



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

[Advanced manufacturing \(1\)](#)

[Advanced materials \(4\)](#)

[Autonomous systems
& robotics \(5\)](#)

[Biotechnology \(1\)](#)

[Communications technology \(2\)](#)

[Energy \(3\)](#)

[Imaging technology \(1\)](#)

[Materials science \(3\)](#)

[Microelectronics \(3\)](#)

[Neuroscience \(1\)](#)

[Quantum science \(2\)](#)

[S&T policy \(1\)](#)

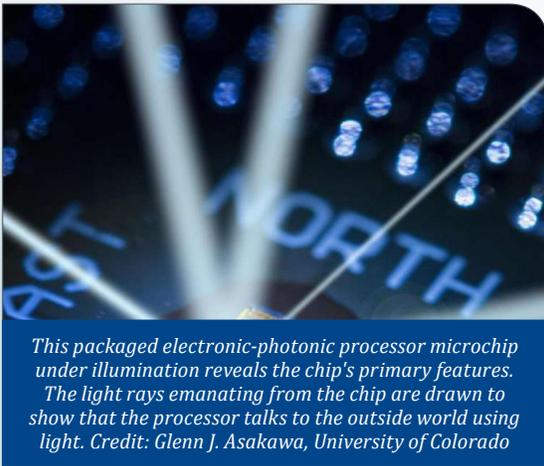
[Science without borders \(4\)](#)

[Sensors \(1\)](#)

FEATURE ARTICLES

[Engineers demo first processor that uses light for ultrafast communications](#)

[PhysOrg.com, 23DEC2015](#)



This packaged electronic-photonic processor microchip under illumination reveals the chip's primary features. The light rays emanating from the chip are drawn to show that the processor talks to the outside world using light. Credit: Glenn J. Asakawa, University of Colorado

A team of researchers in the US (UC Berkeley, MIT, University of Colorado) packed two processor cores with more than 70 million transistors and 850 photonic

components onto a 3-by-6-millimeter chip. They showed that the chip had a bandwidth density of 300 gigabits per second per square millimeter. The chip is also energy-efficient, using only 1.3 picojoules per bit, equivalent to consuming 1.3 watts of power to transmit a terabit of data per second. In the experiments, the data was sent to a receiver 10 meters away and back. The development opens the door to ultrafast, low-power data crunching.

[TECHNICAL ARTICLE](#)

Tags: Communications technology, Quantum science, Featured article

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[NASA team moves closer to building a 3-D printed rocket engine](#)

[PhysOrg.com, 21DEC2015](#)

Researchers at NASA manufactured and tested turbopumps, injectors and valves together to show that it would be possible to build a 3-D printed engine for multiple purposes such as landers, in-space propulsion or rocket engine upper stages. Complex parts like valves that normally would

take more than a year to manufacture were built in a few months. The tests drive down the costs and risks associated with using additive manufacturing, which is a relatively new process for making aerospace quality parts.

Tags: Advanced manufacturing, Government S&T, NASA

ADVANCED MATERIALS

[Nano 'snow blowers' carve straight channels in semiconductor surfaces](#)

[Nanowerk, 28DEC2015](#)

As reported by a team of researchers in the US (NIST, Industry partner), the new gold-catalyzed process for creating patterns of channels with nanoscale dimension is easy to control and could help spawn entirely new technologies fashioned from ensembles of ultra-small structures. Possible applications include integrating lasers, sensors, wave guides and other optical components into lab-on-a-chip devices used for disease diagnosis, screening experimental materials and drugs, DNA forensics and more. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Government S&T

[New silver metamaterial will help create an invisibility cloak and expedite computer processing](#)

[Nanowerk, 28DEC2015](#)

Researchers in Russia have proposed a two-dimensional metamaterial composed of silver elements, that refracts light in an unusual way. Simulations carried out by the authors showed that it would be a high performance material for light with a wavelength from 400-500nm (violet, blue and light blue). The efficiency of the material is approximately 70% for refraction, and 80% for reflection of the light. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, S&T Russia

[Infrared encoding of images with metasurfaces](#)

[PhysOrg.com, 24DEC2015](#)

Researchers in France deposited 50 nanometer-thick rectangular patches of gold on top of a 220 nanometer

continued...

