



S&T NEWS BULLETIN

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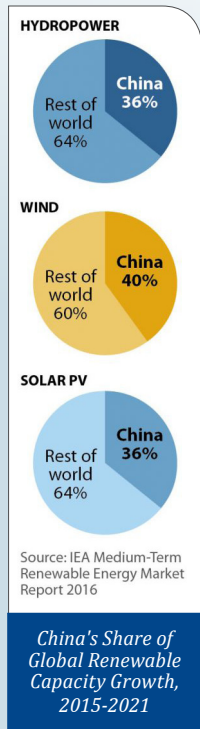
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FEATURE ARTICLES

[China Set to Dominate U.S. in Global Renewables Boom; \\$32 Billion in Overseas Investments in 2016 Alone](#)



[Institute for Energy Economics and Financial Analysis, 06JAN2017](#)

According to the Institute for Energy Economics and Financial Analysis [OPEN ACCESS Report](#), China will likely expand its dominance of the booming global renewable- and clean-energy industries as new American energy policies come into play. The change in leadership in the U.S. is likely to widen China's global leadership in industries of the future, building China's dominance in these sectors in terms of technology, investment, manufacturing and employment. As the U.S. owned the advent of the gas age, so China is shaping up to be unrivaled in clean power leadership today. In years to come, the U.S. may look back in regret.

Tags: S&T policy, Foreign S&T, S&T China, Featured Article

[Engineers work on promising new memory technology](#)

[Physorg.com, 06JAN2017](#)

A team of researchers in the US (UC Santa Cruz, Lawrence Berkeley National Laboratory, industry partner, Brigham Young University) has demonstrated the efficacy of STT-MRAM (spin-transfer torque magnetic random access memory) experimentally and via modeling on a nickel nanomagnet array. Several key advances in physics and materials science over the past 20 years have led to the development of STT-MRAM and other spintronic technologies. It offers the potential for high-speed, high-density and energy-efficient memory that is nonvolatile. [TECHNICAL ARTICLE](#)

Tags: Microelectronics, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Combining catalytic and electrical contact edge-effects to engineer the transport properties of nanocontacts to nanowires](#)

[Nanowerk, 05JAN2017](#)

New technologies based on nanomaterials require reliable electrical contacts that do not alter the nanowire properties. An international team of researchers (UK, Germany) show that the electrical behavior of the nanocontacts between free-standing ZnO nanowires and the catalytic Au particle used for their growth can switch from Schottky to Ohmic depending on the size of the Au particles in relation to the cross-sectional width of the ZnO nanowires. The current-voltage electrical measurements performed reveal that tunneling at the contact edge is the dominant carrier transport mechanism for the nanoscale contacts. The results are applicable to other nanowire materials such as Si, GaAs, and InAs when the effects of surface charge and contact size are considered. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Advanced materials

[Light can switch on topological materials](#)

[Science Daily, 04JAN2017](#)

A team of researchers in the US (Stanford University, University of North Dakota) simulated experiments in which pulses of circularly polarized light, in the red to near-infrared wavelength range, hit a single layer of tungsten disulfide. The results showed that during the time the material was illuminated, its electrons organized themselves in a manner fundamentally different from graphene, creating new paths with absolutely no electrical resistance along the sample's edges. It showed that unwanted heating of the material that would disrupt the paths could be avoided by tuning the light energy to be slightly less than the most-efficient "resonant" energy. If this approach is confirmed by experiments, it could open the door to a new way of creating and controlling this desirable property in a wider range of materials than is possible today. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Advanced materials

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Nano-chimneys can cool circuits[Physorg.com, 04JAN2017](#)

Both graphene and carbon nanotubes consist of six-atom rings and both excel at the rapid transfer of electricity and phonons. But when a nanotube grows from graphene, atoms facilitate forming heptagonal rings instead. The heptagons scatter phonons and hinder the escape of heat through the pillars. A team of researchers in the US (Rice University, AFRL) discovered that removing atoms here and there from the two-dimensional graphene base would force a cone to form between the graphene and the nanotube. The sparsely spaced heptagons leave a clear path for heat to race up the chimney. The nano-chimneys also act like thermal diodes, with heat flowing faster in one direction than the other. [TECHNICAL ARTICLE](#)

