



S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

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FEATURE ARTICLES

[What is Your Favorite Deep, Elegant, or Beautiful Explanation?](#)

[Edge.org](#), 18JAN2012

Every January, John Brockman, the impresario and literary agent who presides over the online salon Edge.org, asks his circle of scientists, digerati and humanities scholars to tackle one question. This year, he posed the open-ended question “what is your favorite deep, elegant or beautiful explanation?” The responses provide a crash course in science both well known and far out-of-the-box, as admired by the likes of Astronomer Royal Martin Rees, physicist Freeman Dyson and evolutionary biologist Richard Dawkins.

Tags: Science without borders, Featured Article

[New Ways to Measure Science](#)

[Wired](#), 09JAN2012

The value of a scientist’s contributions extends beyond simple measures like citations. But science is much more than that. It’s ultimately about being involved in making discoveries and creating new knowledge. It’s creating data, helping others, commenting on previous work, and even using Twitter and blogging. If you help someone out or mentor a student, isn’t that worthwhile as well? How can we begin to measure a person such as Szilard?

Tags: Science without borders, Featured Article

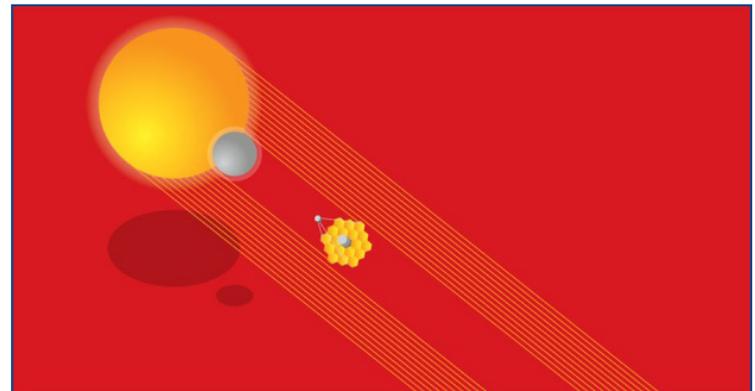
[Frontier experiments: Tough science](#)

[Nature News](#), 04JAN2012

As the media spotlight shines on the Large Hadron Collider in Geneva and its high-profile hunt for a certain boson, other scientists are pressing forward with experiments that are just as challenging — and just as potentially transformative. These often unsung researchers are willing to spend years or even decades getting a finicky instrument to run smoothly; setting up proper controls to minimize spurious results; beat-

ing back noise that threatens to swamp their signal; and striving for an ever more painstaking level of precision—a determination and single-mindedness that borders on heroic. Here, Nature describes five such quests.

Tags: Breakthrough technology, Featured Article



Spectra of the atmosphere of an Earth-like exoplanet could hint at the presence of life.

THOMAS POROSTOCKY

S&T NEWS ARTICLES

ADVANCED MANUFACTURING

[SEMATECH To Conduct Rigorous Manufacturability Assessments to Enable High Volume Manufacturing Readiness of 3D Technology](#)

[Nanowerk](#), 16JAN2012

To enable high-volume production readiness of 3D-based products, SEMATECH’s 3D Interconnect and Manufacturability programs will be conducting Equipment Maturity Assessments (EMAs) of several critical 3D tools during 2012 to establish functional equipment capabilities and address high volume manufacturing maturity issues. The assessment is a cooperative effort among experts from SEMATECH’s 3D program, ISMI’s EMA team, and the supplier.

Tags: Advanced manufacturing, Semiconductors

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ADVANCED MATERIALS

Flaky graphene makes reliable chemical sensors

EurekAlert, 17JAN2012

Researchers have created the one-atom-thick carbon lattice flakes by placing bulk graphite in a solution and bombarding it with ultrasonic waves that broke off thin sheets. The researchers then filtered the solution to produce a graphene film, composed of a haphazard arrangement of stacked flakes, that they used as the top layer of a chemical sensor. When the graphene was exposed to test chemicals that altered the surface chemistry of the film, the subsequent movement of electrons through the film produced an electrical signal that flagged the presence of the chemical.

