



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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## FEATURE ARTICLES

### [This New Browser Plug-in Lets You Access Millions of Scientific Papers for Free](#)

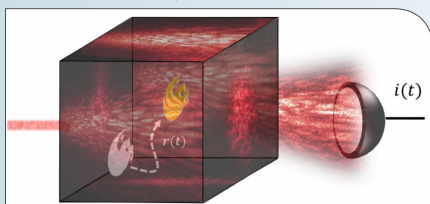
[Science Alert, 21APR2017](#)

Unpaywall was launched earlier this month by the open source not-for-profit Impactstory—funded by the National Science Foundation and the Alfred P. Sloan Foundation. Install the plug-in on your Chrome or Firefox desktop browser, and it will start displaying a little lock symbol whenever you're on the landing page of an article in an academic journal. If the plug-in can find a freely accessible full-text copy of the paper you're looking at, the lock symbol turns from grey to green, and you can simply click on it to get the PDF. If the lock is gold, the article you're reading already has an open access license.

*Tags: Science without borders, Featured Article*

### [By listening to optical 'noise,' researchers discover new way to track hidden objects](#)

[Science Daily, 20APR2017](#)



*The system tracks a target enclosed in a 'scattering box' that impedes direct imaging. Light is collected by an integrating detector, which distinguishes natural noise from fluctuations. Credit: Aristide Dogariu, University of Central Florida*

Researchers at the University of Central Florida have demonstrated real-time tracking of objects, which are surrounded by scattering media that practically conceal the objects. They showed that full 3D motion can be effectively encoded in the statistical properties of spatially diffused but temporally coherent radiation. The method relies on measurements of integrated scattered intensity performed anywhere outside the disturbance region which renders flexibility for different sensing scenarios as well as low-light capabilities. The approach could help advance real-time remote sensing and biomedical research that involves fast-moving particles that cannot be observed directly. [OPEN ACCESS](#)

[TECHNICAL ARTICLE](#)

*Tags: Imaging technology, Featured Article*

## S&T NEWS ARTICLES

### ADVANCED MANUFACTURING

#### [Not stuck on silicon](#)

[MIT News, 19APR2017](#)

An international team of researchers (USA - MIT, Ohio State University, United Emirates) has developed a procedure to place single sheets of graphene onto an expensive wafer to grow semiconducting material over the graphene layer. Graphene is thin enough to appear electrically invisible, allowing the top layer to imprint patterns on the crystalline wafer. As graphene is "slippery" the top semiconducting layer is peeled off from the wafer after its structures have been imprinted. The wafer can be used many times over. The technique makes the use of exotic semiconductors more accessible to industries and it may advance the field of flexible electronics. [TECHNICAL ARTICLE](#)

*Tags: Advanced manufacturing*

### ADVANCED MATERIALS

#### [Self-assembled nanostructures can be selectively controlled](#)

[Science Daily, 24APR2017](#)

Plasmonic nanoparticles can form clusters, plasmonic metamolecules, and then interact with each other. Properties of the metamolecules can be controlled by changing the geometry of the nanoparticles. An international team of researchers (Germany, Finland, Italy) used pH to modify the shapes of the clusters. Metamolecules can be either in a "locked" state at low pH or in relaxed state at high pH. Both states have very distinct optical responses. The technique is promising for the development of sensors, optical switches, transducers and phase shifters at different wavelengths. In the future, pH-responsive nanostructures could also be useful in the development of controlled drug delivery. [OPEN ACCESS](#)

[TECHNICAL ARTICLE](#)

*Tags: Advanced materials*

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## AUTONOMOUS SYSTEMS & ROBOTICS

### **Hacked Drones Become the Ultimate IEDs**

Defense Update, 06MAR2017

Fully integrated with drones, high precision gimballed payloads can turn cheap camera-drones into target acquisition and attack systems. Datalinks gradually migrate to higher frequencies, exploiting frequency hopping techniques that make jamming harder than ever before. These platforms available online, are modular and scalable and components available online as 'do-it-yourself' (DIY) drone. This trend has recently evolved and enabled insurgents in several war zones to hack small commercial drones into lethal weapons, turning what was a small and innocent toy into a smart and deadly IED.

