Volume 4, Issue 30 ■ 25JUL2014

S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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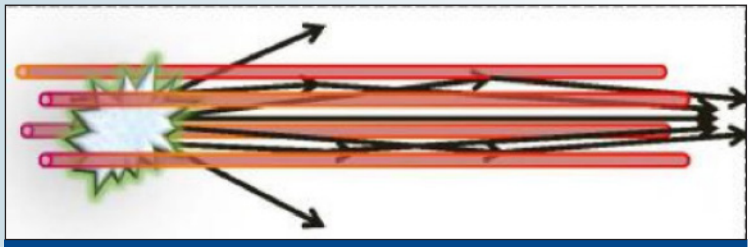
FEATURE ARTICLES

Creating optical cables out of thin air

Science Daily, 22JUL2014

Air waveguides developed by researchers at the University of Maryland consist of a "wall" of low-density air surrounding a core of higher density air. The wall has a lower refractive index than the core. They broke down the air with a laser to create a spark. The air waveguide conducted light from the spark to a detector about a meter away. The signal was 1.5 times stronger than a signal obtained without the waveguide. Air waveguides could have many applications, including long-range laser communications, detecting pollution in the atmosphere, making high-resolution topographic maps and laser weapons. TECHNICAL ARTICLE

Tags: Communications Technology, Optical communication, Featured Article



This is an illustration of an air waveguide. The filaments leave 'holes' in the air (red rods) that reflect light. Light (arrows) passing between these holes stays focused and intense.

Credit: Howard Milchberg

There's a kind of Hush surrounding quantum systems

PhysOrg.com, 18JUL2014

Quantum systems are extremely sensitive to noise, and as little as one per cent can stop some quantum technologies from working. Inspired by noise-cancelling headphones an international team of researchers (Australia, UK) demonstrates that by measuring the noise—then feeding it back in the right way—can cancel the noise's effect on the system. TECHNICAL ARTICLE

Tags: Quantum science, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

Steam from the sun

MIT News, 21JUL2014

Developed by researchers at MIT, the new material—a layer of graphite flakes and an underlying carbon foam—is a porous, insulating material structure that floats on water. When sunlight hits the structure's surface, it creates a hotspot in the graphite, drawing water up through the material's pores, where it evaporates as steam. It is able to convert 85 percent of incoming solar energy into steam.

Tags: Advanced materials

Limiting 'wiggle room' increases carbon chain stiffness

IOP Science, 20JUL2014

Carbyne is a one-dimensional chain of single- and triple-bonded carbon atoms. Predicted to be one of the strongest materials in existence, it has a specific strength and a Young's modulus exceeding that of steel, titanium and even diamond or graphene. Through a computational material science approach, researchers at Northeastern University have found a way to strengthen and control this behaviour in compression.

Tags: Advanced materials

Thermoelectric Material to Hit Market Later This Year

MIT Technology Review, 15JUL2014

A California-based company is commercializing tetrahedrite, an abundant, naturally occurring mineral that also happens to be more efficient on average than existing thermoelectric materials in turning waste heat into power. It is cheap and nontoxic.

Tags: Advanced materials, Energy, Materials science

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AUTONOMOUS SYSTEMS & ROBOTICS

Getting a grip on robotic grasp

MIT News, 18JUL2014

Researchers at MIT have developed a robot that enhances the grasping motion of the human hand. The device, worn around one's wrist, works essentially like two extra fingers adjacent to the pinky and thumb. A novel control algorithm enables it to move in sync with the wearer's fingers to grasp objects of various shapes and sizes.

Tags: Autonomous systems & robotics

Video Friday: RHex Pronking, LS3 Goes to Hawaii, and RoboBoat 2014

IEEE Spectrum, 18JUL2014

Platform-M is a remote controlled (not autonomous) ground vehicle that carries a machine gun and grenade launchers.

