



# S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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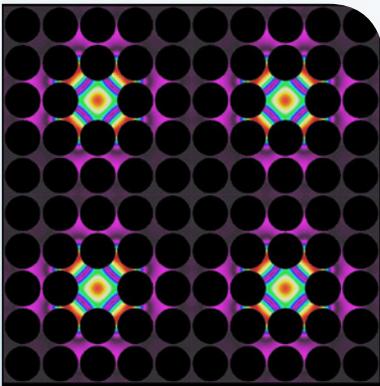
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## FEATURE ARTICLES

### [How to treat heat like light](#)

MIT News, 15JAN2013



Thermal lattices, shown here, are one possible application of the newly developed thermocrystals. In these structures, where precisely spaced air gaps (dark circles) control the flow of heat, thermal energy can be "pinned" in place by defects introduced into the structure (colored areas). Illustration courtesy of Martin Maldovan

The approach relies on engineered materials consisting of nanostructured semiconductor alloy crystals called thermocrystals. In order to apply the techniques already developed to manipulate sound, the first step was to reduce the frequency of the heat phonons, bringing it closer to the sound range. When frequency is reduced, more than 40 percent of the total heat flow is concentrated

within a hypersonic range of 100 to 300 gigahertz, and most of the phonons align in a narrow beam, instead of moving in every direction. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Breakthrough technology](#), [Materials science](#), [Featured Article](#)

### [Rudimentary atom capacitor](#)

Nanowerk, 15JAN2013

Over the past decade or so, still another information modality, atomtronics, has been under development, one employing not electrons but neutral atoms as the vehicle for information. Unlike conventional microchips sculpted from solid (albeit small) chunks of semiconductors, the free-space chip is sculpted out of laser light, focused into a pattern that holds and manipulates atoms suspended in a vacuum chamber. Research is done at the University of Maryland. [TECHNICAL ARTICLE](#)

Tags: [Communications Technology](#), [Featured Article](#)

### [Oscillating gel gives synthetic materials the ability to 'speak': Material rebuilds itself through chemical communication](#)

Science Daily, 13JAN2013

Self-moving gels can give synthetic materials the ability to "act alive" and mimic primitive biological communication, scientists have found. University of Pittsburgh researchers demonstrate that a synthetic system can reconfigure itself through a combination of chemical communication and interaction with light. [TECHNICAL ARTICLE](#)

Tags: [Materials science](#), [Featured Article](#)

## S&T NEWS ARTICLES

### ADVANCED MATERIALS

#### [New material harvests energy from water vapor](#)

Science Daily, 13JAN2013

Researchers at MIT have created a new polymer film that changes its shape after absorbing tiny amounts of evaporated water, allowing it to repeatedly curl up and down. Harnessing this continuous motion could drive robotic limbs or generate enough electricity to power micro- and nanoelectronic devices, such as environmental sensors. [TECHNICAL ARTICLE](#)

Tags: [Advanced materials](#), [Energy](#)

#### [Scientists develop strongest, lightest glass nanofibers in the world](#)

Science Daily, 13JAN2013

Researchers in the UK have created 'nanowires' that are 15 times stronger than steel and can be manufactured in lengths potentially of 1000's of kilometres. The discovery could change the future of composites and high strength materials across the world and have a huge impact on the marine, aviation and security industries.

Tags: [Advanced materials](#), [Materials science](#), [S&T UK](#)

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## AUTONOMOUS SYSTEMS &amp; ROBOTICS

**Machine perception lab shows robotic one year old on video**

Science Daily, 13JAN2013

The world is getting a long-awaited first glimpse at a new humanoid robot in action mimicking the expressions of a one-year-old child. The robot designed by UCAL will be used in studies on sensory-motor and social development—how babies “learn” to control their bodies and to interact with other people. [VIDEO](#)

Tags: *Autonomous systems & robotics*

**Video Friday: CES Robots, FIRST Competition, and Power Loader**

IEEE Spectrum, 11JAN2013

Check out the coolest robots from the Consumer Electronics Show and more!

