



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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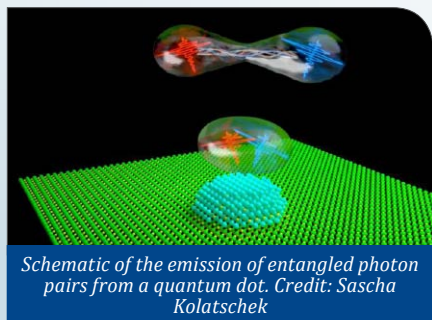
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FEATURE ARTICLES

[Researchers change wavelengths of entangled photons to those used in telecommunications](#)

[Physorg.com, 26SEP2017](#)



Schematic of the emission of entangled photon pairs from a quantum dot. Credit: Sascha Kolatschek

One of the issues with using photon entanglement in quantum computing and communications is the fact that many photon entanglement platforms do not operate within the range

used by most forms of telecommunication. Researchers in Germany demonstrated the emission of polarization-entangled photons from a single semiconductor quantum dot in the telecom C-band (1530 nm–1565 nm). To reach this telecommunication window, InAs quantum dots embedded in InGaAs barriers is utilized with an additional insertion of an InGaAs metamorphic buffer to spectrally shift the system to the desired wavelengths. Their experiment experienced less than one-fifth as much fine-structure splitting as other studies in the literature. Researchers hope that entangled photons will impact cryptography and secure satellite communications. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: [Communications technology](#), [S&T Germany](#), [Featured article](#)

[Dancing electrons lose the race](#)

[Nanowerk, 23SEP2017](#)

An international team of researchers (Germany, Spain, Russia) reports that the relative emission delays they observed, between four photoemission channels measured for the van der Waals crystal tungsten diselenide, can only be explained by accounting for both propagation and intra-atomic delays. The delay depends on the angular momentum of the initial localized state

and is determined by intra-atomic interactions. The finding has required a revision of existing models for solid-state photoemission, and thus, attosecond time-resolved photoemission from solids provides important benchmarks for improved future photoemission models.

[TECHNICAL ARTICLE](#)

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

S&T NEWS ARTICLES

ADVANCED MATERIALS

[Perovskite solar cells reach record long-term stability, efficiency over 20 percent](#)

[Science Daily, 28SEP2017](#)

Until now, only highly expensive, prototype organic hole-transporting materials have been able to achieve power-conversion efficiencies over 20%. An international team of researchers (Switzerland, Germany) fabricated and demonstrated perovskite solar cells achieving stabilized efficiencies exceeding 20% with CuSCN as a hole extraction layer. To improve operational stability, they introduced a thin spacer layer of reduced graphene oxide between the CuSCN and a gold layer. This innovation allowed the perovskite solar cells to achieve excellent operational stability, retaining over 95% of their initial efficiency while operating at a maximum power point for 1000 hours under full-sun illumination at 60 °C. [TECHNICAL ARTICLE](#)

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

AUTONOMOUS SYSTEMS & ROBOTICS

[China touts vaporware robotic military ship](#)

[Next Big Future, 25SEP2017](#)

The planned robotic military ship D3000 is a 98-foot-long, stealthy robotic trimaran warship designed to operate autonomously for months. It can either operate by itself, or as part of a larger task force with manned ships. It would have a trimaran tumblehome hull, with armament that includes autocannons and anti-ship missiles, as well as launching tubes for small unmanned underwater vehicles,

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torpedoes, or mines. DARPA built a 131-foot, 145 ton robotic Sea Hunter with a speed of only 27 knots. It is conceived as a test ship for future unmanned operations. The Sea Hunter and its follow-ons would also take on roles like tracking enemy submarines and mine detection, as opposed to antiship role reflected the D3000 concept.

Tags: Autonomous systems & robotics, Foreign S&T, Military technology, S&T China

BIG DATA

[Learning Machine Learning? Six articles you don't want to miss](#)

[IBM Data Analytics Hub, 28SEP2017](#)

Digital disruption has revolutionized the way we live and do business—and machine learning is the latest wave of that revolution. Whether it is by remaking medicine with innovations from Watson Health or by transforming online shopping with intelligent recommendations, machine learning is remaking industries across the board. Whether you're just getting started with machine learning, or looking to hone your skills, these six articles bring insight to this crucial topic.