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

Anti-tank missile detector joins fight against malaria

Science Daily, 17JUL2014

Researchers in Australia have used an anti-tank Javelin missile detector, more commonly used in warfare to detect the enemy, in a new test to rapidly identify malaria parasites in blood. The technique is based on Fourier Transform Infrared spectroscopy, which provides information on how molecules vibrate. TECHNICAL ARTICLE

Tags: Biotechnology, S&T Australia

COMMUNICATIONS TECHNOLOGY

Math can make the Internet 5-10 times faster

Science Daily, 17JUL2014

An international team of researchers (Denmark, USA) is using a special kind of network coding that utilizes clever mathematics to store and send the signal in a different way. The advantage is that errors along the way do not require that a packet be sent again. Instead, the upstream and downstream data are used to reconstruct what is missing using a mathematical equation.

Tags: Communications Technology, Mathematics

Particle, meet wave: Optical qubit technique squeezes photons to bridge discrete and continuous quantum regimes

PhysOrg.com, 15JUL2014

For the first time, researchers in Japan demonstrated a two-way conversion between a particle like single-photon state and a wavelike superposition of coherent states. This was achieved by applying quantum squeezing/unsqueezing as a quantum gate, deriving Gaussian (coherent) operations that are applicable to nonclassical, non-Gaussian quantum states and therefore expanding the hybrid quantum-information processing optical toolbox. TECHNICAL ARTICLE

Tags: Communications Technology, S&T Japan

CYBER SECURITY

The Growing Threat Of Network-Based Steganography

MIT Technology Review, 18JUL2014

The malware Duqu embeds itself in Microsoft Windows machines and gathers information. It first encrypts this information and then embeds it in a JPEG file. While encryption protects information, steganography hides the existence of a message in the first place. Researchers in Germany give an overview of the way malware hides secret information within ordinary network transmissions and show that the number of different methods has increased dramatically in recent years. TECHNICAL ARTICLE

Tags: Cyber security, S&T Germany

ENERGY

Making a better battery with sulfur 'nano-nugget' cathodes (w/video)

Nanowerk, 20JUL2014

Researchers at Stanford University are making the cathode of sulfur instead of today's lithium-cobalt oxide. However, when lithium ions enter a sulfur cathode during discharging, they bond with sulfur atoms to create a compound that is important for the cathode's performance but it also dissolves in the electrolyte, limiting the cathode's energy capacity. To overcome this, they developed a yolk-shell design where individual nano-nuggets of sulfur are enclosed within a semi-porous shell that allows lithium ions to pass through but blocks the electrolyte.

Tags: Energy, Battery

Flexible, Printed Batteries for Wearable Devices

MIT Technology Review, 18JUL2014

A company in California is developing flexible, rechargeable batteries that can be printed cheaply on commonly used industrial screen printers. It has been testing its ultrathin zinc-polymer batteries in wrist-worn devices and hopes to sell them to manufacturers of wearable electronics, medical devices, smart labels, and environmental sensors.

Tags: Energy, Battery

Cheap, highly efficient solar cells: A new stable and cost-cutting type of perovskite solar cell

Science Daily, 17JUL2014

An international team of researchers (China, Switzerland) has successfully manufactured a perovskite solar cell that does not need a hole-transportation layer. The solar cell shows comparative energy conversion efficiency (12.8%) and was shown to be stable for over 1,000 hours in direct sun exposure. TECHNICAL ARTICLE

Tags: Energy, Solar energy

continued...

"Predictions should never claim to be true. But you can certainly claim that they're possibilities you ought to think about." FREEMAN DYSON

FORECASTING

Freeman Dyson Predicts the Future (w/video)

IEEE Spectrum, 18JUL2014

IEEE Spectrum asks the celebrated physicist what the next 50 years will hold. Dyson was also one of the key players on Project Orion, which ran from 1958 to 1963 and which conceived of a spacecraft, powered by a series of controlled nuclear explosions that could have potentially carried humans to Saturn by 1970.

Tags: Forecasting, Emerging technology

Special Report: The Future We Deserve

IEEE Spectrum, 18JUL2014

We don't know precisely what the next 50 years will bring. But we have an excellent idea of what will be possible, and we know what we hope will happen. So here are scenarios for eight of the most promising of today's technologies.