Tags: Advanced materials, Nanomaterials

New microtweezers may build tiny 'MEMS' structures

EurekAlert, 17JAN2012

Researchers have created new "microtweezers" capable of manipulating objects to build tiny structures, print coatings to make advanced sensors, and grab and position live stem cell spheres for research.

Tags: Advanced materials

Cooling computer chips with interface-enhanced carbon nanotubes

Nanowerk, 13JAN2012

Three factors are playing the most important role in a microscale heat sink cooling system: the thermal conductivity of the material of the cooling fins; the heat exchange area of the cooling fins; and the convection between cooling fins and ambient. Carbon nanotubes satisfy the first two factors very well. Researchers have now demonstrated the application of interface-enhanced CNTs as on-chip cooling fins in a microchannel heat sink.

Tags: Advanced materials, Nanomaterials

Graphene quantum dots: The next big small thing

R&D Magazine, 12JAN2012

A Rice University laboratory has found a way to turn common carbon fiber into graphene quantum dots. The sub-5-nm carbon-based quantum dots were produced in bulk through the wet chemical process, and are highly soluble. Their size can be controlled via the temperature at which they're created.

Tags: Advanced materials, Nanomaterials, Quantum dots

AUTONOMOUS SYSTEMS & ROBOTICS

French Self-Driving Car Takes to the Road

IEEE Spectrum, 12JAN2012

By using a "driving robot," the researchers can control the exact trajectory, speed, and behavior of a vehicle. "Then we

can compare the performance of different safety systems," says Pierre Merriault, one researcher involved.

Tags: Autonomous systems & robotics, Foreign S&T, S&T France

Navy wants self-navigating unmanned cargo aircraft

Defense Systems, 11JAN2012

The goal of the Autonomous Aerial Cargo/Utility System program is to produce a sensor and processing package that will enable the aircraft to safely select its own route and landing point without the direction of a remote pilot.

Solicitation

Tags: Autonomous systems & robotics, Government S&T

BIOTECHNOLOGY

China's new super rice increases yield by 15% over 2004 and will help feed China and the World

Next Big Future, 11JAN2012

The rice breed, DH2525 (Y two superior No 2), produced a harvest of 13.9 tons a hectare during its trial planting in Longhui county in Hunan province. China plants about 29 million hectares of rice every year, with an average output of 6.3 tons a hectare, according to the National Bureau of Statistics.

Tags: Biotechnology, China

COMMUNICATIONS TECHNOLOGY

Sandia develops power-over-fiber communications cable

R&D Magazine, 18JAN2012

Sometimes total electrical isolation is a good thing—and that's the idea behind a power-over-fiber communications cable being developed by engineers at Sandia National Laboratories. The Sandia team is developing a hybrid cable design that uses fiber to send and regulate optical power to the communications electronics integral to the cable.

Tags: Communications Technology

CYBER SECURITY

New Threat Environment For Cyberattacks

Aviation Week, 13JAN2012

Cyberespionage is constant, much of it originating in China known by the euphemism Advanced Persistent Threat. APT attacks break into ostensibly secure company and government networks. Many are aimed at "exfiltrating" information of financial value, but the clear pattern in APT operations against defense interests, since 2006, has been the use of techniques invented by cybercriminals against targets of no importance to anyone except intelligence agencies. This year will see continuing efforts to protect the defense enterprise against APTs, which continued to score hits in 2011.

Tags: Cyber security, China

continued...

“ If you are out to describe the truth, leave elegance to the tailor. ”

ALBERT EINSTEIN

Military Networks ‘Not Defensible,’ Says General Who Defends Them

Wired, 12JAN2012

The Defense Department’s networks, as currently configured, are “not defensible,” according to the general in charge of protecting those networks. And if there’s a major electronic attack on this country, there may not be much he and his men can legally do to stop it in advance.

Tags: Cyber security, Government S&T

Air Force releases RFI for revolutionary cyberspace tech

Defense Systems, 11JAN2012

The study “will analyze current and forecasted capabilities, threats, vulnerabilities, and consequences across core AF missions to identify key [science and technology] gaps and opportunities,” the RFI noted. [RFI](#)

Tags: Cyber security, Government S&T

ELECTRONIC WARFARE

E-Bombs: What is the Threat?

