to take stock of the programme and discuss the most important

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challenges for Europe to solve over the next 20 years.
Tags: S&T policy, S&T EU

Billionaires for basic research

Science Magazine, 27FEB2015

Marc Kastner will leave MIT for a job as the first president of the Science Philanthropy Alliance, a new effort by six foundations to boost private giving to basic science research, which is largely conducted at universities. The alliance has set itself the 5-year goal of boosting such giving by $1 billion a year. Philanthropy will never replace U.S. government support for basic research. But what he calls a "tilt" in federal support toward applied research over basic science has created a "desperation situation" for academic researchers which is probably the worst since the Second World War.
Tags: S&T policy

World's challenges demand science changes—and fast, experts say

Science Daily, 26FEB2015

A team of scientists in the US (Michigan State, Stanford, UC Irvine, Purdue, Oregon State, Yale, UC Berkeley, World Bank, Pacific Institute) makes a compelling case that growing global challenges have rendered sharply segregated expertise obsolete. Artificially breaking down the real world into separate pieces has caused many global problems. Solving these problems requires systems integration—holistic approaches to integrate various pieces of the real world at different organizational levels, across space and over time. Conventional research and decision-making often have taken place within separate disciplines or sectors. TECHNICAL ARTICLE
Tags: S&T policy

SENSORS

Breakthrough in CMOS-based transceivers for MM-wave radar systems

PhysOrg.com, 26FEB2015

At the 2015 International Solid State Circuits Conference imec and Panasonic presented a transceiver chip for phase-modulated continuous-wave radar at 79GHz. This achievement demonstrates the potential of downscaled CMOS for cheap millimeter-wave radar systems that can be used for accurate presence and motion detection.
Tags: Sensors ■

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