Tags: Forecasting, Emerging technology

IMAGING TECHNOLOGY

Researchers develop an optical system that enhances visualization in opaque environments such as skin

PhysOrg.com, 22JUL2014

Researchers in Spain used a micromirror array to project a set of microstructured light patterns that overlap sequentially on the sample. Then, the total energy transmitted to each one of them via a simple photodetector is measured. A signal processing technique called "compressive sampling" enables them to reconstruct the image. TECHNICAL ARTICLE

Tags: Imaging technology

'Nanocamera' takes pictures at distances smaller than light's own wavelength

EurekAlert, 17JUL2014

Researchers at the University of Illinois at Urbana-Champaign have demonstrated that an array of novel gold, pillar-bowtie nanoantennas (pBNAs) can be used like traditional photographic film to record light for distances that are much smaller than the wavelength of light (for example, distances less than ~600 nm for red light). The discovery has potential for optical data storage applications using off-the-shelf, low-cost, read-write laser systems. TECHNICAL ARTICLE

Tags: Imaging technology

Researchers combined hundreds of videos to reconstruct 3D motion without markers (w/ Video)

PhysOrg.com, 17JUL2014

Carnegie Mellon University researchers have developed techniques for combining the views of 480 video cameras mounted in a two-story geodesic dome to perform large-scale 3D motion reconstruction. The research team developed a technique for estimating visibility that uses motion as a cue.

Tags: Imaging technology

INFORMATION TECHNOLOGY

Researchers develop a Wikipedia of fact-checking during natural disasters

PhysOrg.com, 18JUL2014

An international team of researchers (UK, Qatar) designed Verily to rapidly crowdsource the verification of information during disasters. Various questions were posted to www.veri.ly/crisis/1 and users were invited to submit evidence justifying their answer. A user could not simply submit a 'yes' or 'no' for an answer. Instead, they had to verify their position by providing evidence either in the form of an image or video or as text. The success of the challenge confirmed the feasibility of rapid evidence collection.

Tags: Information Technology

No-wait data centers

MIT News, 17JUL2014

Researchers at MIT have developed a system, dubbed Fastpass, which relies on a central server called an "arbiter" to decide which nodes in the network may send data. In experiments it reduced the average queue length of routers in a Facebook data center by 99.6 percent—virtually doing away with queues. When network traffic was heavy the average latency shrank nearly as much, from 3.56 microseconds to 0.23 microseconds.

Tags: Information Technology

MATERIALS SCIENCE

A simple, low cost laser technique to improve properties and functions of nanomaterials

Nanowerk, 22JUL2014

Researchers in Singapore utilised an optical microscope-focused laser beam setup to 'draw' micropatterns directly onto large area MoS_2 films as well as to thin the films. They were able to selectively 'draw' patterns onto any region of

continued...

the film to modify properties of the desired area. They have shown that the technique improves optical functionalities of silicon nanowires. TECHNICAL ARTICLE 1, 2

Tags: Materials science, Advanced materials

Nature's strongest glue comes unstuck

Science Daily, 18JUL2014

An international team of researchers (USA, UK) has shown for the first time that barnacle larvae release an oily droplet to clear the water from surfaces before sticking down using a phosphoprotein adhesive. The findings could pave the way for the development of novel synthetic bioadhesives for use in medical implants and micro-electronics. The research will also be important in the production of new anti-fouling coatings for ships. TECHNICAL ARTICLE

Tags: Materials science

Featured Resource

Forecasting Principles

Summarizes useful knowledge about forecasting. The site is devoted to improving decision making by furthering scientific forecasting.

Supercomputers reveal strange, stress-induced transformations in world's thinnest materials

Science Daily, 16JUL2014

Researchers at Columbia University discovered that straining monolayer materials induced a novel phase transition that leads to instability and failure. Surprisingly, the phenomenon persisted across several different materials with disparate electronic properties, suggesting that monolayers may have intrinsic instabilities to be either overcome or exploited. TECHNICAL ARTICLE

Tags: Materials science

MICROELECTRONICS

Future Electronics May Depend on Lasers, Not Quartz

CalTech, 17JUL2014

For nearly 100 years quartz crystals have been used to provide a frequency reference for electronic devices. Now researchers at the California Institute of Technology have developed a method to stabilize microwave signals in the range of gigahertz using a pair of laser beams as the reference, in lieu of a crystal. Optical reference is particularly useful in compact photonics devices. TECHNICAL ARTICLE

