



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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

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

[Neuroscience \(1\)](#)

[Science without borders \(5\)](#)

[Advanced materials \(5\)](#)

[Cyber security \(1\)](#)

[Photonics \(1\)](#)

[STEM \(1\)](#)

[Autonomous systems  
& robotics \(2\)](#)

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

[Quantum science \(7\)](#)

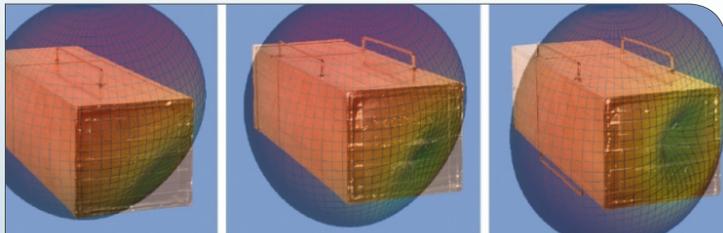
[Microelectronics \(1\)](#)

[S&T policy \(2\)](#)

## FEATURE ARTICLES

### [Antenna design turns entire vehicles into broadcasting equipment](#)

[PhysOrg.com, 26APR2016](#)



*UW-Madison engineers built scale models of military platforms to test the efficiency of radio broadcasts. Heat maps of the signal intensity overlaid onto photos of the devices indicate that the low profile platforms transmit communications comparably to existing antennas. Credit: Nader Behdad*

Instead of adding more bulk, University of Wisconsin-Madison engineers are working to increase the effective size of antennas by turning the military vehicles that carry them into transmitters—using the structures that support the antennas themselves to help broadcast signals. It enhances communication in the field by enabling one device to send and receive multiple types of information. Separate transmitters handle internet data, Bluetooth connections, and cellphone calls, because each signal uses a particular bandwidth.

*Tags: Communications technology, Military technology, Sensors, Featured Article*

### [Team devises new technique to probe ‘noise’ in quantum computing](#)

[PhysOrg.com, 18APR2016](#)

In their new work, an international team of researchers (USA - Dartmouth College, Australia) designed a new family of control sequences and showed how they can extract information about the higher-dimensional (beyond two-point) correlation functions of the noise. Knowledge of these correlation functions offers a complete characterization of the noise, enabling accurate modeling of the interaction between a quantum system and its environment. The researchers demonstrate noise spectroscopy protocols that apply to both classical,

non-Gaussian and a class of paradigmatic quantum, non-Gaussian environments. [TECHNICAL ARTICLE](#)

*Tags: Quantum science, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### [Printing nanomaterials with plasma](#)

[EurekAlert, 22MAR2016](#)

A team of researchers in the US (NASA Ames Research Center, SLAC National Accelerator Laboratory) has developed a new method that uses plasma to print nanomaterials onto a 3-D object or flexible surface, such as paper or cloth. The technique could make it easier and cheaper to build devices like wearable chemical and biological sensors, flexible memory devices and batteries, and integrated circuits. [TECHNICAL ARTICLE](#)

*Tags: Advanced manufacturing, Government S&T*

### ADVANCED MATERIALS

#### [Micro-sized, liquid-metal particles for heat-free soldering](#)

[Science Daily, 25APR2016](#)

Researchers at Iowa State University developed liquid-metal particles containing Field's metal (an alloy of bismuth, indium and tin) and particles containing an alloy of bismuth and tin. They engineered the surface of the particles so there is no pathway for liquid metal to turn into a solid. They demonstrated healing of damaged surfaces and soldering of metals at room temperature without requiring high-tech instrumentation or complex material preparation. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

#### [Novel anti-biofilm nanocoating offers significant anti-adhesive potential](#)

[Nanowerk, 25APR2016](#)

An international team of researchers (Israel, Singapore) has developed anti-adhesive patches that are made

*continued...*

[BACK TO TOP](#)

from naturally occurring biomaterials which can prevent destructive bacterial biofilm from forming on metal surfaces when they are immersed in water and other damp environments. The material has potential for a variety of medical and industrial applications. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

### [Cool method for making waveguides](#)

[Nanowerk, 20APR2016](#)

While silicon has many advantages, it suffers from high losses when used in waveguides as a result of nonlinear absorption at the wavelength used for telecommunications. Researchers in Singapore have discovered a way to make silicon-rich nitride films (see image) at temperatures as low as 250 degrees Celsius, which is much lower than the temperatures usually used to produce the material. They used a plasma to deposit a tailored mixture of silicon and nitrogen atoms onto a substrate. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, Materials science*

### [Beyond the rainbow colors](#)

[Nanowerk, 18APR2016](#)