Tags: *Autonomous systems & robotics*

## BIOTECHNOLOGY

**Molecular machine could hold key to more efficient manufacturing**

Science Daily, 13JAN2013

Researchers in the UK have developed a machine which uses molecules to make molecules in a synthetic process similar to the robotic assembly line in car plants. This will benefit all sorts of manufacturing areas as many humanmade products begin at a molecular level. They are currently modifying their machine to make drugs such as penicillin. [TECHNICAL ARTICLE](#)

Tags: *Biotechnology, Breakthrough technology*

## BREAKTHROUGH TECHNOLOGY

**Phased-Array Antennas for Light**

IEEE Spectrum, 15JAN2013

Each antenna, which consists of a silicon waveguide and five curved grooves etched in silicon, is 3 micrometers long, 2.8  $\mu\text{m}$  wide, and 0.22  $\mu\text{m}$  thick. The 4096 antennas, each of which constitutes a pixel, fit in a 0.33-square-millimeter area. An infrared laser beam is delivered to the antennas through a waveguide. The technology holds the promise of holographic televisions and cheaper automobile crash-avoidance systems. [TECHNICAL ARTICLE](#)

Tags: *Breakthrough technology, Photonics*

**Virus caught in the act of infecting a cell**

Science Daily, 13JAN2013

Researchers at UT Austin show that when searching for its prey, the virus briefly extends—like feelers—one or two of six ultra-thin fibers it normally keeps folded at the base of its head. At the preferred infection site, the virus goes through a major change in structure in which it ejects some of its proteins through the bacterium’s cell membrane,

creating a path for the virus’s genetic material to enter the host. [TECHNICAL ARTICLE](#)

Tags: *Breakthrough technology, Biology*

## COUNTER WMD

**New treatment could combat deadly chemical agents**

EurekAlert, 15JAN2013

Using a modified human enzyme researchers in UK and Russia created a “bioscavenger” which protected mice against nerve agent VR. That was achieved by a combination of chemical surface modification (polysialylation) and production through the use of an in vitro CHO-based expression system employing genes encoding butyrylcholinesterase and a proline-rich peptide under special promoter control. [TECHNICAL ARTICLE](#)

Tags: *Counter WMD*

## ENERGY

**Engineer making rechargeable batteries with layered nanomaterials**

Nanowerk, 16JAN2013

Researchers at Kansas State University created graphene films that are between two and 10 layers thick. They found that the charge and discharge characteristics of graphene films grown on copper did not cycle the lithium ions and the battery capacity was negligible. But graphene grown on nickel showed improved performance because it was able to store and release lithium ions more efficiently.

[TECHNICAL ARTICLE](#)

Tags: *Energy, Battery*

**Multi-junction solar cell design breaks efficiency barrier**

Nanowerk, 15JAN2013

In multi-junction (MJ) solar cells, each junction is ‘tuned’ to different wavelength bands in the solar spectrum to increase efficiency. High bandgap semiconductor material is used to absorb the short wavelength radiation with longer wavelength parts transmitted to subsequent semiconductors. In theory, an infinite-junction cell could obtain a maximum power conversion percentage of nearly 87 percent.

Tags: *Energy, Solar energy*

**New clean nuclear fusion reactor designed**

Science Daily, 15JAN2013

Researchers in Spain have patented a nuclear fusion reactor by inertial confinement that, apart from being used to generate electric power in plants, can be applied to propel ships. This invention helps solve the problem of contamination risk associated with the generation of nuclear fission power.

Tags: *Energy, Nuclear energy*

*continued...*

“No amount of experimentation can ever prove me right; a single experiment can prove me wrong.” ALBERT EINSTEIN

## GOVERNMENT S&T

### NASA researchers studying advanced nuclear rocket technologies

Science Daily, 13JAN2013

By using an innovative test facility at NASA, researchers are able to use non-nuclear materials to simulate nuclear thermal rocket fuels. Among the fuel options are a graphite composite and a “cermet” composite—a blend of ceramics and metals.

Tags: Government S&T, NASA, Propulsion systems

## FEATURED RESOURCE

### ResearchGate

Launched in 2008, it is a professional network for scientists and researchers to help build their reputation and accelerate scientific progress, while enabling them to collaborate on a global scale. 45 million abstracts and over 10 million fulltexts cover a wide range of topics.

