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FEATURE ARTICLES

[Robot Toddler Learns to Stand by “Imagining” How to Do It](#)



Darwin tries moving its torso around under the control of several neural networks.

MIT Technology Review, 05NOV2015

UC Berkeley developed a robot, Darwin; its motions are controlled by several simulated neural networks. The approach makes use of deep-learning networks which have many layers of simulated neurons. The new technique could prove useful for any robot working in all

sorts of real environments, but it might prove especially useful for more graceful legged locomotion.

Tags: Autonomous systems & robotics, Featured Article

[Graphene-based Magnetoresistance Sensor 200 Times as Sensitive as Silicon](#)

IEEE Spectrum, 30OCT2015

An international team of researchers (Singapore, UK) used boron nitride as a substrate for graphene sheets; the resulting chip forms an interface that allows electrons to pass through the material very quickly thus responding to magnetic fields with greater sensitivity. The chip possesses high sensitivity to both high and low intensity magnetic fields, and neither its tunability nor its resistance changes substantially in varying temperatures. **TECHNICAL ARTICLE**

Tags: Sensors, Advanced materials, Featured Article

ADVANCED MATERIALS

[Graphene paper goes for a stroll](#)

Physics World, 09NOV2015

Researchers in China have built self-folding paper from extremely thin sheets of graphene oxide. The new paper bends in response to light or heat, and can be made to “walk” on a surface and even turn corners. The material could be used in a range of applications, including sensing, artificial muscles and robotics. **TECHNICAL ARTICLE**

Tags: Advanced materials, S&T China, Sensors

[Nanostructuring technology to simultaneously control heat and electricity](#)

PhysOrg.com, 09NOV2015

Researchers in Japan created a nanostructure in silicon using ultrasmall germanium nanodots with identical crystal orientations where high electric conductivity and low heat conductivity were realized simultaneously. By changing the shape and dimension of Ge nanodots they were able to control thermal conductivity at will. The research is a potential breakthrough in the realization of Si-based thermoelectric materials for use in large scale integrated circuits waste heat conversion. **TECHNICAL ARTICLE**

Tags: Advanced materials, S&T Japan

AUTONOMOUS SYSTEMS & ROBOTICS

[Video Friday: Breakfast Robot, Programmable Matter, and Exploding Ping Pong Balls](#)

IEEE Spectrum, 06NOV2015

A lecture on “Paths to Human-level AI” by Murray Shanahan at Aldebaran Paris.

Tags: Autonomous systems & robotics

[This Surveillance Drone Never Needs to Land](#)

MIT Technology Review, 05NOV2015

A drone called Parc, developed by a company in Boston can perform aerial surveillance indefinitely, using a

continued...

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“microfilament” that transmits power and data. The fact that it’s tethered means the drone can’t travel very far. The company expects it to be used for reconnaissance or as a communications relay.

Tags: Autonomous systems & robotics

BIOTECHNOLOGY

Microscopic cage for light traps photons but lets fluids through

[New Scientist](#), 05NOV2015

A team of researchers in Australia ran a computer simulation of a wire 200 nanometres wide made from gallium arsenide coated with silver and another layer of gallium arsenide. They found it could absorb light from up to 100 nanometres away from its edges. By placing such wires at regular intervals, they were able to simulate cages that prevented light getting in or out, including one in the shape of Australia to show they could take on any shape. The technique can protect and shield systems such as live cells inside the metacages from outside radiation, while gases and liquids can pass through it to feed them and get the chemical products out. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Medical sciences

World’s first lab-in-a-briefcase

[Science Daily](#), 30OCT2015

The lab-in-a-briefcase, developed by researchers in the UK, consists of four components; a manually driven multi-syringe device capable of performing up to 80 simultaneous tests from whole blood samples; microwell plates pre-loaded with assay reagents; a portable USB-powered film scanner to image the test strips; and a portable computer for real-time data analysis. A disposable microfluidic test strip comprising of tiny tubes about the size of a human hair is used for the quick measurement of different types of cancer biomarkers in a whole blood sample. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Medical sciences, S&T UK

COMMUNICATIONS TECHNOLOGY

Wi-FM listens to FM signals to determine best times to send and receive data

[PhysOrg.com](#), 09NOV2015

Wi-Fi networks often bump into each other and prevent data from getting through. Researchers at Northwestern University found that problems caused by competing networks can be mitigated by using an already-existing, extremely cheap medium: FM radio. Called “Wi-FM,” the team’s technique enables existing wireless networks to communicate through ambient FM radio signals. Minor upgrades to software would allow devices to take advantage of Wi-FM. [TECHNICAL ARTICLE](#)

Tags: Communications Technology

ENERGY

Harvesting more energy from photons

[Nanowerk](#), 05NOV2015

A team of researchers in the US (MIT, UCLA, Harvard University, Oak Ridge National Laboratory, Sandia National Laboratory) has found a way to significantly boost the energy that can be harnessed from sunlight. It is based on the discovery that unexpected quantum effects increase the number of charge carriers that are knocked loose when light of different wavelengths strikes a metal surface coated with high-index dielectrics. The researchers used a sheet of silver coated with an oxide, which converts light energy into polarization of atoms at the interface.

