

Diamonds offer solution for quantum computers

Quantum computing relies on the ability to store and manipulate qubits (superpositions of 1 and 0), but this is not easy to do without losing coherence. Now, Mikhail Lukin and colleagues from Harvard University, Stuttgart University and Texas A&M University have made a huge breakthrough. Using optical and microwave manipulation of electron and nuclear spins associated with a nitrogen vacancy in diamonds, they have succeeded in creating a controllable quantum register.

Using the spins to store qubits and transfer them without loss of coherence even at room temperature, the team got them to interact coherently, having made use of the coupling

between the nitrogen-vacancy spin system and the nuclear spins of nearby carbon-13 nuclei, which naturally make up 1.1% of a diamond. Their observations indicate that when advanced nuclear magnetic resonance techniques are used, controlled manipulation of a few coupled nuclear spin qubits is possible with coherence times that can approach seconds. These registers could be used as a basis for scalable, optically coupled quantum information systems.

Further reading

MV Gurudev Dutt *et al.* 2007 *Science* **316** 1312.

Meditation improves attention

Many of the claimed benefits of meditation are often fairly subjective, but recent research shows a clear and measurable effect on attention. Richard Davidson and colleagues at the University of Wisconsin-Madison and Leiden University asked 17 volunteers to spend three months studying Vipassana meditation, which is supposed to help reduce distractions and enhance awareness through mental training.

Participants were asked, before and after their intensive meditation, to try to spot one or two numbers among a series

of letters flashed on a screen, with the two numbers coming as little as half a second apart. The results showed a boost in correct recognition of the second number, which increased from 60% of the time to as much as 90% (with an average of 80%). This seems to indicate that the brain can be trained to make use of its resources in more efficient ways.

Further reading

HA Slagter *et al.* 2007 *PLoS Biology* **5** e138; doi:10.1371/journal.pbio.0050138.

Lunar laser ranging does it better

The Gravity Probe B (GP-B) satellite was launched by NASA in 2004 to test, among other things, the effect predicted by general relativity that the Earth would drag inertial frames with it as it rotates. TW Murphy Jr of the University of California and colleagues have argued that as the frame-dragging effect is a consequence of gravitomagnetism it has already been confirmed by lunar laser ranging measurements in the Earth-Moon system to a higher accuracy than GP-B will provide. That said, the data from the sophisticated gyroscope system on GP-B

are still interesting since they will provide a very direct measurement. GP-B will also test a related general relativistic effect, the “geodetic effect”, which is an additional gravitation-induced precession.

Further reading:

TW Murphy Jr *et al.* 2007 *Phys. Rev. Lett.* **98** 071102.

SM Kopeikin 2007 *Phys. Rev. Lett.* **98** 229001.

TW Murphy Jr *et al.* 2007 *Phys. Rev. Lett.* **98** 229002.

Muons see inside an active volcano

If you want to look at what lies inside a volcano, it turns out that cosmic rays may be just what you need. Hiroyuki Tanaka and colleagues from the University of Tokyo and Nagoya University have managed to use cosmic-ray muons to create a “radiograph” near the top of Mt Asama, one of the largest and most active volcanoes in Japan. They succeeded in measuring the internal structure of a newer crater region known as Mt Kama-yama, through the bulk of an older volcanic rim, Mt Maekake-yama.

Tanaka and colleagues used emulsion chambers with some shielding to help prevent exposure to the effects of lower-energy natural radioactivity. The approach is novel, a big advantage of emulsion chambers being that they need no electric power and are light enough to carry up a mountain. The technique has clear potential for monitoring active volcanoes from points that are not too close for comfort.

Further reading

HKM Tanaka *et al.* 2007 *Nucl. Instrum. Methods Phys. Res. A* **575** 489.

Cold fusion appears again

Cold fusion is one of those topics that just keeps coming back, most recently as reported in an article in *Naturwissenschaften*. Frank Gordon of the US Navy's Space and Naval Warfare Systems Center in San Diego and colleagues have reported new evidence for low-energy fusion in a palladium-deuterium film deposited on nickel. Not only do they get significant rises in temperature, but they find what seem to be nuclear tracks in CR-39, the etch-track detector familiar to particle physicists! Is there something interesting going on? Time and more experiments should eventually find out.

Further reading

S Szpak, PA Mosier-Boss and FE Gordon, 2007 *Naturwissenschaften* **94** 511.