## IMAGING TECHNOLOGY

### Next-generation adaptive optics brings remarkable details to light in stellar nursery

Science Daily, 13JAN2013

The new system, called GeMS, is installed on the Gemini South telescope in Chile and is the first of its kind to use laser guide stars and a technology called Multi-Conjugate Adaptive Optics (MCAO) to image the sky. It brings an unprecedented level of clarity and detail by removing distortions due to the Earth’s atmosphere.

Tags: Imaging technology

## INFORMATION TECHNOLOGY

### Professor works to overcome challenges in harnessing power of multicore computer processors

PhysOrg.com, 15JAN2013

According to researchers at the University of Delaware to effectively exploit the power of multi-core processors, programs must be structured as a collection of independent tasks where separate tasks are executed on independent cores. They are developing new algorithms and tools for parallelization of large-scale programs.

Tags: Information Technology

## Will Machines Ever Master Translation?

IEEE Spectrum, 15JAN2013

Language translation is proving to be one of the hardest tasks to automate—and one of the most important. January is a time for prediction, so here’s one: Google will have driverless production cars on the road before Google Translate gets used at the UN. Why? Because self-driving cars is a hard problem, but translation is a really hard problem.

Tags: Information Technology, Artificial intelligence

## MATERIALS SCIENCE

### Chemistry resolves toxic concerns about carbon nanotubes, experts say

Science Daily, 15JAN2013

Researchers in the UK show for the first time that only those reactions that are able to render carbon nanotubes short and stably suspended in biological fluids without aggregation are able to result in safe, risk-free material.

TECHNICAL ARTICLE

Tags: Materials science, S&T UK

### Researchers confirm intrinsic superconductor behavior

Nanowerk, 15JAN2013

Cornell physicists and materials scientists have now verified that cuprates respond differently when adding electrons versus removing them, resolving a central issue about the compounds’ most fundamental properties. They describe the behavior of a strontium-lanthanum copper oxide cuprate superconductor when chemically “doped” with electrons. TECHNICAL ARTICLE

Tags: Materials science

## MICROELECTRONICS

### Photovoltaic cell manufacture: Device tosses out unusable PV wafers

Science Daily, 16JAN2013

Researchers at DOE have developed an instrument that puts pressure on the wafers to find which ones are too fragile to make it through the manufacturing process—and then kicks out those weak wafers before they go through their costly enhancement. If a way can be found to eliminate the cost of the 5% to 10% of cells that are destined to fail before they’re finished, potential annual savings run into the billions of dollars.

Tags: Microelectronics, Government S&T

**Nanocircuits flex tech muscle (w/video)**

Nanowerk, 15JAN2013

The flexible nanoelectronic circuit designed by IBM researchers is 10,000 times thinner than a piece of paper, and was peeled off of a silicon wafer and put onto plastic. These circuits are also easily transferrable at any size, arbitrary in shape, and compatible with any flexible substrate. With a radius of curvature of only 6 mm, the sheets of circuits could cover or roll on top of almost anything. Thin flexible circuits are so light that a large number of these circuits can be stacked to provide unprecedented computing power.

Tags: *Microelectronics*

**Building Electronics from the Ground Up**

Science Daily, 14JAN2013

Researchers at the University of South Carolina fabricated nanoparticles of pure, crystalline iron oxide with controlled size and spacing on silicon wafers by covalently incorporating a ferrocene moiety into a tri-block copolymer.

TECHNICAL ARTICLE

Tags: *Microelectronics*

## NEUROSCIENCE

**Who Decides in the Brain?**

Alpha Galileo Foundation, 15JAN2013

Researchers in Germany have shown how the weight of individual neurons in the decision-making process can be reconstructed despite interdependencies between the neurons. They have developed an equation that allows them to calculate to what degree a given individual sensory neuron is involved in the decision process.

TECHNICAL ARTICLE

Tags: *Neuroscience*

**Newly found ‘volume control’ in brain promotes learning, memory**

Science Daily, 13JAN2013

Researchers at Georgetown University report synapses that act as “volume control” for nerve cell activity in the brain’s hippocampus, the epicenter for learning and memory. The finding describes how synapses that link two different groups of nerve cells in the hippocampus keep neuronal activity throughout that region at a steady, optimal level.

