



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Acoustic “Radar” Spots Stowaways Inside Metal Cargo Containers](#)

[MIT Technology Review, 10JUL2015](#)

The device built by a company in the US is essentially a hammer, a mechanical impact transmitter that produces a powerful acoustic signal by repeatedly banging on a metal disc, which then resonates at a specific frequency. An acoustic receiver picks up any reflections from each pulse and a signal processor can detect a person on the other side of a metal wall who is moving and even one that is stationary, merely from the breathing action.

[TECHNICAL ARTICLE](#)

Tags: Sensors, Featured Article

[Graphene gets competition as a semiconductor: Black arsenic-phosphorus](#)

[Science Daily, 09JUL2015](#)



Crystals of black arsenic phosphorus -- exchanging phosphorus against arsenic, the band gap can be tuned to as low as 0.15 eV, making the material predestined for long wavelength infrared sensor. Credit: Andreas Battenberg / TUM

An international team of researchers (USA, Germany) has developed a technology that allows the synthesis of black arsenic phosphorus without high pressure. Like graphene, black

arsenic phosphorus forms extremely thin layers. It behaves like a semiconductor. Another interesting property is its anisotropic electronic and optical behavior. Possible applications range from transistors and sensors to mechanically flexible semiconductor devices.

[TECHNICAL ARTICLE](#)

Tags: Advanced materials, Featured Article

S&T NEWS ARTICLES

AUTONOMOUS SYSTEMS & ROBOTICS

[Video Friday: Your New Buddy, Atlas Fast Walking, and Robot Deception](#)

[IEEE Spectrum, 10JUL2015](#)

Here's a fantastic explanation of how robots obeying global commands can be made to perform arbitrary computational actions.

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

[Researchers develop basic computing elements for bacteria](#)

[MIT News, 09JUL2015](#)

Researchers at MIT developed a series of genetic parts that can be used to precisely program gene expression within the bacteria. Using these parts they built sensors, memory switches, and circuits that can be encoded in the common human gut bacterium *Bacteroides thetaiotaomicron*. The bacterium's DNA respond to a signal to switch genes on and off. One day they can be programmed to detect and ultimately treat diseases.

[TECHNICAL ARTICLE](#)

Tags: Biotechnology

COMMUNICATIONS TECHNOLOGY

[Chameleon satellite to revolutionise telecom market](#)

[PhysOrg.com, 10JUL2015](#)

Once in space, the chameleon-like satellite built by a company in Europe can adapt to new commands in coverage, frequency band, power use and even change its orbital position. This will make it the first generation of universal satellites able to serve any region of the world and adjust to new business without the user needing to buy and launch an entirely new satellite.

Tags: Communications Technology, Satellite technology

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CYBER SECURITY

Seven Teams Hack Their Way to the 2016 DARPA Cyber Grand Challenge Final Competition

DARPA News, 08JUL2015

Out of 104 teams that had originally registered in 2014, 28 teams made it through two DARPA-sponsored dry runs and into last month's CGC Qualifying Event. DARPA wants an automation revolution in computer security so machines can discover, confirm and fix software flaws within seconds, instead of waiting up to a year under the current human-centric system.

Tags: Cyber security, DARPA

ELECTRONIC WARFARE

Russia has new anti electronics and anti-satellite weapon

Next Big Future, 10JUL2015

Russia is developing a fundamentally new electronic warfare system capable of suppressing cruise missile and other high-precision weaponry guidance systems and satellite radio-electronic equipment. The system mounted on ground-based, air-and seaborne carriers will target and suppress the enemy's deck-based, tactical, long-range and strategic aircraft and military satellites' radio-electronic equipment.

Tags: Electronic Warfare, Military technology, S&T Russia

ENERGY

Towards self-powered electronic papers

Nanowerk, 13JUL2015

Researchers have already demonstrated various types of devices on paper—batteries, solar cells, RFID tags, or transistors. Now an international team of researchers (USA, China) has designed and demonstrated novel self-powered human-interactive transparent nanopaper systems based on an electrostatic induction mechanism and a dielectric material. [TECHNICAL ARTICLE](#)

Tags: Energy, Flexible electronics, S&T Germany

Skylon spaceplane developers reveal the antifreeze method for the sabre hypersonic engine

Next Big Future, 11JUL2015

Researchers in the UK are developing the hypersonic Synergetic Air-Breathing Rocket Engine (Sabre) to power a vehicle from a standing start to Mach 5.5 in air-breathing mode, and from the edge of the atmosphere to low Earth orbit in pure rocket mode. A fundamental enabler of the concept is a complex heat-exchanger system made up of miles of fine tubing that allows oxygen to be taken straight from the atmosphere for use as fuel.