*Tags: Advanced materials***AUTONOMOUS SYSTEMS & ROBOTICS****AI and Chatbots: Where we are and Where we're headed**[Inside Big Data, 05JAN2017](#)

One of the more popular AI-driven technologies in 2017 are chatbots. They will continue to be driven by artificial intelligence algorithms which can recognise commands more effectively at times than a traditional search query-response. They may also eliminate the need for many third party apps and streamline our interactions with multiple parties. Chatbots enable us to have deeper experiences through our Internet connected devices and allow us to experience a more satisfying 'human' interaction – delivered by AI.

*Tags: Autonomous systems & robotics, Artificial intelligence***BIG DATA****The big data challenge of transformation for the manufacturing industry**[IBM Big Data and Analytics Hub , 03JAN2017](#)

According to a recent study by McKinsey & Company, [The Internet of Things: Mapping the Value Beyond the Hype](#), much of the data collected from the Internet of Things sensors today is not used at all. In a new world of managing massive volumes of data, no longer will there be one big physical, monolithic data repository. Volume, variety and velocity of data are forcing us to think within a multifaceted framework in which a purpose-built data layer, along with the ability to logically combine and interact with data in multiple ways, is required.

*Tags: Big data***BIOTECHNOLOGY****Implantable microrobots: Innovative manufacturing platform makes intricate biocompatible micromachines**[Nanowerk, 04JAN2017](#)

By exploiting the unique mechanical properties of hydrogels, researchers at Columbia University developed a "locking mechanism" for precise actuation and movement of freely moving parts which can provide functions such as valves, manifolds, rotors, pumps, and drug delivery. This platform, called implantable microelectromechanical systems (iMEMS), enables development of biocompatible implantable microdevices with a wide range of intricate moving components that can be wirelessly controlled on demand. [OPEN ACCESS TECHNICAL ARTICLE](#)

*Tags: Biotechnology***COMMUNICATIONS TECHNOLOGY****Smart prioritization of visually important data to improve video streaming**[Physorg.com, 04JAN2017](#)

Existing methods for streaming video and audio generally require a large allocation of bandwidth to each user. Researchers in Singapore developed an efficient method to derive an 'importance index' for each video packet based on the video bit rate, which varies packet-to-packet depending on how much new information needs to be displayed. By prioritizing video packets – each a fraction of an individual frame of video – based on bit rate and other network parameters, and inserting this priority in the Quality of Service scheme in real time, the team was able to achieve a significant enhancement in the perceived quality of streaming video among multiple users in a laboratory environment with limited wireless bandwidth. [TECHNICAL ARTICLE](#)

*Tags: Communications technology***CYBER SECURITY****NSRI to Support Defense Research on Emerging Cyberbiosecurity Concerns**[Global Biodefense, 05JAN2017](#)

A team of researchers in the US (MIT, Harvard University), working under a DOD contract, will establish and develop the foundations of cyberbiosecurity as a new specialty at the interface between biosecurity and cybersecurity. The work could gain the attention and involvement from a broad community of interest to design and implement technical and non-technical measures to protect and secure critical life science information that could be misappropriated or misused. [TECHNICAL ARTICLE](#)

Tags: Cyber security

“A study of history shows that civilizations that abandon the quest for knowledge are doomed to disintegration.” SIR BERNARD LOVELL

ENERGY

[Three-layer nanoparticle catalysts improve zinc-air batteries](#)

Nanowerk, 04JAN2017

Reaction with oxygen limits Zinc-air battery's voltage output and its performance at high current. Researchers in Singapore have developed a nanoparticle catalyst with a cobalt core encased by an inner shell of cobalt oxide, which is surrounded by an outer shell of pyrolyzed polydopamine. Their structure helps to prevent them from leaching cobalt and the outer shell makes the nanoparticles more durable. In tests, the battery produced a current of five milliamps per square centimeter of electrode at 1.36 volts for five days, outperforming an electrode that relied on platinum catalyst. [TECHNICAL ARTICLE](#)