Tags: Autonomous systems & robotics, Military technology

## BIOTECHNOLOGY

### **Researchers develop faster biosensor platform using a magnetic field**

Physorg.com, 24APR2017

The existing biosensors are slow to detect low-density biomolecules and have poor sensing efficiency as they only depend on diffusion. Researchers in South Korea labeled the biomolecules with superparamagnetic particles which could be controlled with the use of an external magnetic field and detected with an ultra-sensitive magnetic sensor. The biosensor platform uses a spider web-shaped micro-magnetic pattern that improves the sensing ability of the biosensor by attracting labeled biomolecules to the sensing area. The new technique is 20 times faster than the diffusion method. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Biotechnology

### **Tiny 'cages' could keep vaccines safe at high temperatures**

Science Daily, 24APR2017

Researchers in the UK have developed a technique called ensilication, where a protein in solution is mixed with silica. Silicon dioxide binds closely around protein to match its shape and quickly builds up many layers, encasing the protein. Once the protein has been encased in silica it can be stored or transported without refrigeration before the silica coat can be removed chemically, leaving the proteins unaffected. They have demonstrated that with ensilication, proteins can be kept from breaking down up to 100°C, or stored as powder for up to three years at room temperature without loss of function. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Biotechnology, Medical technology, S&T UK

### **Nanotube sensors promise smarter performance tracking**

Nanotechweb, 20APR2017

Researchers at UCSD designed a multifunctional, wearable, fabric-based sensing system made from carbon nanotubes.

CNTs and latex were mixed together and sprayed onto glass, where it is annealed to produce a freestanding thin-film network of nanotubes. They attached two electrodes and sandwiched the film between two layers of fabric and ironed them together to produce a flexible fabric sensor. The device has applications in real-time monitoring of patients through telemedicine and those working in extreme environments. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Biotechnology

## COMMUNICATIONS TECHNOLOGY

### **Fidelity in a marriage between electronic and optical effects**

Science Daily, 20APR2017

The performance of electro-optical interface is a factor that limits the rate of data transmission. Researchers in Singapore have developed a method that allows the electrical-optical interaction inside the modulator to be visualized by showing the light intensity as an overlay on the modulator's distribution of electronic properties. The exact position of the nano-scale features and electronic properties can then be fine-tuned to achieve the best optical performance. They developed a code to perform both electrical and optical simulation in one single platform with no loss in data fidelity. [TECHNICAL ARTICLE](#)

Tags: Communications technology

### **On-chip nanowire laser delivers on data**

Nanotechweb, 19APR2017

An international team of researchers (Japan, Singapore) overcame the difficulty of confining light in a structure much smaller than its wavelength by using a silicon photonic crystal to trap light in a semiconductor nanowire and turned the chip itself for optical processing and sensing. They have shown that a photonic crystal/nanowire hybrid can sustain telecom-band lasing stable enough to transmit a high-frequency data signal. The platform's advantages for component integration could enable them to build an on-chip photonic network. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Communications technology

## COUNTER WMD

### **Assessing the Threat of Infectious Disease to the Biosecurity of the United States**

US Army Command, 10JUN2016

Climate change, globalization, bioterrorism and policy all have a variance of impact that must be considered to prevent an outbreak of disease. Climate change is having an effect upon the habitat of many arthropod vectors of disease. Global travel and human migration are increasing the ranges of many infectious diseases of global significance. When diseases are assessed against the four variables, the vulnerability of public health prevention and response efforts can be assessed, identified as gaps which must

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“Advances are made with new insights, but the final arbitrator of any point of view are experiments that seek the unbiased truth, not information cherry picked to support a particular point of view.” STEVEN CHU

be mitigated to prevent or lessen the impact of future outbreaks of infectious diseases. [OPEN ACCESS TECHNICAL ARTICLE](#)

*Tags: Counter WMD, S&T Policy*

## ENERGY

### [Freezing lithium batteries may make them safer, bendable](#)

[Science Daily, 24APR2017](#)

An international team of researchers (USA - Columbia University, China) cooled an aqueous solution with ceramic particles from the bottom and then let ice grow and push away and concentrate the ceramic particles. They then applied a vacuum to transition the solid ice to a gas, leaving a vertically aligned structure. Finally, they combined this ceramic structure with polymer to provide mechanical support and flexibility to the electrolyte. The new design increases battery energy density for transportation and storage and shows great promise in creating bendable devices. [TECHNICAL ARTICLE](#)