Tags: Energy, Military technology, S&T UK

ENVIRONMENTAL SCIENCE

Solar activity predicted to fall 60% in 2030s, to 'mini ice age' levels: Sun driven by double dynamo

Science Daily, 09JUL2015

Developed by researchers in the UK, a new model of the Sun's solar cycle is producing unprecedentedly accurate predictions of irregularities within the Sun's 11-year heartbeat. The model draws on dynamo effects in two layers of the Sun, one close to the surface and one deep within its convection zone. Predictions from the model suggest that solar activity will fall by 60 per cent during the 2030s to conditions last seen during the 'mini ice age' that began in 1645.

Tags: Environmental science, S&T UK

INFORMATION TECHNOLOGY

New network design exploits cheap, power-efficient flash memory without sacrificing speed

PhysOrg.com, 10JUL2015

At the International Symposium on Computer Architecture in June, MIT researchers presented a new system that, for several common big-data applications, should make servers using flash memory as efficient as those using conventional RAM, while preserving their power and cost savings.

Tags: Information Technology

Carnegie Mellon leads Google expedition to create 'Internet of Things' technology

EurekAlert, 09JUL2015

A team of researchers in the US (Carnegie Mellon, Stanford University, University of Illinois, Google) is working on a Google funded project to radically enhance human-to-human and human-to-computer interaction through a large-scale deployment of the Internet of Things (IoT) that ensures privacy, accommodates new features over time and enables people to readily design applications for their own use.

Tags: Information Technology

Computer program fixes old code faster than expert engineers

MIT News, 09JUL2015

Companies devote massive manpower to going back into the code every few years and, by hand, testing out a bunch of different strategies to try to patch it. Researchers at MIT developed a system called Helium that automatically revamps and fine-tunes code in a matter of hours or even minutes without ever needing the original source.

[TECHNICAL ARTICLE](#)

Tags: Information Technology

“Somewhere, something incredible is waiting to be known.”

CARL SAGAN

IBM Pushes Deep Learning with a Watson Upgrade

MIT Technology Review, 09JUL2015

IBM aims to add deep learning to the commercial version of Watson. The move could make the platform considerably smarter and more useful, and points to a promising future direction for AI research. Although the results produced by deep learning systems are often spectacular, the systems responses are extremely specialized and they can fail in surprising ways because they don't comprehend the world in a very meaningful way. Combining disparate strands of AI research could become an important trend in coming years.

Tags: Information Technology, Artificial intelligence

MATERIALS SCIENCE

Bacteria used to create superfluids

PhysOrg.com, 13JUL2015

Researchers in France added various amounts of E. Coli to a water/nutrient solution and then tested its viscosity at different rotation speeds. Adding more bacteria led to a viscosity reading of zero, and then to negative viscosity. When the E. Coli were killed, the viscosity readings did not go down. It might be possible to harness the viscosity lowering ability of bacteria by inserting tiny rotors into a fluid that would be dragged around, perhaps powering a small device. [TECHNICAL ARTICLE](#)

Tags: Materials science, S&T France

Clay sheets stack to form proton conductors

PhysOrg.com, 13JUL2015

An international team of researchers (India, China, USA) has shown that when two-dimensional sheets of clay, called vermiculite, are exfoliated in water, they carry negative charges, attracting positively charged protons. After the sheets dry, they self-assemble into paper-like films. The near 1-nanometer spacing between the layers serves as the nanochannels that can concentrate protons for conduction. [TECHNICAL ARTICLE](#)

Tags: Materials science

Nanowires have unusually pronounced 'anelastic' properties

Science Daily, 13JUL2015

Researchers at North Carolina State University worked with both zinc oxide and silicon nanowires, and found that when bent, the nanowires would return more than 80 percent of the way to their original shape instantaneously, but return the rest of the way (up to 20 percent) slowly. Anelasticity is a fundamental mechanical property

of nanowires, and we need to understand these sort of mechanical behaviors if we want to incorporate nanowires into electronics or other devices. [TECHNICAL ARTICLE](#)

Tags: Materials science

Scientists advance toward tunable carbon-capture materials

PhysOrg.com, 13JUL2015

An international team of researchers (UK, USA) found pyrolyzing the material changes its chemical composition in ways that may someday be used to tune what the scientists call PEI-C60 for specific carbon-capture applications.