IEEE Spectrum, 13JAN2012

Carlo Kopp, pioneer in the area, argues the threat is larger than one might think. Why can E-bombs produce mass destruction effects against the electrical and electronic infrastructure? The first reason is that digital hardware is now pervasive across the complete infrastructure. Expose any monolithic semiconductor device to voltages, whether transient or radio frequency, in excess of the specification limits of several Volts, and devices break down electrically. The second reason is the cascading failure effect, in a large interconnected system.

Tags: Electronic Warfare, Military technology

ENERGY

Battery, heal thyself: Inventing self-repairing batteries

PhysOrg.com, 11JAN2012

The idea is to station a team of “emergency repairmen” already contained in the battery. These are tiny microspheres, each smaller than a single red blood cell, and containing liquid metal inside. Added along with the battery components, they lie dormant for most of the battery’s lifetime. But if the battery is damaged, the capsules burst open and release their liquid metal into the battery.

Tags: Energy, Battery, Information technology

Engineering slimmer solar cells - A recipe to increase a thin film’s appetite for light

Nature News, 11JAN2012

A theoretical light-trapping limit, called the ray-optic limit, sets out the maximum amount of light that a material can trap, but reaching that pinnacle requires the material to be thick. Researchers have made thin-film solar cells with absorbing layers just tens of nanometers thick, but such a fine film can allow much of the light to pass through before it has a chance to be absorbed.

Tags: Energy, Solar energy

New Fuel Cell System Reduces Weight for Warfighters

Wright-Patterson Air Force Base, 09JAN2012

The new UltraCell XX55 fuel cell system replaces batteries needed for recharging, allowing recharge of batteries for fielded gear via a methanol-fueled system, reducing the weight carried by warfighters for a 72-hour mission by greater than 70 percent.

Tags: Energy, Battery

ENVIRONMENTAL SCIENCE

Researchers discover particle which could ‘cool the planet’

PhysOrg.com, 12JAN2012

In a breakthrough paper published in Science, researchers from US and UK report the potentially revolutionary effects of Criegee biradicals. These invisible chemical intermediates are powerful oxidisers of pollutants such as nitrogen dioxide and sulfur dioxide, produced by combustion, and can naturally clean up the atmosphere. Although these chemical intermediates were hypothesised in the 1950s, it is only now that they have been detected. Scientists now believe that, with further research, these species could play a major role in off-setting climate change.

Tags: Environmental science, Climatology

EXPLOSIVES

Military technology: Magic bullets

The Economist, 12JAN2012

An American firm, and Heckler & Koch, a German one, have come up with a rifle that negates the advantage of cover. XM25, as the new gun is known, weighs about 6kg (13lb) and fires a 25mm round. The trick is that instead of having to be aimed directly at the target, this round need only be aimed in proximity to it.

Tags: Explosives, Military technology

FORECASTING

Controlling centrality in complex networks

Scientific Reports (Nature publication), 10JAN2011

The issue of centrality, and the related problem of identifying the central elements in a network, has remained pivotal since its first introduction. We show that there exist particular subsets of nodes, called controlling sets, which can assign any prescribed set of centrality values to all the nodes of a graph, by cooperatively tuning the weights of their out-going links. We found that many large networks from the real world have surprisingly small controlling sets, containing even less than 5 – 10% of the nodes.

Tags: Forecasting

GOVERNMENT S&T

Five nations expected to join wideband satellite effort

Aviation Week, 17JAN2012

The United States is close to wrapping up an agreement with five more nations to support the Wideband Global Satellite (WGS) constellation program. WGS spacecraft, which provide large-data-rate communications, are being added to the constellation as the Defense Satellite Communications System satellites age out. Three WGS satellites are now in orbit; three are being built under the guidance of prime contractor Boeing and three more are on contract.

Tags: Government S&T, Satellite technology

Meet the Invincible, Invisible Soldiers of 2001

Wired, 16JAN2012

Today's soldiers are invisible. They can't be harmed by bullets or chemical weapons. They can see through walls and distinguish enemy from civilian with a simple glance. At least, that was the vision outlined in a 2001 Pentagon-funded report, "Objective Force Warrior: Another Look," written by a smattering of military officers, academics, magazine editors.