Tags: Big data, Information technology

BIOTECHNOLOGY

[We Just Got a Huge Step Closer to Getting Rid of Malaria Using Genetic Modification](#)

[Science News Alert, 29SEP2017](#)

In 2015, there were roughly 212 million cases of malaria and 429,000 deaths. The disease has become increasingly resistant to drugs. Studies conducted by a team of researchers in the US (Johns Hopkins University, University of Maryland School of Medicine) found that the normal male mosquitoes preferred the genetically modified females, while the genetically modified males went wild over the normal females. In the second study, the researchers genetically modified a type of bacteria, which caused it to secrete a substance inside the mosquitoes' gut that kills off the malaria-causing parasite before it can develop properly. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Counter WMD

[Illinois researchers develop gene circuit design strategy to advance synthetic biology](#)

[Eureka!ert, 26SEP2017](#)

The gene circuits hold great promise in medical and biotechnological applications, such as combating super bugs, producing advanced biofuels, and manufacturing functional materials. Researchers at the University of Illinois at Urbana-Champaign addressed the trial-and-error manner of circuit construction by constructing an integrated modeling framework for quantitatively describing and predicting gene circuit behaviors. The framework consists of a coarse-grained but mechanistic description of host physiology that involves dynamic

resource partitioning, multi-layered circuit-host coupling, and a detailed kinetic module of exogenous circuits. They successfully demonstrated the utility of the platform by applying it to examine a growth-modulating feedback circuit. [TECHNICAL ARTICLE](#)

Tags: Biotechnology, Synthetic biology

COMMUNICATIONS TECHNOLOGY

[Team builds world's first space-ground integrated quantum communication network](#)

[Physorg.com, 29SEP2017](#)

The first quantum-safe video conference held between Beijing and Vienna was the first real-world demonstration of intercontinental quantum communication. Within a year after the launch of the satellite Micius for quantum science experiments in 2016, three key milestones toward a global-scale quantum internet have been achieved: satellite-to-ground decoy-state QKD, satellite-based entanglement distribution and ground-to-satellite quantum teleportation. To test the robustness and versatility of the Micius, QKD from the satellite to a ground station near Vienna was carried out successfully this June. Future experiments are also planned between China and Singapore, Italy, Germany, and Russia.

Tags: Communications technology, Quantum science

[Flexible new platform for high-performance electronics](#)

[Science Daily, 28SEP2017](#)

Researchers at the University of Wisconsin-Madison Have fabricated a thin-film transistor, BiCMOS (bipolar complementary metal oxide semiconductor), on a single-crystal silicon nanomembrane on a single bendable piece of plastic. The secret to their success is their unique process, which eliminates many steps and slashes both the time and cost of fabricating the transistors. It combines speed, high current and low power dissipation in the form of heat and wasted energy—all on one surface. The “mixed-signal” devices (with both analog and digital capabilities) deliver both brains and brawn. The process is easily scalable to commercial level.

Tags: Communications technology, Microelectronics

[Engineers to pioneer unprecedented high speed wireless data coverage](#)

[Science Daily, 26SEP2017](#)

Emerging technologies and unpredictable applications will need zettabyte of wireless data. The millimetre wave frequencies, 30-300 GHz, with their multi GHz bandwidths, could support tens of gigabit per second of wireless data rate but rain which can weaken or block data transmission and other technological limits have so far prevented the full exploitation of this portion of the spectrum. An EU sponsored project, ULTRAWAVE started in September 2017, aims to build technologies able to exploit the whole

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“Be less curious about people and more curious about ideas.”

MARIE CURIE

millimetre wave spectrum beyond 100 GHz. The concept is to create an ultra-capacity layer, aiming to achieve the 100 gigabits of data per second threshold that is flexible and easy to deploy to feed data to hundreds of small and pico cells. The ULTRAWAVE ultra capacity layer requires significant transmission power to cover wide areas which will be achieved by the convergence of three main technologies, vacuum electronics, solid-state electronics and photonics.