[TECHNICAL ARTICLE](#)

Tags: Materials science, Advanced materials

The quantum physics of artificial light harvesting

Science Daily, 13JUL2015

Plants and bacteria make use of sunlight with remarkably high efficiency: nine out of ten absorbed light particles are being put to use in an ordinary bacterium. An international team of researchers (Germany, Sweden, Czech Republic, Austria, Spain) has examined these quantum effects in an artificial model system and shown that the quantum phenomena can be understood as a delicate interplay between vibrations and electrons of the involved molecules. Research sheds light on physical mechanisms necessary for energy-efficient, cheaper, more flexible and lighter photovoltaic cells. [TECHNICAL ARTICLE](#)

Tags: Materials science

Tunneling out of the surface

Nanowerk, 09JUL2015

An international team of researchers (Japan, UK) has discovered a new chemical reaction pathway on titanium dioxide. It involves the application of an electric field that narrows the width of the reaction barrier, thereby allowing hydrogen atoms to tunnel away from the surface. This opens the way for the manipulation of the atomic-scale transport channels of hydrogen, which could be important in hydrogen storage. [TECHNICAL ARTICLE](#)

Tags: Materials science

MICROELECTRONICS

A Biodegradable Computer Chip That Performs Surprisingly Well

MIT Technology Review, 14JUL2015

Researchers at the University of Wisconsin made electronic components on the surface of a rigid wafer made of a semiconducting material, but then used a rubber stamp to lift them from the wafer and transfer them to

continued...

a new surface made of nanocellulose. This reduced the amount of semiconducting material used by a factor of up to 5,000, without sacrificing performance. The new technique is becoming more established in the electronics industry.

Tags: Microelectronics

IBM Research Alliance Produces Industry's First 7nm Node Test Chips

[IBM News, 09JUL2015](#)

IBM and their collaborators have produced the semiconductor industry's first 7nm node test chips with functioning transistors. The breakthrough could result in the ability to place more than 20 billion tiny switches on the fingernail-sized chips that power everything from smartphones to spacecraft.

Tags: Microelectronics

'Straintronic spin neuron' may greatly improve neural computing

[PhysOrg.com, 08JUL2015](#)

Researchers at Virginia Commonwealth University have proposed a new type of artificial neuron called a "straintronic spin neuron" that could serve as the basic unit of artificial neural networks. Compared to previous designs, the new artificial neuron is potentially orders of magnitude more energy-efficient, more robust against thermal degradation, and fires at a faster rate.

[TECHNICAL ARTICLE](#)

Tags: Microelectronics

FEATURED RESOURCE

100 Best Science RSS Feeds

In this list, find feeds that touch on everything from space exploration to sustainability to evolution.

NEUROSCIENCE

Neuroscientists establish brain-to-brain networks in primates, rodents

[Science Daily, 09JUL2015](#)

Researchers at Duke University have introduced a new paradigm for brain-machine interfaces that investigates the physiological properties and adaptability of brain circuits, and how the brains of two or more animals can work together to complete simple tasks. The brains of monkeys and the brains of rats are linked, allowing the animals to exchange sensory and motor information in real time to control movement or complete computations.

[TECHNICAL ARTICLE 1, 2](#)

Tags: Neuroscience

PHOTONICS

Nanoscale device that can emit light as powerfully as an object 10,000 times its size

[PhysOrg.com, 13JUL2015](#)

An international team of researchers (USA, China) created an artificial material in which the wavelength of light is much larger than in a vacuum, which allows light waves to resonate more powerfully. The device condenses light to a size smaller than its wavelength and then scatters the light over a very large area. Its output can be harnessed for imaging applications that make microscopic particles appear huge. This research opens up a new way to manipulate the flow of light, and could enable new technologies in light sensing and solar energy conversion. [TECHNICAL ARTICLE](#)

Tags: Photonics, Sensors

Nanoscale Device Amplifies Fiber-Optic Signals

[American Physical Society Spotlight, 10JUL2015](#)

