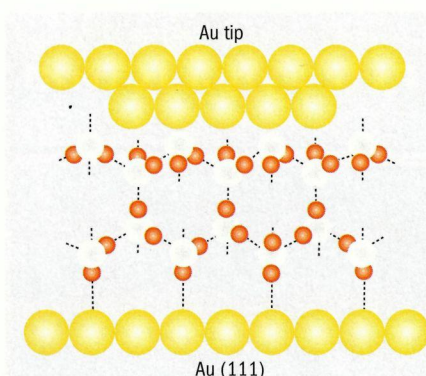


Electric fields create hot ice

Ice at room temperature? Don't worry – this is not the deadly "ice-nine" of Kurt Vonnegut's novel *Cat's Cradle*, but rather a special state found to exist in the presence of high-electric fields. Heon Kang of Seoul National University, Korea, and colleagues were using an electrochemical scanning tunnelling electron microscope – which has an electrically charged tip – to look at how electrons move through water to a gold surface below. Measurements indicated a solid barrier, which was interpreted as the electric field driving the alignment of water molecules into a solid.

Theorists had predicted that such an effect could occur, but at about a thousand times the field strength in this experiment. Kang and colleagues observed the effect at a mere 1 million V/m, or close to the breakdown voltage for air. Fields of this strength can occur in many places, from cracks in rocks to across cell membranes, so this new type of hot ice may be more common than anyone had imagined.



The electric field between the gold tip of an STM and a negatively biased gold surface, Au (111), may align water molecules so they form ice. Here white and red spheres represent the oxygen and hydrogen atoms as they appear in the ice structure.

Further reading

Eun-Mi Choi *et al.* 2005 *Phys. Rev. Lett.* **95** 085701.

Bose–Einstein feels the Casimir effect

Two quintessentially quantum phenomena are the Casimir effect, whereby two electrically neutral objects exert forces on each other by distorting the zero-point fluctuations in the vacuum, and the Bose–Einstein condensation. Bringing these together, Eric Cornell and his colleagues at the University of Colorado, Boulder, have set up a pancake-shaped Bose–Einstein condensate of rubidium atoms, several micrometres thick, in a magnetic trap just below a silica plate.

Watching the condensate oscillate at various distances 6–10 μm from the plate, the

researchers could determine the Casimir force from the way it pulled differently on the near and far sides of the pancake. The results came out in good agreement with expectations from theory, but perhaps the most interesting thing about this measurement is the shift in focus away from the condensate itself and towards interesting things that can actually be done with this novel state of matter.

Further reading

D M Harber *et al.* 2005 *Phys. Rev. A* **72** 033610.

New nanorods are harder than diamond

Natalia Dubrovinskaia of the University of Bayreuth and her colleagues have made carbon that is harder than diamond. Squeezing together buckyballs, each made of 60 carbon atoms, at 20 GPa and 2200 °C, the group reports the formation of a translucent cylinder made of diamond nanorods that is about 0.2–0.4% denser than

natural diamond. This is the densest form of carbon that has been determined experimentally and may find applications in very hard coatings for tools.

Further reading

Natalia Dubrovinskaia *et al.* 2005 *App. Phys. Lett.* **87** 083106.

Nanotechnology gives new twist to measuring spin

Nanotechnology and spintronics are two technologies that are supposed to revolutionize computing. Now Anatoly Mal'shukov of the Russian Academy of Sciences, Moscow, and colleagues have suggested that merging the fields could lead to interesting new devices. The group proposes that the flow of spin-polarized electrons could be detected as a measurable torsion in a tiny crystalline bridge.

The idea builds on something that is familiar to high-energy physicists: a strained crystal can provide an electric field in its rest frame that looks like a magnetic field to particles travelling through the crystal. A twisting of the bridge in response to the current of tiny magnets (the electrons) could provide a way of measuring the spin associated with that current. So far the work is theoretical, but it could lead to very real devices.

Further reading

A G Mal'shukov *et al.* 2005 *Phys. Rev. Lett.* **95** 107203.