Tags: Communications technology, S&T EU, S&T Policy

The fastest light-driven current source

[Physorg.com, 26SEP2017](#)

Researchers in Germany fired extremely short laser pulses with specially engineered waveforms onto graphene. When these light waves hit graphene, the electrons inside were hurled in one direction. Under intense optical fields, a current was generated within a half femtosecond. They succeeded in switching on a current in a desired direction using a single laser pulse within a femtosecond. This is more than a thousand times faster compared to the most efficient transistors today. The results are another important step in bringing electronics and optics together. The method could open a door for realizing ultrafast electronics operating at optical frequencies. [TECHNICAL ARTICLE](#)

Tags: Communications technology, S&T Germany

COUNTER WMD

Likely scenarios for global spread of devastating crop disease

[Science Daily, 28SEP2017](#)

By adapting previously used model systems to predict other plant diseases, researchers in the UK have revealed the most likely months and routes for the spread of new strains of airborne ‘wheat stem rust’ that could endanger global food security by ravaging wheat production across Africa, the Middle East, Asia and the wider world. According to the model, the airborne transmission of the disease from East African countries directly to South Asia is highly unlikely, with transmission events possible only on less than one day a year. Their modelling framework can be applied as a tool to analyse risks in case new disease strains should be uncovered in any geographic areas. In ongoing work, the team is developing an Early Warning System forecasting rust risk in Ethiopia, East Africa’s largest wheat producing country. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Counter WMD, S&T Policy

CYBER SECURITY

Computer scientists address gap in messaging privacy

[Physorg.com, 27SEP2017](#)

According to an international team of researchers (Luxembourg, UK) DECIM can solve the challenge of detecting endpoint compromise in messaging. It manages and refreshes encryption/decryption keys in an automatic and transparent way and makes it necessary for uses of the key to be inserted in an append-only log. They propose a multi-device messaging protocol that exploits their concept to allow users to detect unauthorised usage of their device keys. The methods are not intended to replace existing methods used to keep keys safe (such as hardware devices, careful procedures, or key refreshment techniques). Rather, they provide a useful and effective additional layer of security. [TECHNICAL ARTICLE](#)

Tags: Cyber security

New non-contact, remote biometric tool could be next advance in computer security

[Science Daily, 25SEP2017](#)

Researchers at SUNY Buffalo have developed a computer security system using low-level Doppler radar to measure heartbeat, and then continually monitor to make sure no one else has stepped in to run your computer. The signal strength of the system’s radar is much less than Wi-Fi and the reader is about 5 milliwatts, even less than 1 percent of the radiation from smartphones. The system could be used for user identification on cell phones and airport identification and monitor a person up to 30 meters away. Their paper will be presented at an upcoming meeting.

Tags: Cyber security

ENERGY

Body energy as a power source

[Science Daily, 02OCT2017](#)

Researchers in Germany have developed and demonstrated two systems, one for lower extremity and the other which can be worn on the wrist like a wristwatch. The one for lower extremity uses body weight during walking. A small cushion each filled with oil installed under the heel and the ball of a walker pumps oil back and forth through a hose connection, as the person walks, driving a piston which drives a generator. For the wrist system, to operate a generator, the highly discontinuous movements of the arm was converted into a continuous movement. The current

power output is 2.2 milliwatt. They are working on a more powerful consumer version.

Tags: Energy, S&T Germany

[Paper supercapacitor addresses power/energy density tradeoff](#)

[Physorg.com, 27SEP2017](#)

An international team of researchers (South Korea, USA - Georgia Institute of Technology) has developed metallic cellulose paper-based supercapacitor electrodes with excellent energy storage performance by minimizing the contact resistance between neighboring metal and/or metal oxide nanoparticles. The process converts the insulating paper to the highly porous metallic paper with large surface areas that can function as current collectors and nanoparticle reservoirs for supercapacitor electrodes, increase capacitance and rate capability and decrease the internal resistance. The maximum power and energy density of the metallic paper-based supercapacitors are estimated to be 15.1 mW cm² and 267.3 μWh cm², respectively. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Energy

FEATURED RESOURCE

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FORECASTING

[Using deep learning to forecast ocean waves](#)