Researchers at UCLA, in collaboration with China, designed an amplifier for near-infrared light that is 20 times more powerful than previous devices and small enough to fit on an integrated circuit. It is based on an optical nanowire with a core-shell structure surrounded by a thick shell of erbium/ytterbium silicate material. Size of the core and shell are independently tuned to minimize the loss of light power and maximize gain. [TECHNICAL ARTICLE](#)

Tags: Photonics, Communications technology

QUANTUM SCIENCE

Zooming in on Entanglement

[American Physical Society Spotlight, 13JUL2015](#)

Previous observations of entanglement in optical lattices have been either indirect or averaged over a macroscopic ensemble of atoms, but not on a local scale. Now researchers in Germany have observed entanglement between the spins of individual atoms in an optical lattice. This achievement opens the door to the microscopic characterization of strongly entangled many-body systems as well as to future uses of optical lattices in quantum information protocols. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T Germany

IARPA wants a quantum leap

[Federal Computer Week, 09JUL2015](#)

IARPA's recent request for proposals is a next step in the quest to develop a new quantum bit circuit design. According to the solicitation, success in building practical quantum computers hinges on the ability to control the errors in quantum gates, which can be achieved by finding a way to encode physical qubits into a logical qubit. [RFP](#)

Tags: Quantum science

RESILIENT SYSTEMS

Researcher devises method to untangle, analyze ‘controlled chaos’

PhysOrg.com, 13JUL2015

Researchers at Indiana University have developed a new mathematical framework to more effectively analyze “controlled chaos,” or how interactions among highly complex systems affect their operation and vulnerability. It could potentially be used to improve the resilience of complex critical systems, such as air traffic control networks and power grids, or slow the spread of threats across large networks, or disease outbreaks. The key to the equations’ power is that they are not dependent on the use of large-scale simulations and they are able to quickly and accurately measure “percolation” in a system.

TECHNICAL ARTICLE

Tags: Resilient systems, Mathematics

S&T POLICY

Investing ~3.5 percent GDP in science, technology, innovation is benchmark for sustainable development: Experts

EurekAlert, 09JUL2015

According to a United Nation’s Scientific Advisory Board report, countries with strong and effective STI systems invest up to 3.5% of their GDP in R&D. The report recommends a dedicated seat for science at an influential new world leaders’ forum created to promote and monitor sustainable development, and suggests engaging scientific bodies in reviews of pending policy decisions against scientific evidence.

Tags: S&T policy, STEM

SENSORS

Acoustical metamaterial with near-zero density

Science Daily, 14JUL2015

Researchers in China created a material from polyethylene membranes. The intensive resonances of the membranes significantly reduce the structure’s effective mass density. When sound at a frequency of 990 Hz is conducted and rapidly accelerated through the material, the membranes act as a tunnel for sound, encapsulating the waves into local subwavelength regions. This arrangement allows the sound waves to pass through without accumulating a phase change or distorting the wavefront. TECHNICAL ARTICLE

Tags: Sensors, S&T China

Introducing a New Material for Invisibility Cloaks

IEEE Spectrum, 14JUL2015

Researchers at UC San Diego used two dielectric materials, a teflon substrate studded with cylinders made of a ceramic. The ceramic has a high refractive index, and the teflon has a low refractive index. When combined, they create a metamaterial, capable of bending light in unusual ways. The cloak is very thin and lossless, so there’s no dimming to give away the presence of the cloak.

TECHNICAL ARTICLE

Tags: Sensors

Clever cloaks: Unique metamaterials preserve phase while guiding surface waves around ultrasharp corners and bumps

PhysOrg.com, 13JUL2015

An international team of researchers (China, Singapore) led by MIT created invisibility cloaks based on specifically-designed nonmagnetic anisotropic, or directionally dependent, metamaterials that achieve nearly ideal transmission efficiency over a broadband frequency range. According to the researchers, the results show that transformation optics can be applied to plasmonic circuits, and in so doing could lead to high-performance, large-scale integrated photonic circuits. TECHNICAL ARTICLE

Tags: Sensors

A graphene-based sensor that is tunable and highly sensitive

PhysOrg.com, 09JUL2015

An international team of researchers (Switzerland, Spain) developed a reconfigurable highly sensitive molecule sensor by harnessing graphene’s ability to focus light on a precise spot on its surface and “hear” the vibration of a nanometric molecule that is attached to it. TECHNICAL ARTICLE

Tags: Sensors, Advanced materials ■

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