Tags: Energy, Advanced materials, Battery

ENVIRONMENTAL SCIENCE

[Crystallization method offers new option for carbon capture from ambient air](#)

Science Daily, 09JAN2017

Carbon capture and storage is an important strategy for stabilizing the increasing concentration of atmospheric CO₂ and the global temperature. A team of researchers in the US (Oak Ridge National Laboratory, UT Austin, University of Tennessee) has developed guanidine crystals which capture carbon dioxide directly from ambient air. They were able to release the bound carbon dioxide, to be stored underground, by heating the crystals at 80-120 degrees Celsius, which is relatively mild when compared with current methods. After heating, the crystals reverted to the original guanidine material. The recovered compound could be recycled through three consecutive carbon capture and release cycles. [TECHNICAL ARTICLE](#)

Tags: Environmental science, Climatology

[Climate change could trigger strong sea level rise](#)

Science Daily, 05JAN2017

An international team of researchers (Australia, New Zealand, Italy, UK, Germany, Chile) report that the largest melt occurred 14,700 years ago. During this time the Antarctic contributed to a sea level rise of at least three meters within a few centuries. The present discovery is the first direct evidence from the Antarctic continent which confirms the assumed models. The research team used isotopic analyzes of ice cores from the Weddell Sea region, which now flows into the ocean about a quarter of the Antarctic melt. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Environmental science, Climatology

[Global warming hiatus disproved – again](#)

Science Daily, 04JAN2017

An international team of researchers (USA - UC Berkeley, George Mason University, Caltech, UK, Canada) calculated average ocean temperatures from 1999 to 2015, separately using ocean buoys and satellite data, and confirmed the uninterrupted warming trend reported by NOAA in 2015, based on that organization's recalibration of sea surface temperature recordings from ships and buoys. The new results show that there was no global warming hiatus between 1998 and 2012. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Environmental science, Climatology

[The fire through the smoke: Working for transparency in climate projections](#)

Science Daily, 04JAN2017

To help policymakers more confidently prepare for the effects of climate change, an international team of researchers (USA - NCAR, Princeton University, Rutgers University, Stanford, Wesleyan University, UK, Wold Bank, Germany, South Africa, Belgium, Japan) evaluated the scientific work and expert judgments behind the most recent projections from the Intergovernmental Panel on Climate Change regarding the potential ecological, social, economic and meteorological repercussions of climate change. [TECHNICAL ARTICLE](#)

Tags: Environmental science, Climatology

FORECASTING

[5 Big Predictions for Artificial Intelligence in 2017](#)

MIT Technology Review, 04JAN2017

According to the MIT Technology Review, these are five key things to look forward to in 2017 - Reinforcement learning, Neural networks, China's AI boom, Language learning, and Backlash to the hype.

Tags: Forecasting, Artificial intelligence

FOREIGN S&T

[MBDA team confirmed for £30M UK laser weapon demonstrator](#)

Optics.org , 06JAN2017

The project will assess innovative laser directed energy weapon technologies and approaches, culminating in a demonstration of the system in 2019. The contract will assess how the system can pick up and track targets at various ranges and in varied weather conditions over land and water. If it is successful, the first laser weapons would come into service in the mid-2020s.

Tags: Foreign S&T, Military technology, S&T UK

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New Camera Can See Around Corners**MIT Technology Review, 06JAN2017**

Researchers in China have built a single pixel camera that can see around corners by randomizing the light that the pixel detects, record the resulting light intensity, and then repeat this process thousands of times. Their new device can photograph objects even when they are not in direct view. These differences in intensity are not random but instead correlated with the scene in front of the pixel. So producing an image is simply a question of mining this data to find the correlation. And the more data that is collected, the better the image becomes. [OPEN ACCESS TECHNICAL ARTICLE](#). Similar technologies reported by American scientists which are not referenced by Chinese authors: In 2012 by MIT researchers [OPEN ACCESS TECHNICAL ARTICLE](#); In 2016 by Southern Methodist University, Rice University, Northwestern University, Harvard University researchers working under DARPA project [REVEAL](#)

*Tags: Foreign S&T, S&T China***UK building \$38 million combat laser prototype by 2019 and field lasers in mid-2020s****Next Big Future, 06JAN2017**

The aim is to see whether “directed energy” technology could benefit the armed forces, and is to culminate in a demonstration of the system in 2019. If the demonstration is successful, the first laser weapons could come into service in the mid-2020s. The demonstrator was not being developed to counter any specific threat, but to assess whether such weaponry could be delivered as a capability for the armed forces.