[TECHNICAL ARTICLE](#)

Tags: Energy, Materials science, Solar energy

Researchers have designed a battery that’s 90 percent more efficient than lithium-ion

[Digital Trends](#), 05NOV2015

Researchers in the UK have developed a new design for a lithium-air battery to prevent the production of electrically resistant lithium peroxide. They engineered a lithium iodide and water-based electrolyte that is light and porous. During the Li-air cell reaction, hydrogen from the water joins with the lithium to produce lithium hydroxide crystals instead of lithium peroxide. The pores collect the crystals and render them inert. The new design is 90 percent more efficient than conventional Li-ion batteries and capable of over 2,000 recharge cycles. [TECHNICAL ARTICLE](#)

Tags: Energy, Battery, S&T UK

Aquion Founder Jay Whitacre on the “Miracle Technology” in Batteries

[MIT News](#), 03NOV2015

Professor Jay Whitacre invented a new class of battery, made of nontoxic materials that can provide long-term storage of energy from solar, wind, and other intermittent sources at a very low cost. He spoke with MIT Technology Review about the future of energy storage and the path to scaling low-cost, nontoxic batteries. According to him there are two or three battery technologies that are on a trajectory to get well below \$100 per kilowatt-hour.

Tags: Energy, Battery

FORECASTING

Quantum materials: A new paradigm for computing?

[MIT News](#), 06NOV2015

A new family of quantum materials, including graphene, hexagonal boron nitride and molybdenum disulfide, and nitrogen vacancy centers in diamond, are at the forefront of recent scientific research. They are being explored for their unusual electronic, optical and magnetic properties

“The greatest enemy of knowledge is not ignorance; it is the illusion of knowledge.”

STEPHEN HAWKING

with special interest in their potential uses for sensing, information processing and memory. While such materials may not necessarily be the basis for a replacement technology, they will certainly be the basis for a complementary technology to conventional integrated circuit technology.

Tags: Forecasting, Advanced materials

IMAGING TECHNOLOGY

Better, faster, cheaper imaging.

[Nanowerk, 06NOV2015](#)

Researchers at Tufts University have invented a device they call FT-nanoDMA because it employs Fourier transform spectroscopy and dynamic mechanical spectroscopy down to the nanoscale. The device can accurately gather information about soft materials down to 10-50 nanometers. And it can do that quickly, taking less than one second per surface point to relay back properties of a 100-by-100-pixel area in just a few hours' time compared with the 23 days the competing existing technologies require. The new technique can also study dynamic mechanical properties of individual cells. [TECHNICAL ARTICLE](#)

Tags: Imaging technology, Biology

Graphene could take night-vision technology beyond 'Predator'

[Science Daily, 04NOV2015](#)

Current night vision systems require cryogenic cooling to filter out background radiation and create a reliable image. A team of researchers in the US (MIT, Harvard University, UC Riverside, Army Research Laboratory) integrated graphene with silicon MEMS to make their device. Testing showed that it could be used to detect a person's heat signature at room temperature without cryogenic cooling. [TECHNICAL ARTICLE](#)

Tags: Imaging technology, Government S&T

INFORMATION TECHNOLOGY

Resistive synaptic array paves the way for on-chip neuro-computing

[Nanotechweb, 09NOV2015](#)

An international team of researchers (USA - University of Arizona, Taiwan) fabricated a forming-free, Si-process compatible synaptic cross-point array with smooth change of the conductance state by identical programming pulses. A fully parallel write scheme is designed and experimentally demonstrated in a small-scale crossbar array to accelerate the weight update in the training process, at the speed that is independent of the array size, which is promising for on-chip learning. [TECHNICAL ARTICLE](#)

Tags: Information Technology

Nanographene charge trapping memory could further miniaturize flash

[PhysOrg.com, 05NOV2015](#)

Researchers in China fabricated nanographene with a density estimated at more than a trillion nanographene islands per square centimeter. Using plasma etching, they created large numbers of defects as well as extended defects along the edges of the main defects which provided a large number of charge trapping sites. Memory device made from this material had improved memory performance. [TECHNICAL ARTICLE](#)