Tags: Microelectronics

PHOTONICS

New material puts a twist in light

Science Daily, 18JUL2014

The material developed by researchers in Australia can rotate the polarisation of light orders of magnitude more strongly than natural materials. The effect can be switched on and off directly with light. It is the latest step in the development of a less carbon-hungry successor to electronics. TECHNICAL ARTICLE

Tags: Photonics, S&T Australia

Capture of a terahertz wave in a photonic-crystal slab

Nature Photonics, 10JUL2014

Researchers in Japan utilize the in-plane resonance of a thin, planar photonic-crystal slab with negligible absorption loss to successfully demonstrate and visualize terahertz-wave trapping. The study shows the capability of photonic crystals as a terahertz-wave platform, the application of which may be extended to other components including filters, couplers, antennas, detectors, modulators, switches and emitters.

Tags: Photonics, S&T Japan, Terahertz technology

QUANTUM SCIENCE

Entanglement between particle and wave-like states of light resembles Schrodinger's cat experiment (Update)

PhysOrg.com, 15JUL2014

An international team of researchers (South Korea, Italy, Australia) has devised and experimentally demonstrated a novel scheme to generate entanglement between quantum and classical states of light. It provides a new type of qubit (a hybrid qubit) that can be used for efficient quantum computation. TECHNICAL ARTICLE

Tags: Quantum science

S&T POLICY

China plans super collider

Nature News, 22JUL2014

Working with international collaborators China is planning to build a 'Higgs factory' by 2028—a 52-kilometre underground ring that would smash together electrons and positrons. Physicists say that the proposed US$3-billion machine is within technological grasp and is considered conservative in scope and cost. But China hopes that it would also be a stepping stone to a next-generation collider—a super proton–proton collider—in the same tunnel.

Tags: S&T policy, S&T China

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SCIENCE WITHOUT BORDERS

Index Ranks 143 Countries on Ability to Innovate, Led by Switzerland, UK, Sweden

Newswise, 18JUL2014

Switzerland, the United Kingdom and Sweden topped this year's Global Innovation Index, while Sub-Saharan Africa posted significant regional improvement in the annual rankings published by Cornell University. The United States ranked 6th. "Global Innovation Index 2014"

Tags: Science without borders

Physicists detect process even rarer than the long-sought Higgs particle

PhysOrg.com, 15JUL2014

Scientists running the ATLAS experiment at the LHC, report the first evidence of a process that can be used to test the mechanism by which the recently discovered Higgs particle imparts mass to other fundamental particles. This process—a scattering of two same-charged particles called W bosons off one another—also provides a new stringent test of the Standard Model of particle physics. TECHNICAL ARTICLE

Tags: Science without borders, Particle physics

SENSORS

Tiny laser sensor heightens bomb detection sensitivity

Science Daily, 20JUL2014

Researchers at UC Berkeley have created a plasmon laser detector that can sniff out tiny traces of airborne molecules of explosives. The sensor detected both DNT and ammonium nitrate at concentrations below one part per billion. TECHNICAL ARTICLE

Tags: Sensors

Mechanical Properties of Nanoantennas Explored for First Time

IEEE Spectrum, 17JUL2014

Recent experiments have shown that placing plasmonic nanoantennas on top of glass pillars enhances their power for sensor applications. Now researchers at the University at Illinois have discovered that this high perch for the nanoantennas introduces mechanical properties into the system that can be tuned and manipulated. This approach opens new avenues for fabricating reconfigurable nanoantennas. TECHNICAL ARTICLE

Tags: Sensors

Technology could screen for emerging viral diseases

R & D Magazine, 15JUL2014

With the use of the LLMDA, combined with a DNA amplification technique developed by researchers from Denmark, a team of international researchers (Denmark, US, Greece, Switzerland, France, Sweden, UK, Germany) was able to correctly identify 29 different emerging viruses in both clinical and non-clinical samples. TECHNICAL ARTICLE

Tags: Sensors, Government S&T

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