Tags: Government S&T, Military technology

DARPA hybrid cyborg insects

Next Big Future, 15JAN2012

HI-MEMS-derived technologies will enable many robotic capabilities at low cost, impacting the development of future autonomous defense systems. The realization of cyborgs will provide compact platforms that use highly efficient biological systems developed over millions of years of evolution. HI-MEMS platforms will extend the duration and improve the capability of microbotic missions due to the combined efficiency of biochemical energy storage (fat) and bio-actuators.

Tags: Government S&T, DARPA, Robotics

AFRL Develops Advanced Techniques for Electromagnetic Propagation

Wright-Patterson Air Force Base, 09JAN2012

The Air Force Research Laboratory, through a Small Business Innovative Research (SBIR) contract, developed a simulation tool called WaveProp. The tool is used to model lasercom systems, weapons systems, laser guide star systems and phase array systems, among others. With this tool the Air Force can test new designs in simulation, instead of building trial designs at much greater expense.

Tags: Government S&T

IMAGING TECHNOLOGY

Powerful sensor on unmanned helos headed for Afghanistan

Defense Systems, 17JAN2012

By spring, soldiers will remotely pilot Boeing's A160 Hummingbird helicopter to see across vast portions of Afghanistan through the ultra-powerful Autonomous Real-time Ground Ubiquitous Surveillance Imaging System (ARGUS). A single blink of ARGUS' eye covers up to 36 square miles, depending on the quality of the resolution and will give its remote pilots at least 65 independent, scalable video windows in that blink.

Tags: Imaging technology, Drones, Sensors

Scientists identify novel approach to view inner workings of viruses

PhysOrg.com, 12JAN2012

Despite the success of cryo-EM, scientists have been unable to clearly visualize structures inside of viruses, because radiation used to image them damages viruses. The researchers realized that proteins inside the virus are more sensitive to damage than DNA. In the new technique, while the inner structure was damaged, the team was able to superimpose the images, using three-dimensional computer reconstruction.

Tags: Imaging technology, Biology, Biotechnology

INFORMATION TECHNOLOGY

The world's smallest magnetic data storage unit

EurekAlert, 12JAN2012

The nanometre data storage unit was built atom by atom with the help of a scanning tunneling microscope (STM) at IBM's Almaden Research Center in San Jose, California. The researchers constructed regular patterns of iron atoms, aligning them in rows of six atoms each. Two rows are sufficient to store one bit. A byte correspondingly consists of eight pairs of atom rows. It uses only an area of 4 by 16 nanometres. TECHNICAL ARTICLE: "Bistability in atomic-scale antiferromagnets," Sebastian Loth, Science, Bd. 335, S.196, DOI: 10.1126/science.1214131

Tags: Information Technology

[A Hand-Cranked Tablet Unveiled at CES](#)**[Technology Review, 09JAN2012](#)**

The rugged eight-inch tablet comes from the One Laptop Per Child team.

Tags: Information Technology

[Intel demos gesture-control ultrabook range - CES 2012](#)**[BBC News, 09JAN2012](#)**

Near field communication technology would allow online shoppers the option of swiping their credit card over their ultrabooks rather than having to type in their details to make a purchase; Most ultrabooks would ship with touch-screens - and further down the line with sensors allowing them to be controlled by touch-free gestures or by tilting the machine.

Tags: Information Technology

FEATURED RESOURCE**[Edge.org](#)**

Edge is a Conversation: Closer resemblances are the early seventeenth-century Invisible College, a precursor to the Royal Society. Edge.org was launched in 1996 as the online version of "The Reality Club," an informal gathering of intellectuals that met from 1981-1996 in Chinese restaurants, artist lofts, the Board Rooms of Rockefeller University, the New York Academy of Sciences, and elsewhere. The Reality Club lives on in the lively back-and-forth discussions on the hot-button ideas driving the discussion today. [RSS](#)

MATERIALS SCIENCE**[Researchers uncover transparency limits on transparent conducting oxides](#)****[PhysOrg.com, 18JAN2012](#)**

Researchers in the Computational Materials Group at the University of California, Santa Barbara (UCSB) have uncovered the fundamental limits on optical transparency in the class of materials known as transparent conducting oxides. Their discovery will support development of energy efficiency improvements for devices that depend on optoelectronic technology, such as light-emitting diodes and solar cells.