Researchers in China have combined three nanorod structured semiconducting sulfide crystals with a ternary nanostructured photovoltaic system that absorbs irradiation from ultraviolet to near infrared regions. The nanorods effectively convert the full-spectrum light energy into electric current. This discovery marks a new level in the development of more efficient solar cells. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials, S&T China, Solar energy*

### [Unexpected discovery leads to a better battery](#)

[Science Daily, 18APR2016](#)

Zinc-manganese oxide batteries significantly lose storage capacity after just a few cycles because manganese from the battery's positive electrode begins to sluff off, making the battery's active material inaccessible for energy storage. A team of researchers in the US (Pacific Northwest National Laboratory, University of Washington, Pennsylvania State University) added manganese ions to the electrolyte. The test battery was able to reach a storage capacity of 285 milliAmpere-hours per gram of manganese oxide over 5,000 cycles, while retaining 92 percent of its initial storage capacity. [TECHNICAL ARTICLE](#)

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

## AUTONOMOUS SYSTEMS & ROBOTICS

### [China is Building a Robot Army of Model Workers](#)

[MIT Technology Review, 26APR2016](#)

Countless manufacturers in China are planning to transform their production processes using robotics and

automation at an unprecedented scale. Almost a quarter of the world's products are made in China today. If China can use robots and other advanced technologies to retool types of production never before automated, that might turn the country, now the world's sweatshop, into a hub of high-tech innovation.

*Tags: Autonomous systems & robotics, S&T China*

### [Robotic consensus](#)

[MIT News, 21APR2016](#)

Planning algorithms for teams of robots fall into two categories: centralized algorithms, in which a single computer makes decisions for the whole team, and decentralized algorithms, in which each robot makes its own decisions based on local observations. Researchers at MIT have developed a decentralized planning algorithm for teams of robots that factors in not only stationary obstacles, but moving obstacles, as well. The algorithm also requires significantly less communications bandwidth than existing decentralized algorithms, but preserves strong mathematical guarantees that the robots will avoid collisions. [TECHNICAL ARTICLE](#)

*Tags: Autonomous systems & robotics*

## COMMUNICATIONS TECHNOLOGY

### [Waveguide with integrated carbon nanotubes for conversion of electric signals into light](#)

[PhysOrg.com, 19APR2016](#)

By the integration of the smallest carbon nanotubes into a nanostructured waveguide, researchers in Germany have developed a compact miniaturized switching element that converts electric signals into clearly defined optical signals. They act like a photonic crystal and allow for customizing the properties of light from the carbon nanotube. They can generate narrow-band light in the desired color on the chip. Processing of the waveguide precisely defines the wavelength at which the light is transmitted. [TECHNICAL ARTICLE](#)

*Tags: Communications technology, Advanced materials, S&T Germany*

## CYBER SECURITY

### [System predicts 85 percent of cyber-attacks using input from human experts](#)

[PhysOrg.com, 18APR2016](#)

A team of researchers in the US (MIT, industry partners) demonstrates an artificial intelligence platform called AI2 that combs through data and detects suspicious activity by clustering the data into meaningful patterns using unsupervised machine-learning. It then presents this activity to human analysts who confirm which events are actual attacks, and incorporates that feedback into its models for the next set of data. [TECHNICAL ARTICLE](#)

*Tags: Cyber security*

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

## MATERIALS SCIENCE

### [Towards controlling the electronic surface structure of materials](#)

Nanowerk, 19APR2016

To influence the topological surface state of a topological insulator through the Zeeman effect, it is important to determine its g-factor. An international team of researchers (China, Japan) used spectroscopic imaging scanning tunnelling microscopy to determine the g-factors of the topological surface states of topological insulators  $\text{Bi}_2\text{Se}_3$  and  $\text{Sb}_2\text{Te}_2\text{Se}$ . As the g-factor of topological surface states could potentially be controlled by modifying the chemical composition of the topological insulators, this knowledge could open the door to new, high-quality material for use in future applications such as spintronic devices and quantum computing. [TECHNICAL ARTICLE](#)

Tags: *Materials science, Quantum science*

### [Glowing nanomaterial to drive new generation of solar cells](#)

Science Daily, 18APR2016

An international team of researchers (Australia, USA - UC Berkeley, Germany, Saudi Arabia) produced a metamaterial made of tiny nanoscopic structures of gold and magnesium fluoride, which radiates heat in specific directions. The geometry of the metamaterial can also be tweaked to give off radiation in specific spectral range. This makes it ideal for use as an emitter paired with a thermophotovoltaic cell. [TECHNICAL ARTICLE](#)