*Tags: Energy, Battery*

### [New breakthrough in battery charging technology](#)

[Science Daily, 24APR2017](#)

Researchers in South Korea have developed a new class of monolithically integrated, portable PV-battery systems (SiPV-LIBs) based on miniaturized crystalline Si photovoltaics (c-Si PVs) and printed solid-state lithium-ion batteries (LIBs). The device uses a thin-film printing technique, in which the solid-state LIB is directly printed on the high-efficiency c-Si PV module. The SiPV-LIB device was capable of fully charging under sunlight illumination after only 2 min. It can store energy at 60°C and charge at low light intensity, equivalent to a dimly-lit living room. The technology allows charging portable electronics anywhere with access to light. [TECHNICAL ARTICLE](#)

*Tags: Energy, Battery*

### [Solar cell design with over 50% energy-conversion efficiency](#)

[Physorg.com, 24APR2017](#)

To reduce large energy losses and raise efficiency of solar cells, researchers in Japan used two small photons from the energy transmitted through a single-junction solar cell containing a hetero-interface formed from semiconductors with different bandgaps. Using the photons, they developed a new solar cell structure for generating photocurrents.

They demonstrated theoretical results of up to 63% conversion efficiency. [OPEN ACCESS TECHNICAL ARTICLE](#)

*Tags: Energy, S&T Japan, Solar energy*

### [One small change makes solar cells more efficient](#)

[Nanowerk, 21APR2017](#)

Researchers at the University of Wyoming have demonstrated a huge enhancement in the incident photon-to-current efficiency of PbS quantum dot sensitized solar cells by manganese doping. In the presence of Mn dopants with relatively small concentration (4%), the photoelectric current increased by an average of 300%. They propose that the dramatic increase is due to a mechanism of increased electron tunneling through the atom pairs at the quantum dot interface with the next layer of the solar cell.

[TECHNICAL ARTICLE](#)

*Tags: Energy, Advanced materials, Solar energy*

### [Sodium-ion batteries become fully stretchable](#)

[Nanowerk, 20APR2017](#)

An international team of researchers (USA - UT Austin, University of Minnesota, China) designed PDMS/rGO sponge based electrodes to fabricate a battery. The sponge has high electrochemical conductivity, exhibits reasonable electrochemical performance, robust mechanical deformability and its electrochemical characteristics can be well-maintained under various stretched conditions after hundreds of stretching-release cycles. The device has applications in health monitoring sensors, wearable communication devices, roll-up displays and implantable medical devices. [TECHNICAL ARTICLE](#)

*Tags: Energy, Battery, Biotechnology*

## FORECASTING

### [Asia will surpass the U.S. in C4ISR spending by 2025](#)

[Defense Systems, 19APR2017](#)

A market forecast released this week by Transparency Market Research reports that electronic warfare systems account for the biggest share of the global C4ISR market, a trend that is expected to continue through its 2025 forecast period. Much of the growth in the EW sector will be driven by China, Brazil and the United Arab Emirates which are beefing up military electronics capabilities to protect expanding land, sea and air forces while improving situational awareness.

*Tags: Forecasting, Military technology*

## FOREIGN S&amp;T

**China has successful Long March 7 launch and mission**[Next Big Future, 23APR2017](#)

A Long March 7 rocket lifted off Thursday with Tianzhou 1, an uncrewed refueling freighter heading for China's Tiangong 2 mini-space station to conduct several months of robotic demonstrations, practicing for the assembly and maintenance of a future permanently-staffed orbital research complex. The 174-foot-tall (53-meter) kerosene-fueled launcher blasted off from the Wenchang space center.