*Tags: Foreign S&T, Military technology, S&T UK***FEATURED RESOURCE****IEEE Spectrum magazine**

Flagship publication of the IEEE is a monthly magazine for technology innovators, business leaders, and the intellectually curious. Spectrum explores future technology trends and the impact of those trends on society and business. [RSS](#)

INFORMATION TECHNOLOGY**Telecommunications light amplifier could strengthen integrity of transmitted data****Science Daily, 05JAN2017**

Using ultra-silicon-rich nitride with large nonlinearity and photon efficiency needed for high gain amplification, an international team of researchers (Singapore, MIT) has developed an optical amplifier which is able to amplify light by 17,000 times at the telecommunications

wavelength. Providing high gain on such a small footprint could enable new opportunities in low cost broadband spectroscopy, precision manufacturing and hyperspectral imaging. The device’s efficiency is also revealed through cascaded four wave mixing, which is a higher order mixing of the amplified and converted photons. This phenomenon also allows the amplifier to operate as a tunable broadband light source, enabling cheaper and more efficient spectroscopic sensing and molecular fingerprinting than what is available today. [OPEN ACCESS TECHNICAL ARTICLE](#)

*Tags: Information technology, Photonics***MATERIALS SCIENCE****Inspired by radiation****MIT News, 06JAN2017**

Researchers at MIT believe radiation stores energy in all materials, including metals, in a measurable way that illustrates the defects responsible for its accumulation. Their research involves measuring and simulating this stored energy using nanoscale differential scanning calorimetry and molecular dynamics to visualize the full range of defects produced during irradiation. If their work is successful, scientists will be able to definitively measure whether critical components in a nuclear reactor will remain intact in the coming years, or if they are more likely to break during an accident.

*Tags: Materials science, Particle physics***A flexible transistor that conforms to skin****Science Daily, 05JAN2017**

An international team of researchers (USA - Stanford University, SLAC, University of Southern Mississippi, China, South Korea, Hong Kong, Canada, UK) found that the increased polymer chain dynamics under nanoconfinement significantly reduces the modulus of the conjugated polymer and largely delays the onset of crack formation under strain. As a result, their fabricated semiconducting film could be stretched up to 100% without affecting mobility, retaining values comparable to that of amorphous silicon. The fully stretchable transistors exhibited high biaxial stretchability with minimal change in current even when poked with a sharp object. [TECHNICAL ARTICLE](#)

*Tags: Materials science, Flexible electronics***Physicists solve decades-old scientific mystery of negative differential resistance****Science Daily, 05JAN2017**

Researchers in Canada have discovered the precise atomic structure that gives rise to negative differential resistance (NDR) and accounted for the perplexing reduction in current with increasing voltage. These results point the way to practical and lucrative applications of NDR in everyday electronics such as phones and computers. Existing electronic transistors can be made smaller, faster and cheaper if NDR effect can be incorporated into them.

[TECHNICAL ARTICLE](#)*Tags: Materials science, S&T Canada**continued...*

Electrons ‘puddle’ under high magnetic fields, study reveals

Physorg.com, 04JAN2017

In metals, electrons in outer orbitals can wander fairly freely. However, when the magnetic field is increased dramatically, the motion of these electrons becomes much more tightly confined. A team of researchers in the US (Cornell University, Argonne National Laboratory, MIT, NIST, National High Magnetic Field Laboratory) subjected strontium titanate crystals to extremely high magnetic fields. They observed that the quantum properties of the electrons changed dramatically when the crystals were put under high magnetic fields and cooled down to just a few hundredths of a degree above absolute zero. The research may help scientists gain an enriched understanding of material behavior. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Materials science, Government S&T*

Researcher’s discovery of new crystal structure holds promise for optoelectronic devices

Science Daily, 04JAN2017

A team of researchers in the US (Florida State University, University of Florida) found a way to put metal halide octahedra together in a chain, which is surrounded by organic pieces to form a core-shell type wire. Millions of the organic-coated wires then stack together to form a crystalline bundle. It is highly photo luminescent and can be manipulated. As they are good light emitters they have applications in LEDs or lasers. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Materials science*

Additive manufacturing: A new twist for stretchable electronics?