[BACK TO TOP](#)

silicon oxide layer, which sat atop an opaque 200 nanometer gold layer. Once fabricated, each nanoantenna acts as an independent deep subwavelength emitter for a given polarization and wavelength. This allows it to control emission properties such as wavelength, polarization, and intensity with its specific geometry and orientation. The research could have applications in infrared televisions, biochemical sensing, optical storage, and anti-counterfeit devices. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, S&T France

[Researchers create exceptionally strong and lightweight new metal](#)

[Nanowerk, 24DEC2015](#)

A team of researchers in the US (UCLA, Missouri University of Science and Technology, Clemson University, North Carolina State University, UC Riverside, Industry partner) created a new metal composed of magnesium infused with a dense and evenly dispersed ceramic silicon carbide nanoparticles. The metal demonstrated record levels of specific strength and superior stability at high temperatures. It could be used to make lighter airplanes, spacecraft, and cars, helping to improve fuel efficiency, as well as in mobile electronics and biomedical devices. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

[Improving machine learning with an old approach](#)

[PhysOrg.com, 22DEC2015](#)

While most machine learning specialists build an algorithm which molds to a specific dataset, a team of researchers in the US (Industry partner, UC Irvine, UC Berkeley, Cornell University) built an algorithm which performs well across many datasets taking advantage of stochastic gradient descent. They found that the small amount of “noise” created by the algorithm can be the saving grace of an algorithm which would otherwise be trapped by its own perfectionism. [TECHNICAL ARTICLE](#)

Tags: Autonomous systems & robotics, Artificial intelligence

[A Master Algorithm Lets Robots Teach Themselves to Perform Complex Tasks](#)

[MIT Technology Review, 21DEC2015](#)

Researchers at UC Berkeley give a robot an end goal and an algorithm that let it figure out how to achieve the goal for itself. They tested their algorithm on humanoid shapes, headless, four-legged creatures with absurdly fat bodies and even winged creations. In each case, after a period of learning, some remarkably complex behavior emerges.

Tags: Autonomous systems & robotics

[Robots learn by watching how-to videos](#)

[PhysOrg.com, 21DEC2015](#)

Cornell University’s project “RoboWatch” work is aimed at a future when we may have “personal robots” to perform everyday housework. Part of what makes it possible is that there is a common underlying structure to most how-to videos. A key feature of their system is that it is “unsupervised.” Faced with an unfamiliar task, the robot’s computer brain begins by sending a query to YouTube to find a collection of how-to videos on the topic. The algorithm includes routines to omit “outliers”.

Tags: Autonomous systems & robotics, Artificial intelligence

[Teaching machines to see: New smartphone-based system could accelerate development of driverless cars](#)

[PhysOrg.com, 20DEC2015](#)

Separate but complementary systems have been designed by researchers in the UK and demonstrations are freely available online. Although the systems cannot currently control a driverless car, the ability to make a machine ‘see’ and accurately identify where it is and what it’s looking at is a vital part of developing autonomous vehicles and robotics.

Tags: Autonomous systems & robotics, Artificial intelligence

[Now AI Machines Are Learning to Understand Stories](#)

[MIT Technology Review, 14DEC2015](#)

An international team of researchers (Germany, USA - MIT, Canada) has put together a database about movies that should serve as a test arena for deep learning machines and their abilities to reason about stories. The key insight behind their project is that the ability to answer questions about a story or movie is an important indicator of whether or not it has been understood. [TECHNICAL ARTICLE](#)

Tags: Autonomous systems & robotics, Artificial intelligence

BIOTECHNOLOGY

[Scientists blueprint tiny cellular ‘nanomachine’](#)

[Science Daily, 18DEC2015](#)

An international team of researchers (Ireland, UK, USA - Arizona State University, UCLA, SLAC National Accelerator Laboratory, Germany) produced the structural map of diacylglycerol kinase by using a “hit and run” crystallography technique. In doing so, they have been able to understand how the tiny enzyme performs critical cellular duties. Kinases are key players in metabolism, cell signalling, protein regulation, cellular transport, secretory processes, and many other cellular pathways that allow us to function healthily. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Biology

“The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them.” SIR WILLIAM BRAGG

COMMUNICATIONS TECHNOLOGY

[A fish may hold the key to more efficient wireless networks](#)

[PhysOrg.com, 21DEC2015](#)

Eigenmannia (virescens) is a species of glass knifefish that locates objects by generating an electric field and detecting distortions in the field. They have a neural circuit that can effectively sense the frequency emitted by other fish, and they use this sense to regulate their own emitting frequency so they don't interfere with the others. According to researchers at the University of Georgia, Eigenmannia "jamming avoidance response," or JAR, can serve as the model for an artificial neural network that improves the efficiency of wireless communications. [TECHNICAL ARTICLE](#)

Tags: Communications technology, Biomimetics

ENERGY

[New hybrid electrolyte for solid-state lithium batteries](#)

[Nanowerk, 22DEC2015](#)

A glass-polymer hybrid material, developed by a team of researchers in the US (Lawrence Berkeley National Laboratory, UC Berkeley, University of North Carolina at Chapel Hill), was made by taking particles of glass, attaching perfluoropolyether chains to the surface of the particles, adding salt, and then making a film out of these components. By tuning the polymer-to-glass ratio, they were able to come up with a compliant electrolyte with high conductivity at room temperature and excellent electrochemical stability. [TECHNICAL ARTICLE](#)

