



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[Research boosts optical fiber data speeds](#)

[Science Daily, 16OCT2015](#)

Optical fibers can be sped up by 'twisting' data; multiple data streams are transmitted and received as different twists of light. To digitally re-twist the data, an international team of researchers (USA - University of Southern California, Industry partners, City College of New York, UK, Israel) used MIMO. Even if transmitted data was untwisted, it was received as a different twist (antenna) and recovered. As a proof of principal, the researchers successfully transmitted four data streams on four twists of light over 5 kilometers of standard optical fiber.

[TECHNICAL ARTICLE](#)

Tags: Communications technology, Featured article

[Optical Computing Under the Lens](#)

[American Physical Society Spotlight, 14OCT2015](#)



Researchers in the UK describe a theoretical analysis that puts numbers on the technical resources required to build an optical computer. Their work goes beyond

previous analyses because it does two things simultaneously. One, it determines the overall number of components needed to build a useful linear optical quantum computing machine. And two, it establishes the maximum photon-loss and error rates that each component should have to enable fault-free computation. It also provides a comparison with computing schemes that use matter such as atoms and superconducting circuits, as opposed to photons, to encode quantum information.

[TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T UK, Featured article

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[3-D printing of microwave circuits](#)

[PhysOrg.com, 15OCT2015](#)

3D-printing technology is particularly attractive for manufacturing waveguides as it allows components and circuits used at microwave and millimetre-wave frequencies to be manufactured cheaply while retaining good overall electrical performance. Researchers in the UK investigated the performance of fused deposition modelling for microwave applications, which is a low-cost, lower-resolution technique; and stereolithography for millimetre-wave applications, which has higher resolution. They found the performance of the 3D-printed waveguides was actually better than conventional waveguides. [TECHNICAL ARTICLE](#)

Tags: Advanced manufacturing, S&T UK

[Patterning oxide nanopillars at the atomic scale by phase transformation](#)

[PhysOrg.com, 15OCT2015](#)

An international team of researchers (Japan, Switzerland) applied the focused electron beam of a scanning transmission electron microscope to irradiate $\text{SrNbO}_{3,4}$ crystals, and demonstrated a precise control of a phase transformation from layered $\text{SrNbO}_{3,4}$ to perovskite SrNbO_3 at the atomic scale. Such a precise control of phase transformations opens up new avenues for materials design and processing, as well as advanced nanodevice fabrication. [TECHNICAL ARTICLE](#)

Tags: Advanced manufacturing, S&T Japan

ADVANCED MATERIALS

[Super-slick material makes steel better, stronger, cleaner](#)

[PhysOrg.com, 20OCT2015](#)

Researchers at Harvard University have developed a surface coating, made from rough nanoporous tungsten oxide to make steel stronger, safer and more durable. It is the most durable anti-fouling and anti-corrosive material to date, capable of repelling any kind of liquid

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even after sustaining intense structural abuse. The material could have far-ranging applications and avenues for commercialization, including non-fouling medical tools and devices, such as implants and scalpels, nozzles for 3D printing and, potentially, larger-scale applications for buildings and marine vessels. [TECHNICAL ARTICLE](#)

Tags: Advanced materials, Materials science

[Graphene nano-coils are natural electromagnets](#)

[Nanowerk](#), 19OCT2015

Spirals, or screw dislocations, form naturally in graphite during its growth, even in common coal. Researchers at Rice University found that when a voltage is applied, current will flow around the helical path and produce a magnetic field. They found the magnetic field to be strongest in the hollow, nanometer-wide cavity at the spiral's center. Nano-solenoids may also be useful as molecular relays or switchable traps for magnetic molecules or radicals in chemical probes. [TECHNICAL ARTICLE](#)

[ARTICLE](#)

Tags: Advanced materials, Materials science

[Zinc oxide goes graphene-like](#)