[Physorg.com, 29SEP2017](#)

An international team of researchers (USA - Baylor University, University of Notre Dame, Ireland) has developed a deep learning framework that provides a 12,000 percent acceleration over physics-based models at comparable levels of accuracy. They use the physics-based Simulating Waves Nearshore (SWAN) model to generate training data for the deep learning network. Using a case-study site at Monterey Bay, California, a deep-learning framework was trained to forecast wave conditions at a fraction of the computational cost. Outputs from SWAN and the deep learning network were compared to observed buoy wave data within the model domain demonstrating that despite the huge reduction in computational expense, the new approach provides comparable levels of accuracy to the traditional physics-based, SWAN model. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Forecasting, Simulation and modeling

[What Skills Will You Need to Be Employable in 2030?](#)

[MIT Technology Review, 28SEP2017](#)

When robots take over manual tasks and AI can handle jobs that previously required a brain, what remains to be done by humans will, naturally, be different from what is done today. A new report by the British innovation foundation Nesta and University of Oxford tries to establish how those changes will affect skill requirements by 2030. They identified occupations that look set to be automated away (such as shelf fillers, van drivers, and administrators) and those that are likely to grow in the face of technology's encroachment (including teachers, biotech researchers, and nurses). From the report, here are the top five desirable future work skills: Judgment and decision making, Fluency of ideas, Active learning, Learning strategies and Originality. [OPEN ACCESS REPORT](#)

Tags: Forecasting, S&T Policy

INFORMATION TECHNOLOGY

[Move towards 'holy grail' of computing by creation of brain-like photonic microchips](#)

[Science Daily, 27SEP2017](#)

An international team of researchers (UK, Germany) combined phase-change materials with integrated silicon nitride waveguides to deliver a biological-like synaptic response. They could randomly set the synaptic weight simply by varying the number of optical pulses sent down the waveguide, delivering an incredibly simple yet powerful approach that heralds systems with a continuously variable synaptic plasticity resembling the true analog nature of biological synapses. They believe that the research could pave the way for a new age of computing, where machines work and think like to the human brain, while at the same time exploiting the speed and power efficiency of photonic systems. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Information technology, Neuroscience

MATERIALS SCIENCE

[Ultracold atoms point toward an intriguing magnetic behavior](#)

[Physorg.com, 29SEP2017](#)

An international team of researchers (USA - Princeton University, San José State University, Ohio State University, Columbia University, Brazil) found that applying a strong magnetic field to ultracold atoms caused them to line up in an alternating pattern and lean away from each other. The behavior, which researchers call "canted antiferromagnetism", is consistent with predictions from a decades-old model used to understand how superconductivity arises in certain materials. They observed nonmonotonic behavior of the local polarization with doping for strong interactions, which they attribute to the evolution from an antiferromagnetic insulator to a metallic phase. The findings could help explain how high-temperature superconductivity works. [TECHNICAL ARTICLE](#)

Tags: Materials science

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Generating terahertz radiation from water makes 'the impossible, possible'

[Physorg.com, 28SEP2017](#)

Bulk liquid water is a strong absorber in the terahertz frequency range. An international team of researcher (USA - University of Rochester, China, Russia) used lasers to generate terahertz pulses via interaction with an extremely thin film of water created using water suspended by surface tension between two aluminum wires. They found the THz pulses were 1.8 times stronger than the terahertz waves generated from air plasma under comparable experimental conditions. The field was dependent on the relative position between the water film and the focal point of the laser beam. The radiation from liquid water showed distinct characteristics when compared with the THz radiation from air plasmas with single color optical excitation. The energy of the THz radiation was linearly dependent on the excitation pulse energy. Unlike x-rays, terahertz waves are non-ionizing so they do not have the same harmful effects on human tissue and DNA. [OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Materials science, Terahertz technology

NEUROSCIENCE

In plain sight: Researchers compare the performance of human subjects versus deep neural networks in visual searches

[Science Daily, 26SEP2017](#)