Tags: Energy, Advanced materials, Battery, Government S&T

[Engineer creates origami battery](#)

[PhysOrg.com, 21DEC2015](#)

Researchers at SUNY, Binghamton developed an inexpensive, bacteria-powered battery made from paper which folds into a square the size of a matchbook, uses an inexpensive air-breathing cathode created with nickel sprayed onto one side of ordinary office paper. The anode is screen printed with carbon paints creating a hydrophilic zone with wax boundaries. The battery generates power from microbial respiration, delivering enough energy to run a paper-based biosensor with nothing more than a drop of bacteria-containing liquid. Total cost of this potentially game-changing device? Five cents. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery

[Virus particles engineered to hold enzymes that generate carbon-free hydrogen fuel](#)

[Science Magazine, 21DEC2015](#)

Many different bacteria generate molecular hydrogen as a fuel source for their own metabolism. Starting with P22 bacteriophages, a type of virus that infects salmonella bacteria, a team of researchers in the US (Indiana University, Montana State University, University of Texas at Tyler) was able to make hydrogen for fuel. Their set up increased the efficiency of H₂ production 100-fold over previous attempts with hydrogenases. [TECHNICAL ARTICLE](#)

Tags: Energy, Biotechnology

IMAGING TECHNOLOGY

[Rotate an image, another one appears \(w/ Video\)](#)

[PhysOrg.com, 23DEC2015](#)

When the halftone is printed along lines onto metallic sheets, the resulting colour depends on the viewing angle. Based on these observations, researchers in France have developed both a mathematical model and associated software that predict the colours that will be observed from different viewing angles. Currently, the software supports standard inkjet prints onto metallic sheets. The technique could one day be used as a security element in passports and printed money to prevent counterfeit.

Tags: Imaging technology, S&T France

MATERIALS SCIENCE

[New acoustic technique reveals structural information in nanoscale materials](#)

[PhysOrg.com, 28DEC2015](#)

A team of researchers in the US (Oak Ridge National Laboratory, University of Connecticut, Pennsylvania State University, University of Alabama, Georgia Institute of Technology) has developed a new nondestructive technique for investigating how new generations of the materials change by examining the acoustic response at the nanoscale. Information obtained from this technique could guide efforts to design materials with enhanced properties at small size scales. [TECHNICAL ARTICLE](#)

Tags: Materials science

[Simultaneous detection of the polarities of hundreds of semiconducting nanowires](#)

[Nanowerk, 28DEC2015](#)

Until now, determining their polarities required nanowires to be analysed one-by-one as part of a complex and time-consuming process. The new technique, developed by

an international team of researchers (Spain, France), uses an atomic-strength microscope and a Kelvin probe to detect minuscule forces and measure the electrical characteristics of the sample's surface. When combined with advanced data analysis, these measurements reveal the polarities of hundreds of nanowires at the same time.

TECHNICAL ARTICLE

Tags: Materials science

A quantum of light for material science

Nanowerk, 23DEC2015

An international team of researchers (Germany, France, Spain) has developed a novel theoretical method that treats the whole QED system of particles and photons as a quantum fluid. Here the particles are represented by a charge current, and the photons by a classical electromagnetic field that acts on the current in a very complex manner. This approach can accurately describe the dynamics of an electron that is trapped on a surface and that strongly interacts with photons. TECHNICAL ARTICLE

Tags: Materials science, Advanced materials, Quantum science

FEATURED RESOURCE

Newswise

The majority of news releases posted to Newswise include embargoed research results, feature stories, and expert pitches. Each news release is also permanently archived on the website. RSS

MICROELECTRONICS

AI researchers develop 'Darwin,' a neuromorphic chip based on spiking neural networks

PhysOrg.com, 23DEC2015

Researchers in China fabricated Darwin Neural Processing Unit (NPU), a neuromorphic hardware co-processor based on spiking neural networks through a standard 180nm CMOS process, supporting a maximum of 2048 neurons, more than 4 million synapses and 15 different possible synaptic delays. It is highly configurable. Darwin NPU aims to provide hardware acceleration of intelligent algorithms for resource-constrained, low-power embedded devices. TECHNICAL ARTICLE

Tags: Microelectronics, Artificial intelligence, S&T China

Giant enhancement of magnetic effect will benefit spintronics

PhysOrg.com, 21DEC2015

An international team of researchers (France, USA - Lawrence Berkeley National Laboratory) has

demonstrated that coating a cobalt film in graphene doubles the film's perpendicular magnetic anisotropy (PMA), so that it reaches a value 20 times higher than that of traditional metallic cobalt/platinum multilayers that are being researched for the property. High-PMA materials are being researched for their applications in the next-generation spintronic devices, such as high-density memories and heat-tolerant logic gates. Their results may make graphene-cobalt structures promising candidates for future spintronic devices. TECHNICAL ARTICLE