[Nanotechweb](#), 19OCT2015

An international team of researchers (South Korea, Germany, Poland, UK, Austria, China) has made free-standing graphene-like mono- and bi-layer zinc oxide membranes which have very different properties from other ZnO structures. The membranes have good mechanical properties, they are elastic and flexible and are piezoelectric. They are semiconducting with a wide electronic bandgap of 3.576 eV and a large excitation binding energy, which makes them promising for switching electronics applications, transparent electronics, ultraviolet light emitters, piezoelectric devices and chemical sensors. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Anti-clumping strategy for nanoparticles](#)

[Science Daily](#), 16OCT2015

To be effective, nanoparticles need to remain well dispersed into the fluid surrounding them. Researchers in Brazil found that instability of nanoparticles resulting in clumping occurs when the electric force on their surface no longer balances the sum of the attractive or repulsive forces between nanoparticles. The “culprits” include the formation of an electric double layer and the narrowing of that double layer. In addition, considerable variations in the interface tension followed by a steep increase in ion mobility also contribute to instability. [TECHNICAL ARTICLE](#)

[ARTICLE](#)

Tags: Advanced materials, Materials science

[Boeing demonstrates lightest metal ever \(w/video\)](#)

[PhysOrg.com](#), 15OCT2015

A team of researchers in the US (University of California, Caltech, Boeing) has developed the “Lightest Metal Ever”—called microlattice, which is 99.99 per cent air. The team points out that the material has a high degree of absorption, which means it can be depressed and bounce back—a feature that would come in handy on airplanes. [TECHNICAL ARTICLE](#)

[ARTICLE](#)

Tags: Advanced materials, Materials science

[Nanocircuitry grown with semiconducting graphene nanoribbons](#)

[Science Daily](#), 13OCT2015

An international team of researchers (USA - University of Wisconsin, Argonne National Laboratory, Northwestern University, Canada) used chemical vapor deposition to grow graphene nanoribbons on germanium crystals. They discovered that with their technique all the desirable features we want in graphene nanoribbons are happening automatically—ribbons can be long with narrow width, and smooth. They can be made to grow in certain directions on one side of the germanium crystal, but not on the other two sides. [TECHNICAL ARTICLE](#)

Tags: Advanced materials

AUTONOMOUS SYSTEMS & ROBOTICS

[Video Friday: PlantBots, Real Martians, and Drone Comms Jamm](#)

[IEEE Spectrum](#), 16OCT2015

This is an experiment in generative design from Autodesk, where you tell a computer what materials you have and what you want your quadrotor to be able to do, and it grows a structure for you.

Tags: Autonomous systems & robotics

BIG DATA

[System that replaces human intuition with algorithms outperforms human teams](#)

[PhysOrg.com](#), 16OCT2015

Big-data analysis consists of searching for buried patterns that have some kind of predictive power. But choosing which “features” of the data to analyze usually requires some human intuition. In two of the three competitions, the predictions made by the Data Science Machine developed by researchers at MIT were 94 percent and 96 percent as accurate as the winning submissions. In the third, the figure was a more modest 87 percent. But where the teams of humans typically labored over their prediction algorithms for months, the Data Science Machine took somewhere between two and 12 hours to produce each of its entries. [TECHNICAL ARTICLE](#)

Tags: Big data, Artificial intelligence

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“Most institutions demand unqualified faith; but the institution of science makes skepticism a virtue.” ROBERT K. MERTON

BIOTECHNOLOGY

Four synthetic biology inventions that flummox the feds

Science Insider, 15OCT2015

In the report, authored by the Synthetic Biology Project at the Woodrow Wilson International Center for Scholars, a team of regulatory experts describes just how tortuous the path to market could be for new biotech products. It serves as a warning to startup companies that they'll likely need to visit multiple agencies early in the development process because many new technologies don't fit neatly into the purview of one office.