Tags: Information Technology, S&T China

MATERIALS SCIENCE

New study reports principle for tailored thermal expansion of alloys

[PhysOrg.com, 05NOV2015](#)

Change in temperature can be a problem when dimensional stability of structures and devices is desired in applications that undergo a temperature fluctuation. In a study, a team of researchers in the US (Texas A&M, Los Alamos National Laboratory) demonstrated the possibility of tailoring thermal expansion response of a single material without manipulating its composition. The key technique is to align the alloy's atoms to harness the natural thermal expansion and contraction at the atomic level. [TECHNICAL ARTICLE](#)

Tags: Materials science

Single-layer NbSe₂, a true 2D superconductor

[Nanowerk, 05NOV2015](#)

An international team of researchers (USA - UC Berkeley, Lawrence Berkeley National Laboratory, SLAC National Accelerator Laboratory, California State University at Long Beach, Stanford University, Spain, China, Australia, Austria) has demonstrated the coexistence of superconductivity and charge density wave (CDW) order in a single layer of NbSe₂. It is the first 2D material that remains a superconductor without the need of a special substrate. The results paint a clear picture of the effects of reduced dimensionality on the CDW and superconducting phases of a model strongly correlated system. [TECHNICAL ARTICLE](#)

Tags: Materials science, Advanced materials

Smart fabric provides 'air conditioning' for the wearer, adjustable with a mobile app

[Science Daily, 05NOV2015](#)

Researchers in Finland have developed a new high-volume production method for hot embossing microscopic channel structures onto large areas of plastic film at a low cost for use, for example, in wearable technology. The channels

continued...

can be embedded either in hard or soft plastics. The researchers are currently developing a smart fabric which can be used as “personalised air conditioning” in outdoor clothing.

Tags: Materials science

FEATURED RESOURCE

arXiv

arXiv is an e-print service in the fields of physics, mathematics, non-linear science, computer science, quantitative biology, and more. It is owned and operated by Cornell University, funded by Cornell University Library and supporting user institutions. [RSS](#)

[Researchers uncover new origins of radiation-tolerant materials](#)

[PhysOrg.com](#), 30OCT2015

Using a combination of experimental characterization and a variety of simulation techniques, an international team of researchers (USA - Los Alamos National Laboratory, University of Tennessee, an industry partner, UK) determined that different types of complex oxides have a fundamentally different response to irradiation. Decades of work on one class of complex oxides, pyrochlore, has revealed that there are correlations between the ability of the cations to swap position and the radiation tolerance of the material. The finding provides new opportunities for identifying radiation tolerant oxides for nuclear applications. [TECHNICAL ARTICLE](#)

Tags: Materials science, Government S&T

[Unraveling the complex, intertwined electron phases in a superconductor](#)

[Science Daily](#), 26OCT2015

An international team of researchers (USA - Brookhaven National Laboratory, Cornell University, Harvard University, Binghamton University, Scotland, Germany, Japan) has characterized a key arrangement of electrons in cuprates, a high-temperature superconductor. The findings may lead to ways to suppress or remove it to induce superconductivity, possibly even at room temperature. Cuprates are prime candidates for numerous potential high-impact applications, including extremely efficient electricity generation, storage, and transmission across the nation's power grid. [TECHNICAL ARTICLE](#)

Tags: Materials science, Government S&T

QUANTUM SCIENCE

[Denser ‘quantum crystal’ will help unlock secrets of exotic materials](#)

[Nanowerk](#), 06NOV2015

The quantum crystal made by a team of researchers in the US (NIST, University of Colorado) is actually a gas

of particles trapped in 3-D formation by laser beams. The trap, called an optical lattice, has local regions of low energy. The researchers maneuvered a single molecule into each well, successfully filling about 25 percent of the crystal. The denser crystal will enable scientists to study and model complex effects such as how spin correlations or entanglement spread through a large system. Scientists might use these effects to make novel materials for electronics or other applications. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Materials science

[Researchers take two big steps toward quantum computing](#)

[PhysOrg.com](#), 06NOV2015

Two recent experiments with entanglement have been reported, one proving that complex quantum states in photons can be preserved even in turbulent atmospheric conditions; the other demonstrating entanglement swapping between qubits over the 143 kilometers between the Canary Islands and Tenerife. One experiment shows that entanglement encoded in OAM can be identified after long-distance transmission. The other provides a solution to the no-cloning theorem which opens a door to such practical applications as cloud quantum computing. [TECHNICAL ARTICLE 1, 2](#)

Tags: Quantum science

[The Ultimate Rate of Quantum Cryptography](#)