Tags: Microelectronics, Advanced materials

NEUROSCIENCE

Mazes and brains: When preconception trumps logic

Medical Express, 22DEC2015

Researchers in Japan wanted to decode prior belief in the brain, because it is crucial for spatial navigation. They were able to reconstruct what scene the participants pictured in their minds as they progressed through the maze. They also discovered that the human sense of objectivity may sometimes be overpowered by preconception, which includes biases arising from external cues and prior knowledge. TECHNICAL ARTICLE

Tags: Neuroscience

QUANTUM SCIENCE

Researchers find a way to create focused spin wave beams

Nanowerk, 22DEC2015

An international team of researchers (China, USA - MIT) have succeeded in demonstrating that it is possible to create and utilize focused beams of spin waves to (i) synchronize oscillators over much larger distances than shown previously and (ii) robustly synchronize a record number of oscillators. They synchronized five oscillators and demonstrated the resulting improvement in the oscillator quality. Since the direction of the spin wave beam can also be tailored via electrical current through the oscillator and via an external magnetic field, the results will also have a major impact in the burgeoning field of magnonics. TECHNICAL ARTICLE

Tags: Quantum science

Team succeeds in observing a two-phonon quantum interference, a world first

PhysOrg.com, 21DEC2015

Researchers in Japan used a laser to irradiate 2 calcium ions to completely remove almost any movement energy from the ions. After this, the team caused a single phonon to form at each of the ion sites. Through experimentation, the two phonons were in fact detected at the same site, confirming that the probability of simultaneous detection of the phonons at individual ion sites is close to zero. The research results will contribute to quantum information processing

research, including quantum simulation using phonons and quantum interface research. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T Japan

S&T POLICY

[Planning for Greatness](#)

[IEEE Spectrum](#), 22DEC2015

Kenneth O. Stanley and Joel Lehman have recently published a book titled “Why Greatness Cannot Be Planned: The Myth of the Objective,” in which they claim that setting objectives for a project can be self-defeating. They argue that instead of setting objectives we should seek novelty and simply look to collecting stepping-stones that may be useful to others.

Tags: S&T policy

SCIENCE WITHOUT BORDERS

[Nanotechweb.org highlights of 2015](#)

[Nanotechweb](#), 28DEC2015

From DNA sequencing and energy storage technology based on coffee dregs, to computers modelled on amoebae, chip features below 7 nm and the International Year of Light, it's been a great year for nanotechnology. Here are some of the highlights.

Tags: Science without borders

[10 Breakthrough Technologies of 2015: Where Are They Now?](#)

[MIT Technology Review](#), 26DEC2015

Each year MIT Technology Review selects 10 emerging technologies that they believe will remake the world. Here's how this year's picks got closer to reality over the past 10 months.

Tags: Science without borders, Forecasting

[The science to look out for in 2016](#)

[Nature News](#), 22DEC2015

Space missions, carbon capture and gravitational waves are set to shape the year.

Tags: Science without borders

[An Open Science plan: Wikidata for Research.eu](#), 21DEC2015

A Horizon 2020 project plan was put together by a team of six European partners to integrate research workflows with Wikidata into a new virtual research environment for Open Science, called Wiki4R. The plan combined approaches to make Wikidata useful for researchers both across disciplines and for several specific use cases, e.g. chemistry. [TECHNICAL ARTICLE](#)

Tags: Science without borders

SENSORS

[Newly developed liquid crystal elastomer material could enable advanced sensors](#)

[PhysOrg.com](#), 22DEC2015

An international team of researchers (USA - Kent State University, Japan) developed the first type of cholesteric liquid crystal elastomers with special properties that enable it to precisely emit laser light, without the use of mirrors, while being stretched. Possible applications include remote sensors and precisely tunable light sources.

[TECHNICAL ARTICLE](#)

Tags: Sensors, Advanced materials ■

ABOUT THIS PUBLICATION

The appearance of external hyperlinks in this publication does not constitute endorsement by the United States Department of Defense (DoD) of the linked web sites, nor the information, products or services contained therein. In addition, the content featured does not necessarily reflect DoD's views or priorities.

To [SUBSCRIBE](#) or [UNSUBSCRIBE](#), visit <https://tin-ly.sainc.com/ASDRE>. To provide feedback or ask questions, contact us at asdrest-bulletin-reply@sainc.com. This publication is authored and distributed by:

Jeff Cissell
Acting Director,
Technical Intelligence
OSD AT&L/OASD(R&E)

Ms. Hema Viswanath
OTI Corporate Librarian