Tags: Materials science

[Berkeley Lab seeks to help US assert scientific leadership in critical materials](#)**[EurekAlert, 11JAN2012](#)**

"We absolutely have to fix the materials problem-it's the linchpin for clean energy technologies. Because Berkeley Lab is such a broad institution, many of the pieces required

are already here. We have the chemistry, the earth science, the materials science, the theory," said Frances Houle, a Berkeley Lab scientist who is Director of Strategic Initiatives in the Chemical Sciences Division. [2011 Critical Materials Strategy](#) is full of tables and charts.

Tags: Materials science

MICROELECTRONICS**[High-speed CMOS sensors provide better images](#)****[EurekAlert, 13JAN2012](#)**

The scientists have developed a new optoelectronic component, the lateral drift field photodetector (LDPD). "In this component, the charge carriers generated by the incident light move at high speed to the readout node," explains the researcher. With the PPD the electrons simply diffuse to the exit; a comparatively slow process but which is sufficient for many applications. "But by integrating an internal electric field into the photoactive region of the component, we have managed to accelerate this process by a factor of up to a hundred."

Tags: Microelectronics, Imaging Technology

NEUROSCIENCE**[How the brain routes traffic for maximum alertness](#)****[KurzweilAI, 18JAN2012](#)**

A new UC Davis study shows how the brain reconfigures its connections to minimize distractions and take best advantage of our knowledge of situations. The new work shows that the brain doesn't always "ramp up" to deal with the situation at hand. Instead, it changes how traffic moves through the existing hard-wired network—rather like changing water flow through a network of pipes or information flow over a computer network—in order to maximize efficiency.

Tags: Neuroscience

[New research to enhance speech recognition technology](#)**[EurekAlert, 17JAN2012](#)**

New research is hoping to understand how the human brain hears sound to help develop improved hearing aids and automatic speech recognition systems. Led by the Universities of Southampton and Cambridge, the research aims to develop physiologically-inspired algorithms, which mimic how our brain hears sound to improve on traditional signal processing algorithms. The novelty of the research is that instead of looking at signal energy—as today's artificial devices do—the researchers are concentrating on how the brain processes sound information instead.

Tags: Neuroscience, Foreign S&T, S&T UK

PHOTONICS

Greatly enhanced continuous-wave terahertz emission by nano-electrodes in a photo-conductive photomixer[Nature Photonics](#), 15JAN2012

The tip-to-tip nanogap electrode structure provides strong terahertz field enhancement and acts as a nano-antenna to radiate the terahertz wave generated in the active region of the photomixer. In addition, it provides good impedance-matching to the terahertz planar antenna and exhibits a lower RC time constant. As a result, the terahertz emission bandwidth also increases by a factor of more than two.

Tags: Photonics, Nanomaterials, Terahertz technology

QUANTUM SCIENCE

Are you certain, Mr. Heisenberg? New measurements deepen understanding of quantum uncertainty[PhysicsOrg.com](#), 17JAN2012

In neutron experiments carried out by professor Yuji Hasegawa and his team at Vienna University of Technology, different sources of quantum uncertainty can now be distinguished, validating theoretical results by collaborators from Japan. The influence of the measurement on the quantum system is not always the reason for uncertainty. Heisenberg's arguments for the uncertainty principle have to be revisited, the uncertainty principle itself however remains valid.

Tags: Quantum science

S&T POLICY

New Report Outlines Trends in U.S. Global Competitiveness in Science and Technology
[NSF](#), 17JAN2012

The United States remains the global leader in supporting science and technology (S&T) research and development, but only by a slim margin that could soon be overtaken by rapidly increasing Asian investments in knowledge-intensive economies. According to the [Science and Engineering Indicators 2012](#), the largest global S&T gains occurred in the so-called "Asia-10"—China, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan and Thailand—as those countries integrate S&T into economic growth. Between 1999 and 2009, for example, the U.S. share of global research and development (R&D) dropped from 38 percent to 31 percent, whereas it grew from 24 percent to 35 percent in the Asia region during the same time.