Tags: *Materials science, Advanced materials, Solar energy*

### [Technique for assembling active photovoltaic components from inexpensive metals](#)

PhysOrg.com, 23MAR2016

Researchers in Singapore used simple sputter deposition to lay down nanometer-thin coatings of aluminum and iron silicide precursors onto an n-type silicon wafer. After rapid thermal annealing, sandwiched between the aluminum alloyed iron silicide coating and the n-type silicon, they found a 5–10 nanometer wide strip of regrown silicon crystals with high densities of aluminum p-type dopants—a spontaneously formed p-n junction. The light harvesting efficiency of the material improved from 0.8 to 5.1 per cent after the rapid thermal anneal. [TECHNICAL ARTICLE](#)

Tags: *Materials science*

## MICROELECTRONICS

### [Breaking of tiny light pulses observed in a nanophotonic chip for the first time.](#)

Nanowerk, 18APR2016

An international team of researchers (Australia, the Netherlands, France) has observed the pulse splitting phenomenon, called soliton fission, which could lead to novel rainbow light sources used in compact optical communications systems and lab-on-a-chip spectroscopic tools for portable medical diagnostics. [TECHNICAL ARTICLE](#)

Tags: *Microelectronics, Photonics*

## NEUROSCIENCE

### [Researchers can identify you by your brain waves with 100 percent accuracy](#)

Science Daily, 18APR2016

According to researchers at Binghamton University, when you take hundreds of images, where every person is going to feel differently about each individual one, then you can be really accurate in identifying which person it was who looked at them just by their brain activity. Brain biometrics is appealing because they are cancellable and cannot be stolen by malicious means the way a finger or retina can. The results suggest that brainwaves could be used by security systems to verify a person's identity. [TECHNICAL ARTICLE](#)

Tags: *Neuroscience, Biometrics*

## PHOTONICS

### [Physicists detect the enigmatic spin momentum of light](#)

PhysOrg.com, 25APR2016

An international team of researchers (UK, Czech Republic, Ukraine, Japan, Australia, USA - University of Michigan, South Korea) has used an extremely precise technique to experimentally verify that light does in fact exert the extraordinary perpendicular force, which is determined by the polarization of light, as was reported by a team of researchers in Japan. Their findings integrate relativistic field-theoretical, quantum-mechanical, and optical aspects of the dynamical properties of light. They offer a new paradigm which could provide insights into a variety of phenomena: from applied optics to high-energy physics. [TECHNICAL ARTICLE 1, 2](#)

Tags: *Photonics, Particle physics*

## QUANTUM SCIENCE

**Rare Earth atoms see the light: Promising route for combined optical, solid state-based quantum information processing**[PhysOrg.com, 26APR2016](#)

An international team of researchers (the Netherlands, Belgium, USA - UC Santa Barbara) reports that the erbium and ytterbium atoms they are studying can store the superpositions of zero and one used in quantum computation. In addition, the light by which they communicate with these atoms can also store quantum information. Their findings indicate that new samples currently under development at UCSB can enable optical communication to a single ytterbium atom inside optical circuits on a silicon chip, a phenomenon of significant interest for quantum information storage. [TECHNICAL ARTICLE](#)

*Tags: Quantum science, Materials science*

## FEATURED RESOURCE

**100 Best Science RSS Feeds**

List of RSS Feeds that touch on everything from space exploration to sustainability to evolution.

**Scientists take next step towards observing quantum physics in real life**[PhysOrg.com, 25APR2016](#)

Researchers in the Netherlands created a highly reflective membrane, visible to the naked eye, that can vibrate with hardly any energy loss at room temperature. The membrane is a promising candidate to research quantum mechanics in large objects. [TECHNICAL ARTICLE](#)

*Tags: Quantum science***The light stuff: A brand-new way to produce electron spin currents**[Science Daily, 25APR2016](#)

An international team of researchers (USA - Colorado State University, UC Irvine, China) used unpolarized light to produce spin voltage in a metal. The researchers will continue exploring making spin currents with light by swapping out materials and trying different light sources. They demonstrated light control in the infrared range. Moving into the visible or UV range would likely offer more robust applications for devices. [TECHNICAL ARTICLE](#)

*Tags: Quantum science***Atoms placed precisely in silicon can act as quantum simulator**[Science Daily, 22APR2016](#)

In a proof-of-principle experiment, an international team of researchers (Australia, USA - Purdue University) has demonstrated that a small group of individual atoms placed very precisely in silicon can act as a quantum simulator, mimicking nature—in this case, the weird quantum interactions of electrons in materials. Their success provides a route to developing new ways to test fundamental aspects of quantum physics and to design new, exotic materials.