Tags: *Neuroscience*

## QUANTUM SCIENCE

**New qubit control bodes well for future of quantum computing**

Nanowerk, 15JAN2013

The Yale physicists successfully devised a new, non-destructive measurement system for observing, tracking and documenting all changes in a qubit’s state, thus preserving the qubit’s informational value. In principle, the

scientists said, this should allow them to monitor the qubit’s state in order to correct for random errors. TECHNICAL ARTICLE

Tags: *Quantum science*

**News from the world of quantum physics: A non-causal quantum eraser**

Science Daily, 13JAN2013

Whether a certain photon behaves like a particle or like a wave depends on the measurement performed on a second photon. In the new experiment conducted by researchers in Austria, this second photon is so far separated from the first photon that no transfer of information whatsoever (the velocity of which can never exceed the speed of light) would be fast enough. Yet, the first photon behaves like a wave or like a particle, still depending on the measurement performed on the second. TECHNICAL ARTICLE

Tags: *Quantum science*

**Experts still split about what quantum theory means**

Nature News, 11JAN2013

A poll of 33 key thinkers on the fundamentals of quantum theory shows that opinions on some of the most profound questions in the field are fairly evenly split over several quite different answers. However, more than two-thirds believed that there is no fundamental limit to quantum theory—that it should be possible for objects, no matter how big, to be prepared in quantum superpositions like Schrödinger’s cat. So the era where quantum theory was associated only with the atomic realm appears finally over.

TECHNICAL ARTICLE

Tags: *Quantum science*

## S&amp;T POLICY

**New US rare earth centre to be built**

BBC, 12JAN2013

The Critical Materials Institute will bring together the best and brightest research minds from universities, national laboratories and the private sector to find innovative technology solutions that will help us avoid a supply shortage that would threaten our clean energy industry as well as our security interests. According to the US Geological Survey, there may be deposits of rare earths in 14 US states.

Tags: *S&T policy*

## SCIENCE WITHOUT BORDERS

**Growing food on walls? Robotic nutritional advice? What does the future kitchen hold?**

Science Daily, 15JAN2013

By 2050 people all over the world could be growing food on the walls of their homes and have eco-kitchens—complete with robots to provide nutritional advice, if one

*continued...*

group's projections come true. That's the vision of a team of Chinese students who have won a competition, called Dream Lab 2012, which focused on how farming, cooking and eating will change during the next four decades.

*Tags: Science without borders*

### **IBM Tops U.S. Patent List for 20th Consecutive Year**

**IBM, 15JAN2013**

IBM today announced that it received a record 6,478 patents in 2012 for inventions that will enable fundamental advancements across key domains including analytics, Big Data, cybersecurity, cloud, mobile, social networking and software defined environments, as well as industry solutions for retail, banking, healthcare, and transportation.

*Tags: Science without borders*

## **SENSORS**

### **Frequency combs for sniffing molecules**

**Nanowerk, 15JAN2013**

Researchers in Germany have demonstrated the generation of mid-infrared frequency combs with small crystalline micro-resonators. Such miniaturized instruments, which can detect and characterize such molecules quickly and with high sensitivity, could revolutionize many areas of science and technology. **TECHNICAL ARTICLE**

*Tags: Sensors*

### **Small UAV Supports Development of Lightweight Sensors**

**Newswise, 15JAN2013**

Engineers at the Georgia Tech Research Institute are developing GTRI Airborne Unmanned Sensor System (GAUSS), an airborne testing capability for sensors, communications devices and other payloads. The overall concept for the aerial test bed program is that the airplane itself will be simply a conveyance, and we can mount on it whatever sensor/communication package is required.

*Tags: Sensors*

## **STEM**

### **The reach and impact of mathematical sciences** **EurekAlert, 15JAN2013**

The Mathematical Sciences in 2025, a new report from the National Research Council, finds that the mathematical sciences are an increasingly integral component of many disciplines—including biology, medicine, the social sciences, business, advanced design, and climate studies.

*Tags: STEM* ■

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