Tags: *Biotechnology, S&T Policy, Synthetic biology*

Researchers use engineered viruses to provide quantum-based enhancement of energy transport

PhysOrg.com, 10OCT2015

In photosynthesis, a photon hits a chromophore, which in turn produces an exciton. This exciton jumps from one chromophore to another until it reaches a reaction center, where that energy is harnessed to build the molecules that support life. By engineering a virus, an international team of researchers (USA- MIT, Italy) was able to get the virus to bond with multiple synthetic chromophores—or, in this case, organic dyes. The researchers were then able to produce many varieties of the virus, with slightly different spacings between those synthetic chromophores, and select the ones that performed best. TECHNICAL ARTICLE

Tags: *Biotechnology*

CYBER SECURITY

The Making of “Lessons From a Decade of IT Failures”

IEEE Spectrum, 16OCT2015

IEEE Spectrum looks through 1750 blog posts, and gives an overall impression of what has and hasn't changed vis a vis software crashes and glitches through interactive charts and graphs. Even given the limitations of the data, the lessons we draw from them indicate that IT project failures and operational issues are occurring more regularly and with bigger consequences.

Tags: *Cyber security*

ENERGY

The road to longer battery life

Science Daily, 14OCT2015

The solid electrolyte interphase (SEI) film forms from the reaction between the electrolyte and the anode when the

battery is charged. SEI is key in determining a battery's lifetime, thermal stability and capacity, especially at high rates. Researchers in Norway are modifying the electrolyte to achieve higher battery capacity and life span, especially at low temperatures by preventing too much lithium loss in the formation of the SEI film. This allows more of the lithium in the electrolyte solution to participate in charging the electrodes.

Tags: *Energy, Battery*

ENVIRONMENTAL SCIENCE

Scientists identify climate ‘tipping points’

Science Daily, 15OCT2015

An international team of researchers (the Netherlands, UK, Germany, France) analysed the climate model simulations on which the recent 5th IPCC reports are based. They found evidence of 41 cases of regional abrupt changes in the ocean, sea ice, snow cover, permafrost and terrestrial biosphere. Many of these events occur for global warming levels of less than two degrees, a threshold sometimes presented as a safe limit. However, although most models predict one or more abrupt regional shifts, any specific occurrence typically appears in only a few models.

TECHNICAL ARTICLE

Tags: *Environmental science, Climatology*

FORECASTING

To capture a wave

MIT News, 16OCT2015

Researchers at MIT seek to understand, predict, and optimize complex engineering and environmental systems under extreme uncertainty. By using analytical and computational methods, they try to predict and optimize behavior, particularly when the dynamics and excitations are uncertain and occasionally extreme. This places much of their work in the ocean environment, and whether it's an energy-harvesting configuration or an ocean structure, their goal is to create designs that maintain operational robustness and safety regardless of the constantly varying conditions.

Tags: *Forecasting*

IMAGING TECHNOLOGY

Affordable camera reveals hidden details invisible to the naked eye

EurekAlert, 15OCT2015

A team of researchers in the US (University of Washington, industry partners) developed HyperCam, a lower-cost hyperspectral camera that uses both visible and invisible

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near-infrared light to “see” beneath surfaces, captures unseen details and illuminates a scene with 17 different wavelengths and generates an image for each. One challenge in hyperspectral imaging is sorting through the sheer volume of frames produced. The UW software analyzes the images and finds ones that are most different from what the naked eye sees, essentially zeroing in on ones that the user is likely to find most revealing.

Tags: Imaging technology

FEATURED RESOURCE

[Asia Research News](#)

ResearchSEA is a one-stop centre where journalists and members of the public can gain access to news and local experts from the research world in Asia.