*Tags: Foreign S&T, Military technology, S&T China, Space technology*

## IMAGING TECHNOLOGY

**Cameras can reveal images that are hidden to the naked eye**[Physorg.com, 20APR2017](#)

Human eyes are not capable of averaging video images that last longer than 40 milliseconds. Using this fact, researchers in Switzerland modified an image over time through temporal masking, eventually turning it into a video. They tweaked many technical components of the image to make it invisible, but without changing the underlying image. The human eye cannot detect the temporal variation but a camera can reveal the hidden image. [TECHNICAL ARTICLE](#)

*Tags: Imaging technology*

## FEATURED RESOURCE

**AI Topics**

AI Topics is the Internet's largest collection of information about the research, the people, and the applications of Artificial Intelligence. A wide variety of curated and organized resources are gathered from across the web. [RSS](#)

## INFORMATION TECHNOLOGY

**Internet of the future via massive mobile antennae technology**[Physorg.com, 24APR2017](#)

To meet the needs of a 5G network, researchers in Denmark are working on a system they call "massive MIMO" with a base station unit that holds several hundred antennas, making it possible to connect mobile units much more precisely to each other and increase the data transmission rate many times. According to the researchers, the new technology creates a sort of virtual cable that is focused and narrow between the base station and the connected unit improving the security of data.

*Tags: Information technology, Communications technology*

**Researchers working toward indoor location detection**[Physorg.com, 17APR2017](#)

Researchers at Rice University are mapping a new solution for interior navigational location detection by linking it to existing sensors in mobile devices. Unlike their earlier invention CapSuLe, their current technique uses time-series mining for analyzing data provided by gyroscope and accelerometers that already exist in most mobile devices. The technology may also have wide applications in health care and marketing.

*Tags: Information technology*

## MATERIALS SCIENCE

**A more fundamental approach to correlation**[Nanowerk, 21APR2017](#)

Electron correlation effects often manifest themselves as modifications of band structure. To apply wave-function theory to strongly correlated materials, researchers in Japan developed an efficient calculation method based on many-body wave functions using the transcorrelated method. The method provides an accurate correlated band structure that agrees well with experimental observations. Their technique offers an important basis for theoretically investigating the physics observed in strongly correlated materials. [OPEN ACCESS TECHNICAL ARTICLE](#)

*Tags: Materials science, S&T Japan*

**Black phosphorus holds promise for the future of electronics**[Physorg.com, 20APR2017](#)

Black phosphorus has bandgap and higher mobility than silicon. An international team of researchers (US - Yale University, Washington University, UMass Amherst, University of Southern California, University of Minnesota, Israel) has reported that bandgap can be controlled at a certain thickness by applying a vertical electric field. They demonstrated that passivating the surface with self-assembled monolayers of octadecyltrichlorosilane, that provides long-term stability in ambient conditions, is a viable solution to overcome the material's degradation due to its sensitivity to oxygen and moisture. The findings could lead to replacing silicon with black phosphorus for electronics. [OPEN ACCESS TECHNICAL ARTICLE 1, 2](#)

*Tags: Materials science*

## MICROELECTRONICS

**Smallest transistor ever**[Nanowerk, 20APR2017](#)

The gate length of a transistor is the defining parameter of the transistor size, and is presently about 20 nanometers in commercial electronic chips. It is not possible to shrink it below 5 nanometers using silicon. A team of researchers in the US (UC Berkeley, Lawrence Berkeley National Laboratory, UT Dallas, Stanford University) used atomically

*continued...*

uniform molybdenum disulfide and single-walled carbon nanotubes to fabricate a fully operational transistor. They have demonstrated that the transistor gate length can be reduced to 1 nanometer. [TECHNICAL ARTICLE](#)

*Tags: Microelectronics*

## QUANTUM SCIENCE

### [Focused ion beam creates single-photon emitters in diamond nanostructures](#)

[Nanotechweb](#), 24APR2017

A team of researchers in the US (MIT, Sandia National Laboratory, Harvard University) succeeded in directly implanting silicon ions into diamond photonic crystal nanocavities with a precision of about 50 nm and have created SiV centres with nearly perfectly stable optical transitions. Their technique can create millions of quantum emitters over a wafer-scale-sized sample. The emitters generate coherent, indistinguishable single photons. The research has applications in quantum secure communications, metrology and computing. [OPEN ACCESS](#)

[TECHNICAL ARTICLE](#)

*Tags: Quantum science, Photonics*

### [Google's New Chip Is a Stepping Stone to Quantum Computing Supremacy](#)

[MIT Technology Review](#), 21APR2017

By the end of this year, Google will build a device that achieves “quantum supremacy,” meaning it can perform calculations that are beyond the reach of any conventional computer. Google’s latest chip has only six qubits, but they are arranged in a two-by-three configuration that shows the company’s technology still works when qubits are nestled side by side, as they will be in larger devices. Designs for devices with 30 to 50 qubits are already in progress. The experiment could become a benchmark for anyone claiming to have a working quantum computer. The race to develop quantum processors includes Intel, Microsoft, IBM, and even startups.