Amazon puts the pressure on Earth

This almost sounds like something from the era of CERN's Large Electron–Positron collider when distortions due to solid-earth tides were found to affect the beam energies. It turns out that a Global Positioning System (GPS) station in Manaus, close to the centre of the Amazon basin, has been registering an up-and-down motion of about 50–75 mm a year. A close look by Michael Bevis of Ohio State University, Columbus, tracked this down to the rising and falling levels of the Amazon river pushing the ground up and down over the course of the year. If the interpretation is correct, this is the first measurement of an elastic response of the earth to changes in weight of a river system.

Further reading

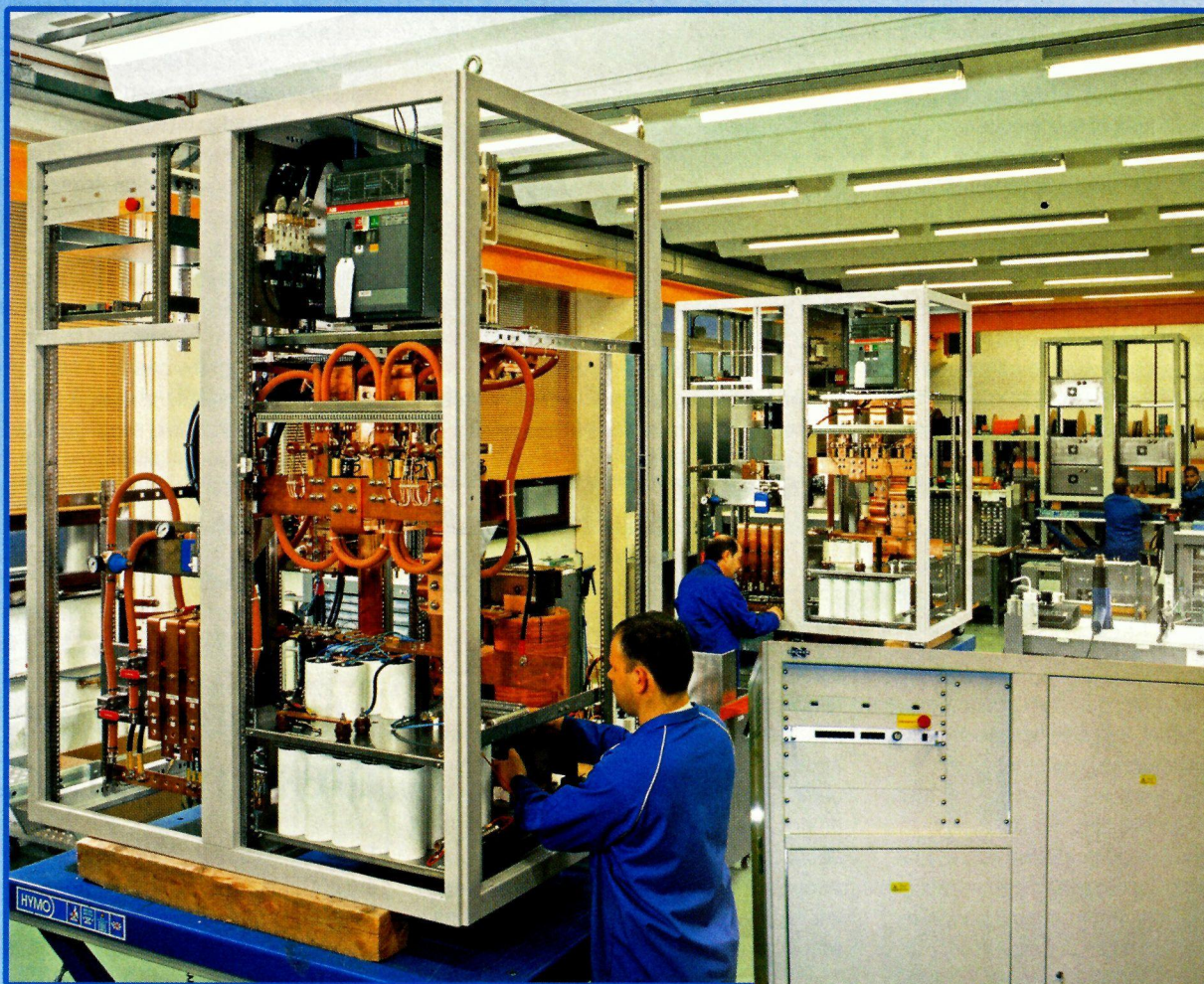
Michael Bevis *et al.* 2005 *Geophys. Res. Lett.* **32** L16308.



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