Science Daily, 03JAN2017

In a review article, researchers at the Missouri University of Science and Technology assess the current state of the emerging field of stretchable electronics, focusing on conductors built on elastomer. Overcoming mismatches between the flexible elastomer base and more brittle electronic conductors is a challenge. They suggest additive manufacturing as a possible solution. They are testing direct aerosol printing which involves spraying a conductive material and integrating it with a stretchable substrate to develop sensors that can be placed on skin. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Materials science, Flexible electronics*

NEUROSCIENCE

Using light to make single cells self-destruct

Medical Express, 06JAN2017

Many diseases are caused by death of certain important cells. Researchers at UCSF have developed a new optogenetic tool called miniSOG2 that will enable exquisitely precise experiments to help researchers understand how each cell contributes to the whole. This should lead to a more precise understanding of these cells’ normal functions, as well as new ways to test therapeutics against specific diseases. [TECHNICAL ARTICLE](#)

Tags: *Neuroscience*

PHOTONICS

Feature issue on nonlinear optics provides insight into field’s latest ideas

Physorg.com, 04JAN2017

The feature issue is dedicated to works on both second-order and third-order nonlinear optics. Slightly more than half of the papers focus on theoretical analysis, with a strong emphasis on understanding model systems. The remaining papers provide an experimental counterpoint that includes examples of nonlinear optical responses in a variety of systems. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: *Photonics*

QUANTUM SCIENCE

Decoding the quantum horizon

Physics World, 05JAN2017

The study of qubits may hold the key to uniting quantum theory and general relativity into a unified theory of quantum gravity. In recent years, high-energy theorists have been making exciting progress by borrowing techniques and concepts originally developed in the study of quantum information. The latter is primarily interested in harnessing the weirdness of quantum theory to develop new systems for ultrafast computation and ultra-secure communications. However, it has become clear that quantum information theory is also a powerful new lens through which to examine the conundrums of quantum gravity.

Tags: *Quantum science, Science without borders*

SCIENCE WITHOUT BORDERS

Can big data yield big ideas? Blend novel and familiar, new study finds

Science Daily, 09JAN2017

By analyzing the text in a large number of ideas across different domains, researchers at Columbia University were able to link an idea judged creative to its set of ‘ingredients.’ They found that what makes an idea creative as judged by both consumers and firms’ executives is a mix of ingredients (words) that includes a balance between

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words that commonly appear together (familiar combinations) and words that do not (novel combinations). Using insights gained from this research, the authors have developed a tool that can help people come up with better ideas. [TECHNICAL ARTICLE](#)

Tags: Science without borders

[India to launch 103 satellites in record single mission](#)

[Physorg.com](#), 04JAN2017

The rocket is set to blast off in February carrying three Indian and 100 foreign satellites from the US, France and Germany. If successful India will set a world record as the first country to launch the most satellites in one go, leaving behind Russia which launched 39 satellites in a single mission in June 2014.

Tags: Science without borders, Satellite technology, Space technology

SENSORS

[High Sensitivity Terahertz Detection through Large-Area Plasmonic Nano-Antenna Arrays](#)

[ArXiv](#), 24DEC2016

Plasmonic photoconductive antennas have great promise for increasing responsivity and detection sensitivity of conventional photoconductive detectors. However, operation is limited by bandwidth constraints. Researchers at UCLA present a specific large-area device geometry that offers a strong interaction between the incident terahertz beam and optical pump at the nanoscale, while maintaining a broad operation bandwidth and allowing robust operation against optical and terahertz beam misalignments. They demonstrated detection with signal-to-noise ratio levels as high as 107 dB. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Sensors, Terahertz technology ■

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