Researchers at UC Santa Barbara have shown that humans often miss targets when their size is inconsistent with the rest of the scene, even when the targets were made larger and more salient and observers fixated the target. In contrast, the state-of-the-art deep neural networks do not exhibit such deficits in finding mis-scaled targets, but they can be fooled by target-shaped distractors. The human deficiency to miss targets when they are inconsistent in size with the scene is a byproduct of a useful strategy that the brain has implemented to rapidly discount potential distractors. The findings might suggest ways to improve computer vision by implementing some of the tricks the brain utilizes to reduce false positives. [TECHNICAL ARTICLE](#)

Tags: Neuroscience, Artificial intelligence

PHOTONICS

Inducing Multiple Reactions with a Single Photon

[American Physical Society View Point, 27SEP2017](#)

The second law of photochemistry states that, in most cases, no more than one molecule is activated for an excited-state reaction for each photon absorbed by a collection of molecules. Researchers in Spain have demonstrated that it is possible to trigger a many-molecule reaction using only one photon by strongly coupling the molecular ensemble to a confined light mode. The collective nature of the resulting

hybrid states of the polaritons leads to the formation of a polaritonic "supermolecule" involving the degrees of freedom of all molecules, opening a reaction path on which all involved molecules undergo a chemical transformation. By developing applications based on the hybrid nature of polaritonic states, we also learn more about the fundamental description of light-matter interaction. [TECHNICAL ARTICLE](#)

Tags: Photonics, Materials science

Researchers report innovative solid-state fluoride ceramic lasers

[Physorg.com, 27SEP2017](#)

Highly transparent ceramic is an attractive gain medium for high-power lasers due to its high fracture toughness, homogeneity, and size scalability. Researchers in Japan fabricated CaF₂ ceramics doped with two rare earth ions of La and Yb. Codoping of La³⁺La³⁺ ion can reduce the formation of Yb²⁺Yb²⁺ ions and enhance the laser efficiency. The laser had a maximum power output of 4.36 W and slope efficiency of 69.5%. The random orientation of the axes of grains in ceramics improves their mechanical robustness, which is one of the main motivations for producing CaF₂ ceramics for gain media. According to the researchers, Yb:CaF₂-LaF₃Yb:CaF₂-LaF₃ ceramic is a promising gain medium for high-power ultrashort pulse laser and amplifier. [TECHNICAL ARTICLE](#)

Tags: Photonics, Materials science, S&T Japan

QUANTUM SCIENCE

New 'building material' points toward quantum computers

[Science Daily, 02OCT2017](#)

An international team of researchers (Denmark, USA-Purdue University) has shown that it is possible to produce 'Majorana particles' in a new 'building material'. They combined two ultra thin sheets in a 'sandwich'. The bottom layer is made out of indium arsenide and the top layer is made out of aluminium. The 'sandwich' sits on top of a wafer. According to theory, if you carve out a nano wire from this 'sandwich'-layer it is possible to create a state where electrons inside the wire display Majorana-properties. Using a technique they developed to design the nano wire on a laptop, they expect to construct computers of significant size. [TECHNICAL ARTICLE](#)

Tags: Quantum science

Universal quantum computing with measurement-induced continuous-variable gate sequence in a loop-based architecture

[University of Tokyo, 22SEP2017](#)

Researchers in Japan propose a scalable scheme for optical quantum computing using measurement-induced continuous-variable quantum gates in a loop-based architecture. The time-bin-encoded quantum information in

a single spatial mode is deterministically processed in a nested loop by an electrically programmable gate sequence. This architecture can process any input state and an arbitrary number of modes with almost minimum resources, and offers a universal gate set for both qubits and continuous variables. Furthermore, quantum computing can be performed fault tolerantly by a known scheme for encoding a qubit in an infinite-dimensional Hilbert space of a single light mode. [TECHNICAL ARTICLE](#)

Tags: Quantum science, S&T Japan

SCIENCE WITHOUT BORDERS

[Nobel Prize 2017](#)

[Nobelprize.org](#), 03OCT2017

Physics, Medicine, Chemistry, Literature - 10/5; Peace - 10/6; Economics - 10/9

Tags: Science without borders

SENSORS

[Researchers develop technique that could detect explosives, dangerous gases rapidly and remotely](#)

