Combining quantum information communication and storage

Aalto University researchers in Finland have successfully connected a superconducting quantum bit, or qubit, with a micrometer-sized drum head. Thus they transferred information from the qubit to the resonator and back again.


This shows a merger of three quantum systems: a superconducting quantum qubit, or, qubit (spheres) interacting with two different resonant cavities. A low frequency phonon cavity (vibrating string) was used as storage of quantum information from the qubit, whereas an electrical microwave cavity (represented by the mirrors) acted as a means of communicating to the outside world. The idea could be used as a building block in the emerging field of quantum information and communication.

Credit: Juha

Team creates MRI for the nanoscale

Magnetic resonance imaging (MRI) reveals details of living tissues, diseased organs and tumors inside the body without x-rays or surgery. What if the same technology could peer down to the level of atoms? Doctors could make visual diagnoses of a person’s molecules – examining damage on a strand of DNA, watching molecules misfold, or identifying a cancer cell by the proteins on its surface.


A tiny defect, called a nitrogen vacancy (NV), inside a diamond enabled researchers to detect the magnetic resonance of organic molecules in the same way an MRI produces images of a tissue or an organ. Credit: T. Staudacher and F. Reinhard
Curiosity rover collects first Martian bedrock sample

At the center of this image from NASA’s Curiosity rover is the hole in a rock called “John Klein” where the rover conducted its first sample drilling on Mars. The drilling took place on Feb. 8, 2013, or Sol 182, Curiosity’s 182nd Martian day of operations. Several preparatory activities with the drill preceded this operation, including a test that produced the shallower hole on the right two days earlier, but the deeper hole resulted from the first use of the drill for rock sample collection. Credit: NASA/JPL-Caltech/MSSS

NASA’s Curiosity rover has, for the first time, used a drill carried at the end of its robotic arm to bore into a flat, veiny rock on Mars and collect a sample from its interior. This is the first time any robot has drilled into a rock to collect a sample on Mars.

Invisible tool enables new quantum experiments with atoms, molecules, clusters and other nanoparticles

Experiments on the quantum wave nature of atoms and molecules have enabled researchers to precisely measure tiny forces and displacements as well as to shed light onto the unexplored zone between the microscopic realm of quantum physics and our everyday world. Physicists around Philipp Haslinger and Markus Arndt at the University of Vienna have now succeeded in constructing a novel matter wave interferometer which enables new quantum studies with a broad class of particles, including atoms, molecules and nanoparticles. These lumps of matter are exposed to three pulsed laser light gratings which are invisible to the human eye, exist only for a billionth of a second and never simultaneously.

Unique 4D microscope captures motion of DNA structures in space and time

Every great structure, from the Empire State Building to the Golden Gate Bridge, depends on specific mechanical properties to remain strong and reliable. Rigidity—a material’s stiffness—is of particular importance for maintaining the robust functionality of everything from colossal edifices to the tiniest of nanoscale structures. In biological nanostructures, like DNA networks, it has been difficult to measure this stiffness, which is essential to their properties and functions. But scientists at the California Institute of Technology (Caltech) have recently developed techniques for visualizing the behavior of biological nanostructures in both space and time, allowing them to directly measure stiffness and map its variation throughout the network.
Researchers strain to improve electrical material and it's worth it

Like turning coal to diamond, adding pressure to an electrical material enhances its properties. Now, University of Illinois at Urbana-Champaign researchers have devised a method of making ferroelectric thin films with twice the strain, resulting in exceptional performance.


Messier 106: Amateur and Professional Astronomers Join Together to Peer Into the Eyes of Creation

Nearly four million light years away in the direction of the constellation of Canes Venatici, a visage of creation awaited to be revealed. Now, thanks to the teamwork of the astronomical image processors at the Space Telescope Science Institute in Baltimore, Maryland, and world-renowned astrophotographers Robert Gendler and Jay GaBany, we’re able to see combined Hubble Space Telescope data with ground-based telescope imaging. Let’s look deep into spiral galaxy, Messier 106. (…)

Read the rest of Messier 106: Amateur and Professional Astronomers Join Together to Peer Into the Eyes of Creation

After Higgs Boson, scientists prepare for next quantum leap

Seven months after its scientists made a landmark discovery that may explain the mysteries of mass, Europe's top physics lab will take a break from smashing invisible particles to recharge for the next leap into the unknown.

Research conducted at the Physics department spans a wide range of pure and applied physics topics. These comprise: High-Energy and Elementary Particles Physics, Mathematical and Computational Physics, Superconductivity, Atomic Physics, Theoretical and Experimental Solid State Physics, Experimental Nano Physics, Materials Science and Engineering, Laser and Plasma Physics, Nuclear Physics and Engineering, Astrophysics, and Medical Physics.

Some of the topics are represented by more faculty members than others. The largest cluster is the Experimental Solid State Physics group. High Energy and Elementary Particles Physics is also strongly represented at the department. In addition, Computational Physics, Mathematical Physics, and Medical Physics are the subject of research activity for more than one faculty member each.

Quantum computers can solve certain problems much faster than their classical counterparts, but their realization on a scale relevant for practical applications has proven to be very difficult. However, this could change with a new method for solid state quantum computers devised by physicists from Leibniz Universität Hannover, Germany, and Harvard University. The scientists around Dr. Hendrik Weimer from institute for Theoretical Physics at Leibniz Universität report their results in the journal Physical Review Letters.

A meteor shower caused explosions in the lower atmosphere above Russia's Urals region, blowing out windows in some areas and leaving several people injured, officials and agencies reported. A plunging meteor exploded with a blinding flash above central Russia on Friday, setting off a shockwave that shattered windows and hurt almost 1,000 people in an event unprecedented in modern times. Experts insisted the meteor's fiery entry into the atmosphere was not linked to the asteroid 2012 DA 14, which later passed about 17,200 miles (27,700 kilometres) above the Earth without incident in an unusually close approach. The fall of such a large meteor estimated as weighing dozens of tonnes was extremely rare, while the number of casualties as a consequence of its burning up around a heavily-inhabited area was unprecedented.

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