[TECHNICAL ARTICLE](#)*Tags: Quantum science***Better tests for Schrodinger cats (Updated)**[PhysOrg.com, 18APR2016](#)

Researchers in Germany have shown that inequalities can never be optimal for tests of macroscopic realism. Their results reveal a hitherto unknown radical difference in the mathematical structures of spatial and temporal correlations in quantum physics, and also provide a better tool for the search of Schrödinger cat-like states. [TECHNICAL ARTICLE](#)

*Tags: Quantum science***Inverse spin Hall effect: A new way to get electricity from magnetism**[PhysOrg.com, 18APR2016](#)

By showing that inverse spin Hall effect works in several organic semiconductors—including carbon-60 buckyballs—researchers at the University of Utah changed magnetic “spin current” into electric current. The efficiency of this new power conversion method isn’t yet known, but it might find use in future electronic devices including batteries, solar cells and computers. [TECHNICAL ARTICLE](#)

*Tags: Quantum science, Materials science*

## S&amp;T POLICY

**Air force research lab roadmaps for game changing hypersonic vehicles, directed energy weapons and drones**[Next Big Future, 24APR2016](#)

Pentagon futurists envision a third-offset strategy to leapfrog U.S. technological capabilities to stay ahead of Russia and China. Military planners have honed in on artificial intelligence and robotics, an arsenal plane filled with airborne weapons, undersea sub-hunting drones, swarming autonomous vehicles, electromagnetic rail guns and directed-energy weapons like lasers and microwave energy, among other breakthroughs.

*Tags: S&T policy, Government S&T, Military technology*

## **Information and Communications Technology Industries Account for \$133 Billion of Business R&D Performance in the United States in 2013**

NSF News, 13APR2016

According to the Business R&D and Innovation Survey (BRDIS), of the \$323 billion of research and development performed by companies in the United States in 2013, ICT industries accounted for 41% (\$133 billion) Table 1. For perspective, R&D expenditures of ICT industries are 2.5 times larger than the pharmaceutical manufacturing industry.

Tags: S&T policy

## **SCIENCE WITHOUT BORDERS**

### **The reliability of material simulations put to test**

Nanowerk, 25APR2016

The possibility to produce identical results in independent yet identical researches is a corner stone of science. Researchers in Finland have demonstrated that although a few of the older methods clearly yield deviating results, predictions by recent codes are entirely equivalent. They also define a quality criterion that allows the verification of future software developments against their extensive database.

Tags: Science without borders

### **The Universe, where space-time becomes discrete**

Science Daily, 22APR2016

In a theoretical study, researchers in Italy have analyzed a model that saves special relativity and reconciles it with granularity by introducing small-scale deviations from the principle of locality demonstrating that it can be experimentally tested with great precision.

#### **TECHNICAL ARTICLE**

Tags: Science without borders, S&T Italy

### **Power Over Nature**

Edge, 20APR2016

The big story of the 20th and the 21st century is that we're learning to control the world better. With the development of quantum mechanics, we understand the fundamental principles of what matter is and how it behaves that's adequate for all engineering purposes.

Tags: Science without borders

### **Academics admit to embellishing the impact of their research to get grants**

Science Alert, 19APR2016

In a study, researchers in the UK found that a common perception among academics is that if the impact was not immediately apparent, it was almost inevitable

to have to inflate and embellish claims about how much impact a piece of work would have in order to secure funding. While many agreed that their research ought to be communicated in order to make a difference and contribute to the public good, many disagreed with the way funders conceptualise and ask for 'impact' to be predicted in funding applications.

Tags: Science without borders

### **Little lander that could—the legacy of Philae**

PhysOrg.com, 18APR2016

Despite its short life on the comet, Philae was able to conduct the first-ever measurements from the surface of a comet. Some of the results include the indication that the comet surface is non-magnetic; high-resolution camera images from the surface material; analyses and the detection of rich organic chemistry; measurements of the physical properties of the surface material and measurements of the internal structure by radar sounding.

Tags: Science without borders

## **STEM**

### **Root, the code-teaching robot**

PhysOrg.com, 19APR2016

Researchers at Harvard University have developed a robot called Root that is programmed using the tablet interface Square. Root has light and color sensors, bumpers, and a touch surface that enable it to respond to the physical world. In a classroom setting, Root would "drive" along a magnetic dry-erase whiteboard at the front of the class, giving the young programmers an "instant, physical manifestation" of the code.

Tags: STEM, Autonomous systems & robotics ■

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