*Tags: Quantum science, Microelectronics*

### [Researchers harness mysterious Casimir force for tiny devices](#)

[Physorg.com](#), 20APR2017

Casimir force arises from quantum effects and can be seen experimentally by placing two opposing plates very close to each other in a vacuum. An international team of researchers (China, USA - Princeton University) designed a silicon structure that looks like two plates lined with teeth that face each other across a tiny gap which is only about 100 nanometers wide. As the two plates are pushed closer together, the Casimir force comes into play and pushes them apart. They developed techniques that allowed the researchers to compute interactions between the plates as they approach each other. They are using the tools to explore more complex geometries. [TECHNICAL ARTICLE 1, 2](#)

*Tags: Quantum science*

## S&T POLICY

### [A moonshot for chemistry](#)

[Science Magazine](#), 21APR2017

Researchers at the University of Illinois, Champaign, believe chemistry is ready for a major new research initiative aimed at synthesizing most of the natural products and their structural kin. Their analysis suggests that 75% of all natural product molecules could be synthesized by machines if the community were to create just 1400 building blocks. The payoff could be countless new medicines as well as a bevy of compounds for other uses.

*Tags: S&T policy*

## SCIENCE WITHOUT BORDERS

### [As orbit becomes more crowded, risk from space debris grows](#)

[Physorg.com](#), 21APR2017

More than 750,000 fragments larger than a centimeter are already thought to orbit Earth, and each one could badly damage or even destroy a satellite. Experts meeting in Germany this week said the problem could get worse as private companies send a flurry of new satellites into space over the coming years. They recommend that mega-constellations planned by private companies should have a maximum orbital lifetime of 25 years. After that, the satellite constellations would need to move out of the way, either by going into a so-called ‘graveyard orbit’ or returning to Earth. An ever-growing cascade of collisions could render near-Earth orbits unusable to future generations (Kessler syndrome). Proposals to clean up space include garbage-cleaning spacecraft armed with harpoons, nets, robotic arms and even lasers to fry small bits of debris. ESA’s “clean space” initiative is underway to bring down a very large piece of debris.

*Tags: Science without borders, Satellite technology, Space technology*

### [Physicists bring together detector and accelerator to explore ‘new physics’ beyond the Standard Model](#)

[Physorg.com](#), 20APR2017

To study some of the tiniest particles in the universe, an international team of over 750 physicists from 23 countries is building the SuperKEKB particle accelerator at the KEK research center in Japan. The instrument will smash subatomic particles together and the resulting particles to help scientists understand some of the mysteries of the Standard Model of physics. The detector will also help researchers search for new particles and behaviors that might indicate new physics currently only predicted by theory.

*Tags: Science without borders, Particle physics*

## **The nearly universal link between the age of past knowledge and tomorrow's breakthroughs in science and technology: The hotspot**

Science Magazine, 19APR2017

Scientists and inventors can draw on an ever-expanding literature for the building blocks of tomorrow's ideas. Knowing whether old, new, randomly sampled, or popular information is associated with the creation of novel combinations can help provide insight into where the richest combinations of past knowledge are located. A team of researchers in the US (Northwestern University, non-profit organization, University of Michigan) studied modern science and invention to identify the empirical patterns linking the age of information cited in a paper or patent and the paper's or patent's subsequent impact.

*Tags: Science without borders*

## **Physicists create 'negative mass'**

Science Daily, 17APR2017

An international team of researchers (USA - Washington State University, University of Washington, Japan, China) created the conditions for negative mass by cooling rubidium atoms to create Bose-Einstein condensate. By using lasers they cooled the material further and trapped the atoms. To create negative mass, they applied a second set of lasers that kicked the atoms back and forth and changed the way they spin. When the rubidium rushes out fast enough, it behaves as if it has negative mass. This heightened control gives researchers a new tool to engineer experiments to study analogous physics in astrophysics, neutron stars, and cosmological phenomena like black holes and dark energy. **TECHNICAL ARTICLE**

*Tags: Science without borders* ■

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