[Physorg.com](#), 29SEP2017

Dual-comb spectroscopy relies on a pair of laser pulses with multiple frequencies distributed like tines in a comb. It is a rapid means of characterizing atoms and molecules in fine detail, but, when applied to complex mixtures, it can produce a sea of peaks that are hard to discriminate. A team of researchers in the US (University of Michigan at Ann Arbor, NIST at Boulder, CO) developed a protocol to extend dual comb spectroscopy into the nonlinear regime by acquiring high-resolution multidimensional nonlinear coherent spectra with frequency combs. They experimentally differentiated and assigned the Doppler-broadened features of two naturally occurring isotopes of rubidium atoms (⁸⁷Rb and ⁸⁵Rb) according to the placement of their hyperfine energy states in a two-dimensional spectrum. Their method is general and can be used to identify chemicals in a mixture without previously knowing the makeup of the mixture. They plan to add a third laser that could further speed up their ability to identify gases and use lasers based on fiber optics so that they can look further into infrared light, expanding the number of chemicals they would be able to identify. [TECHNICAL ARTICLE](#)

Tags: Sensors, Photonics

[Developing sensors to defend aircraft against lasers](#)

[MIT News](#), 28SEP2017

To address the present lack of effective laser strike mitigation systems, researchers at MIT Lincoln laboratory have developed Laser Aircraft Strike Suppression Optical System (LASSOS), a ground-based sensor system that can accurately identify the probable location of a perpetrator

of a laser strike and immediately notify law enforcement. The system works by capturing side-scattered laser light and tracing it back to the perpetrator's location. LASSOS is integrated with Google Earth. Within 30 seconds of the image being captured, LASSOS provides nearby members of law enforcement with the perpetrator's GPS coordinates, nearest address, and the time of the incident. This information allows officers to rapidly intervene. The system prototype has already demonstrated its speed and accuracy in several tests. Researchers believe that in the future, the system could be used to protect other targets of laser strikes, including ships, automobiles, and persons.

Tags: Sensors

["Personal thermostat" startup heats up for commercialization](#)

[MIT News](#), 27SEP2017

Researchers at MIT created a smart wristband, called Wristify, that makes its wearer feel warmer or cooler through its contact with the skin on the wrist. Inside the wristband and touching the skin is a thermoelectric tile made of materials that change temperature when exposed to an electrical current. During heating, the current goes into the plate, creating heat waves. When cooling, the device dissipates heat with aid of the aluminum body, a popular material used for heat exchange. The product is being commercialized by a company in Massachusetts.

Tags: Sensors

[Creative use of noise brings bio-inspired electronic improvement](#)

[Nanowerk](#), 25SEP2017

Stochastic resonance (SR) generally hinders the detection of weak signals and degrades overall device performance. Two basic requirements for developing an SR-based electronic device are a signal detection threshold and the presence of additional noise. Researches in Japan created a SWNT network in which up to 300 carbon nanotubes were aligned parallel to each other between chromium electrodes, which increased the signal detection ability. They functionalized the SWNTs with phosphomolybdic acid molecules which can firmly adsorb on graphite materials and generate additional noise. The research offers a glimpse of future bio-inspired electronic devices.

[OPEN ACCESS TECHNICAL ARTICLE](#)

Tags: Sensors, S&T Japan

[For Disposable Voice Recognition, Take Cheap Chips and Add Simple AI](#)

[MIT Technology Review](#), 25SEP2017

Researchers at Google propose to cut down the neural networks that are usually used to process sound until they are efficient enough to run on cheap, lightweight chips. The sensors could have applications in listening for noises rather than voices, spotting tell-tale audio signatures of squeaking wheels in factory equipment, or chirping

crickets in a farm field. They are seeking to identify just a handful of useful commands—such as “on,” “off,” “start,” “stop,” and so on. The team’s first attempts required eight million calculations to analyze a one-second clip of audio with 89 percent accuracy; that could run on a smartphone. After the team borrowed algorithmic tricks, the system was able to analyze a second of speech with 85 percent accuracy by performing just 750,000 calculations. They have published the code on the TensorFlow website for other people to use.

Tags: Sensors, Microelectronics ■

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