Tags: S&T policy, Government S&T, STEM

US joins effort to draw up space 'code of conduct'[PhysOrg.com](#), 17JAN2012

The United States pledged Tuesday to join an EU-led effort to develop a space "code of conduct" that would set out rules for orbiting spacecraft and for mitigating the growing problem of debris.

Tags: S&T policy

SCIENCE WITHOUT BORDERS

The faster-than-fast Fourier transform[PhysicsOrg](#), 18JAN2012

At the Association for Computing Machinery's Symposium on Discrete Algorithms (SODA) this week, a group of MIT researchers will present a new algorithm that, in a large range of practically important cases, improves on the fast Fourier transform. Under some circumstances, the improvement can be dramatic—a tenfold increase in speed. The new algorithm could be particularly useful for image compression, enabling, say, smartphones to wirelessly transmit large video files.

Tags: Science without borders, Mathematics

Map making, made easy[Harvard University](#), 17JAN2012

Developed by Harvard's Center for Geographic Analysis, WorldMap allows scholars to share access to view and edit geospatial information. Unlike similar tools, WorldMap allows the use of large, detailed datasets, and supports a number of formats. The software already boasts 1,250 users from more than 100 countries. Users have contributed more than 1,700 mapping layers and created more than 500 map collections to support their research. [WorldMap](#)

Tags: Science without borders

Search and Rescue Dog Deploys Robot Snake via Bark Control[IEEE Spectrum](#), 17JAN2012

Carnegie Mellon University's Biorobotics Lab teamed up with Ryerson University's Network-Centric Applied Research Team (NCART) Lab and a (very well trained) dog named Freitag for this demo. While Freitag was lucky enough to be running around with a robot snake this time, the system can be adapted to deploy just about anything, and apparently, deployment is controlled by the dog: whenever it starts to bark (which it does when it smells a human), the robot jumps out of the dog's chest-pack and starts exploring.

Tags: Science without borders, Robotics

Scientists predict an out-of-this-world kind of ice

R&D Magazine, 16JAN2012

Exploring what Cornell's Neil Ashcroft calls the "utterly fundamental" transition from insulating to conducting, or metallic, matter, the researchers have combined high-powered computing and "chemical intuition" to discover new phases of water—specifically, ice at extremely high pressures nonexistent on Earth but probably abundant elsewhere in the solar system.

Tags: Science without borders

How research goes viral

R&D Magazine, 11JAN2012

Scores of interesting new findings from the biosciences may speed around the globe at the click of a mouse, but one thing particularly encourages other researchers to follow up on them: The chance to use the laboratory materials upon which studies are based. Indeed, a recent paper co-authored by MIT economist Scott Stern shows that making the physical materials used in lab experiments—such as cell lines, microorganisms, or recombinant DNA—available to other scientists can vastly increase the rate at which knowledge flows through the scientific community.

Tags: Science without borders

SENSORS

A Smart Phone that Knows You're Angry

Technology Review, 17JAN2012

Researchers at Samsung have developed a smart phone that can detect people's emotions. Rather than relying on specialized sensors or cameras, the phone infers a user's emotional state based on how he's using the phone. Further down the line, this sort of emotion detection is likely to have a broader appeal. "Emotion recognition technology will be an entry point for elaborate context-aware systems for future consumer electronics devices or services. If we know the emotion of each user, we can provide more personalized services."

Tags: Sensors, Information technology, Science without borders

Team achieves breakthrough detecting nuclear materials

R&D Magazine, 11JAN2012

In their work, Livermore scientists demonstrated a plastic scintillator that can discriminate between neutrons and gamma rays with a polyvinyltoluene (PVT) polymer matrix loaded with a scintillating dye, 2,5-diphenyloxazole (PPO). They have found that plastic scintillators have a roughly 20% finer resolution for neutron-gamma ray discrimination than liquid scintillators. Crystals, in turn, are about 20% finer in resolution than plastics in their analysis.

Tags: Sensors, Counter WMD

STEM

OSTP Releases Federal STEM Investment Inventory

Federal Laboratory Consortium, 12JAN2012

U.S. federal agencies have a total budgetary commitment of approximately \$3.4 billion in science, technology, engineering and mathematics (STEM) education initiatives across 252 distinct "investment" efforts. These efforts are categorized and presented in a recent report entitled The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio.

Tags: STEM ■

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