RSS feeds: [Science](#), [Technology](#)

MATERIALS SCIENCE

[A new electronic component to replace flash storage](#)

[Nanowerk](#), 19OCT2015

Memristors could one day replace flash memory (DRAM) used in USB memory sticks, SD cards and SSD hard drives. Researchers in Switzerland have shown that the component has three stable resistive states. As a result, it can not only store the 0 or 1 of a standard bit, but can also be used for information encoded by three states – the 0, 1 and 2 of a “trit”. The research provides important knowledge for materials science which will be useful in refining the way the storage operates and in improving its efficiency. [TECHNICAL ARTICLE](#)

Tags: Materials science, Information technology, S&T Switzerland

[Is black phosphorus the next big thing in materials?](#)

[Science Daily](#), 16OCT2015

An international team of researchers (USA - UC Berkeley, Lawrence Berkeley National Laboratory, Arizona State University, Stanford, China, Singapore) has experimentally confirmed strong in-plane anisotropy in thermal conductivity, up to a factor of two, along the zigzag and armchair directions of single-crystal black phosphorus nanoribbons. The discovery should facilitate the future application of this highly promising material to electronic, optoelectronic and thermoelectric devices. [TECHNICAL ARTICLE](#)

Tags: Materials science

[Researchers take first steps to create biodegradable displays for electronics](#)

[PhysOrg.com](#), 15OCT2015

Using peptides, an international team of researchers (USA - University of Missouri, Brazil) demonstrated that organic structures, when combined with a blue light-emitting polymer, could be used in displays. They discovered that by using peptide nanostructures they were able to use less of the polymer resulting in 85 percent biodegradability.

[TECHNICAL ARTICLE](#)

Tags: Materials science

MICROELECTRONICS

[Nanosheet arrays provide on-chip supercapacitors](#)

[Nanotechweb](#), 19OCT2015

Researchers in China employ a direct electrochemical co-deposition method on interdigital-like electrodes to fabricate unique on-chip supercapacitors based on CuO/polypyrrole core/shell nanosheet arrays. The nanosheets are integrated firmly and uniformly with the pre-patterned copper substrate resulting in significantly improved conductivity of copper oxide. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, S&T China

[To infinity and beyond: Light goes infinitely fast with new on-chip material](#)

[EurekAlert](#), 19OCT2015

An international team of researchers (USA - Harvard University, China) has designed the first on-chip metamaterial with a refractive index of zero where there is no phase advance. In quantum optics this allows the waveguide to emit photons which are always in phase with one another. It could also improve entanglement between quantum bits, as incoming waves of light are effectively spread out and infinitely long, enabling even distant particles to be entangled. This on-chip metamaterial opens the door to exploring the physics of zero index and its applications in integrated optics. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Quantum science

[New research could revolutionize flexible electronics, solar cells](#)

[Science Daily](#), 14OCT2015

By using the probe of an atomic force microscope to trigger a local chemical reaction, researchers at Binghamton University showed that electrically conductive features as small as four nanometers can be patterned into individual graphene oxide sheets. The study provides new insight into the spatial resolution limits and mechanisms for a relatively new process for patterning conductive regions in insulating graphene oxide. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Advanced materials

PHOTONICS

[New deposition technique enhances optoelectronic properties of lasers](#)

Science Daily, 13OCT2015

Researchers at UC Santa Barbara have developed a simple new electron-beam multilayer deposition technique for creating intracavity contacts -- an important component of gallium nitride-based (III-nitride) vertical-cavity surface-emitting lasers. The technique not only yields intriguing optoelectronic properties but also paves the way for others entering this realm of research. Potential applications include heads-up displays, automotive headlights, and visible light data transmission. [TECHNICAL ARTICLE](#)

Tags: Photonics

QUANTUM SCIENCE

[Physicists have learned how to restore the entanglement of 'untangled' quantum light](#)

PhysOrg.com, 13OCT2015

Creation of entanglement is a difficult process. Entangled states are very fragile, breaking easily during transmission due to noise or optical losses. An international team of researchers (Russia, China, Australia, Canada) conducted a series of experiments in which they managed to restore the level of quantum correlation between pulses of light in two optical channels, which was almost completely destroyed after a 20x optical loss. This corresponds to the level of loss in 65 kilometers of ordinary fiber optic cable. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology

S&T POLICY

[Unique breed of investors helps universities launch start-ups](#)

Technology Org, 16OCT2015

Ushering new technologies from the university lab to the marketplace has long been a challenge, with many stalling indefinitely due to a lack of funding. But a model of investing has developed over the past 15 years to help bridge that gap with some stunning successes. The traditional venture capital approach doesn't make the kind of long-term investments necessary to develop early, basic research into something marketable. [ARTICLE](#)

Tags: S&T policy

[A national network of neurotechnology centers for the BRAIN Initiative](#)

EurekaAlert, 15OCT2015

The Brain Activity Map authors propose a network of national Neurotechnology Centers as centralized "hubs" to coalesce cross-disciplinary efforts from a spectrum of participants in academic labs, corporate partners and public and private research institutes. These "Brain

Observatories" would tackle outstanding neurotechnology development problems on 4 critical areas of the BRAIN Initiative: Connectomics, Nanotechnology, Optical and Magnetic Imaging and Computational Data Mining.

[TECHNICAL ARTICLE](#)

Tags: S&T policy, Neuroscience

[Policy advice: Use experts wisely](#)

Nature, 14OCT2015

Researchers in Australia write that experts must be tested, their biases minimised, their accuracy improved and their estimates validated with independent evidence. They have created a framework of eight key ways to improve the advice of experts. These include using groups with diverse, carefully selected members well within their expertise areas. They suggest experts should not advise decision makers directly about matters that involve values or preferences, because experts are not impartial.

Tags: S&T policy

SCIENCE WITHOUT BORDERS

[Solving the world's great challenges](#)

MIT News, 15OCT2015

Inaugural Solve Conference at MIT concludes four days of talks, workshops, and discussions on global challenges. The foundational event was based around four key "pillars"—Learn, Cure, Fuel, and Make—that categorized issues and questions around education, health care, resources, and infrastructure. Solve explored four themes to identify specific challenges where new thinking and emerging technologies have the potential to make the world a better place for all. The world's most gifted researchers, business leaders, philanthropists, and change agents were invited to devise practical, actionable solutions.

Tags: Science without borders

[A breakthrough on the mathematical understanding of Einstein's equations](#)

Science Daily, 14OCT2015

An international team of researchers (USA - Princeton University, France) has proven the bounded L2 curvature conjecture that was proposed 15 years ago. It provides a potentially minimal framework in which it is possible to solve the Einstein equations, which in turn could be a critical step toward the proof of major conjectures, such as Penrose's cosmic censorship conjectures. [TECHNICAL ARTICLE](#)

Tags: Science without borders

[Technology Confronts Disasters](#)

MIT Lincoln Laboratory, 01OCT2015

R&D at MIT Lincoln Laboratory will help agencies better respond to disasters and humanitarian crises. The response stage is where the Laboratory has executed programs in the past. In this stage, information gathering and communication are vital to first responders. The

Next-Generation Incident Command System (NICS), a large-scale data-integration software platform, provides first responders with situational awareness and real-time communication. Today, more than 450 organizations—mainly in the United States but also in Victoria, Australia—are using NICS to improve their management of all types of emergency responses.

Tags: Science without borders

SENSORS

Graphene-Coated Fabric Makes for a Wearable Gas Sensor

IEEE Spectrum, 14OCT2015

Researchers in the Republic of Korea coated commercially available yarn with reduced graphene oxide using electrostatic self assembly and molecular glue to produce a bendable and washable electronic textile gas sensor. The yarn was extremely sensitive to nitrogen dioxide. The sensor operates by the nitrogen oxide molecules changing the electrical resistance of the graphene, which in turn triggers an LED light to turn on.

TECHNICAL ARTICLE

Tags: Sensors ■

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