say André Schirmeisen of the University of Münster, Germany, and his colleagues.

They pushed islands of the element antimony across a graphite surface using the tip of an atomic-force microscope. Some of the particles encountered frictional resistance proportional to their area of contact with the surface; others slid almost friction-free.

The latter state, called superlubricity, has been argued to arise from a mismatch between the atomic-scale corrugations of two surfaces, which, in theory, should be the norm for solids. Schirmeisen and his team conclude that lubricity is undermined by impurities stuck at the interface.

PLANETARY SCIENCE

Mars lander

Icarus **197,** 452–457 (2008)

A curious elongated crater in the northern lowlands of Mars may mark the final resting place of a lost moonlet. A related crater a short distance away and 'butterfly wings' of ejecta to either side show that the crater was formed by the larger of two objects following the same, shallow trajectory.

According to modelling by John Chappelow and Robert Herrick at the University of Alaska Fairbanks, the distance to the secondary crater makes it improbable that this was the impact of an asteroid that split up in the atmosphere. And the alignment of the crater and its secondary makes it unlikely to have been a double asteroid. A small moon brought down by tidal drag and fractured in the atmosphere is, they argue, the most likely source.

ATMOSPHERIC CHEMISTRY

A chemical equator

J. Geophys. Res. doi:10.1029/2008JD009940 (2008)

A narrow atmospheric boundary in the Western Pacific keeps apart the more polluted air of the Northern Hemisphere from the cleaner air of the south. This newfound divide is markedly farther north than the Intertropical Convergence Zone (ITCZ), a tropical low-pressure belt that is thought to separate air masses elsewhere according to their hemispheric origin.

Jacqueline Hamilton of the University of York, UK, and her team found that carbon monoxide pollution from biomass burning in Thailand and Indonesia dropped steeply across the 50-kilometre-wide boundary. They conclude that storms may lift air from the Northern Hemisphere into the upper troposphere — where pollutants remain longer — preventing it from mixing with southern air masses.

THEORETICAL PHYSICS

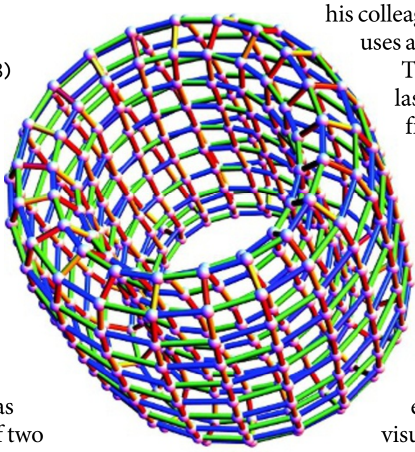
Computing with rainbows

Phys. Res. Lett. **101,** 130501 (2008)

Schemes for quantum computing abound, but most intend to carry out computations on objects such as atoms. Now Nicolas Menicucci at Princeton University in New Jersey and his colleagues propose a method that uses a rainbow of colours.

The group suggests firing lasers of 15 different frequencies into a cavity with a mirror at each end. Inside the cavity, a crystal splits each laser's photons into quantum mechanically 'entangled' pairs. Those pairs, in turn, become entangled with photons from the other lasers.

The resulting cobweb of entangled photons could be visualized as a brightly coloured tube (pictured left).



N. C. MENICUCCI ET AL./PHYS. REV. LETT.

The authors would be able to manipulate their rainbow computer by measuring the entangled photons that escape from the cavity — and the computer could, in theory, perform any computation.

CHEMISTRY

Biofuel acid test

Angew. Chem. Int. Edn doi: 10.1002/anie.200802879 (2008)

Tough, chewy parts of plants and even wood can be tapped for their fuel by dissolving them in an ionic liquid and then passing them over a solid acid catalyst, report Ferdi Schüth and his co-workers at the Max Planck Institute for Coal Research in Mülheim an der Ruhr, Germany. Specifically, a liquid made of an alkylmethylimidazolium salt dissolves woodchips. This allows the cellulose to be selectively hydrolysed when it passes through pores of a resin that contains sulphonic groups, generating sugars and smaller cellulose fragments.

The acidic resins needed to break down the cellulose are already commercially available, making the process easy to apply on a large scale.

JOURNAL CLUB

Roger Buick
University of Washington, Seattle

An astrobiologist considers the implications of microbes' mining abilities.

Microbes have been boring ever since life began on Earth: boring into rocks, that is. But why? Perhaps to avoid competitors or predators, to escape from environmental extremes or simply to secure a site safe from turbulent waters. Or might they be mining minerals for essential nutrients? Although the reason may vary depending on environment and host rock, a recent paper shows that some microbes tunnel towards a particular mineral, suggesting that nutrient mining may be occurring.

Tony Walton of the University of Kansas in Lawrence describes (and illustrates, gloriously) microscopic tubes in submarine glassy basalts from Hawai'i that show all the complex features of microbial borings (A. W. Walton *Geobiology* **6,** 351–364; 2008). The boreholes converge on olivine microcrystals but avoid plagioclase like the plague.

Olivine incorporates trace metals such as nickel, copper and chromium, essential nutrients for many microbes because they form the reactive centres in metalloenzymes and cofactors that catalyse key steps in vital metabolic pathways. These metals are sensitive to levels of oxygen and sulphides, so their bioavailability may have changed as Earth's surface environment has become more oxygenated and, periodically, more or less sulphidic. So the microbes may be mining olivine for metals that are now or were once rare in solution.

Two implications arise. First, although hominids have shown an ability to recognize different rocks for almost a million years, this geological aptitude may be more widespread and more ancient among other organisms. And second, as olivine occurs in martian meteorites and on Mars' surface, perhaps future astrobiological space missions should be alert to the possibility that fossils of microbial miners may occur in subaqueously deposited basaltic sands on that planet.

Discuss this paper at **http://blogs.nature.com/nature/journalclub**