[arXiv](#), 29OCT2015

Researchers in the UK determine the ultimate rate for the quantum distribution of secure keys over a channel with arbitrary transmissivity η . In their proof they construct an upper bound, based on the relative entropy of entanglement, which is shown to coincide with the best known achievable lower bound. No secret key can be generated at a rate higher than their secret-key capacity by discrete- or continuous-variable protocols without the active help of quantum repeaters. Thus, their results establish the fundamental benchmark for testing the ultimate performance of secure quantum communications. [TECHNICAL ARTICLE](#)

Tags: Quantum science, Communications technology, S&T UK

S&T POLICY

[Toyota Invests \\$1 Billion in AI and Robots, Will Open R&D Lab in Silicon Valley](#)

[IEEE Spectrum](#), 06NOV2015

Toyota announced that it is investing US \$1 billion over the next five years to establish a new R&D arm headquartered in Silicon Valley and focused on artificial intelligence and robotics. The Toyota Research Institute (TRI) plans to hire hundreds of engineers to staff a main facility in Palo Alto, Calif., near Stanford University, and a second facility located near MIT in Cambridge, Mass. Toyota wants to significantly speed up the development of AI with applications to smarter and safer vehicles. Although vehicles will be equipped with more powerful sensors, computers, and software, that

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doesn't mean they'll be designed to operate fully autonomously all the time.

Tags: S&T policy, Autonomous systems & robotics

SCIENCE WITHOUT BORDERS

'Crucial steps towards comprehensive theory on the forces of nature'

[PhysOrg.com](#), 09NOV2015

The merging of the electromagnetic and the weak and strong nuclear forces into one single force has been a holy grail for physicists for a long time. An international team of researchers (Lebanon, France, USA - Ohio State University, the Netherlands) proposes a model derived in the framework of non-commutative geometry and has a direct coupling with the Standard Model. The model can now be confirmed at low energies in CERN. It offers possibilities to do more accurate predictions on for instance the mass of particles, because these predictions are now based on solid mathematics. [TECHNICAL ARTICLE](#)

Tags: Science without borders, Particle physics

EmTech 2015 - Discover the technologies and innovators changing our world (videos)

[MIT News](#), 02NOV2015

It's an opportunity to discover future trends and begin to understand the technologies that will drive the new global economy. From AI and robotics to data-driven health care and future cities, the 15th annual EmTech at MIT explores technologies highlighted in the recent 10 Breakthrough Technologies list and celebrates the 2015 Innovators Under 35. [Conference website](#)

Tags: Science without borders, Emerging technology

Yes, There Is a Technology Bubble, and That's Okay

[MIT News](#), 02NOV2015

Economist Robert Shiller spoke with senior editors of MIT Technology Review about the role technology plays in the economy, and whether the next bubble might be technology itself. The way computer technology is exploding right now with robotics and voice-activated things that answer your questions, translate them into a different language. Where will it be in 10, 20, or 30 years? That is the biggest question facing our society.

Tags: Science without borders, Forecasting

SENSORS

Ultrasensitive sensors made from boron-doped graphene

[Nanotechweb](#), 06NOV2015

An international team of researchers (USA - Penn State, UK) found that with the addition of boron atoms, the boron graphene sensors were able to detect noxious gas molecules at extremely low concentrations, parts

per billion in the case of nitrogen oxides and parts per million for ammonia. This translates to a 27 times greater sensitivity to nitrogen oxides and 10,000 times greater sensitivity to ammonia compared to pristine graphene. The discovery may open a path to high-performance sensors that can detect trace amounts of many other molecules.

Tags: Sensors

Calibrating an optical attenuator with few-photon pulses

[PhysOrg.com](#), 05NOV2015

A team of researchers in the US (NIST, University of Maryland) has demonstrated a technique for extending the range of photon-counting detectors by employing optical attenuators. They have worked to extend the transition edge sensor (TES) sensitivity range beyond 6,000,000 photons in a single pulse. Improved determination of optical attenuation could help when characterizing materials that react differently to high- and low-light levels.

[TECHNICAL ARTICLE](#)

Tags: Sensors, Government S&T

New artificial fingerprints feel texture, hear sound

[Science Magazine](#), 30OCT2015

Researchers in South Korea started with a thin, flexible material with ridges and grooves much like natural fingerprints. This allowed them to create what they call a "micro-structured ferroelectric skin". The e-skin's perception of pressure, texture, and temperature all come from a highly sensitive structure called an interlocked microdome array—the tiny domes sandwiched in the bottom two layers of the e-skin. According to the researchers this could be the the key factor in adding sensation to artificial limbs or even enhancing the senses we already have. [TECHNICAL ARTICLE](#)

Tags: Sensors, Advanced materials ■

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