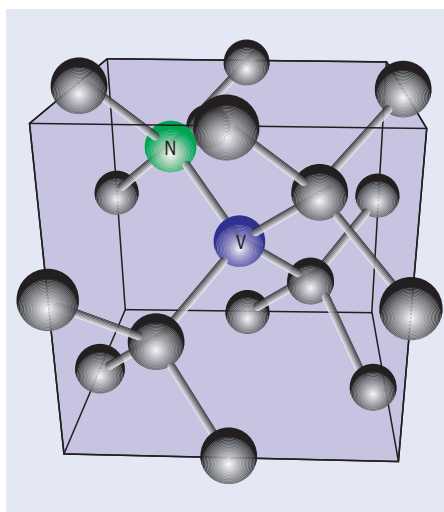


Diamonds help achieve quantum coherence

Quantum computing depends on how quantum objects can be coupled coherently. To suppress decoherence, many schemes have involved temperatures at millikelvin levels. Now, Torsten Gaebel of the University of Stuttgart and colleagues in Germany, Australia and the US have achieved long-lived coherently coupled spins at room temperature by implanting nitrogen into high-purity diamonds.

The idea is to create pairs of spins that are close enough to be strongly coupled, while being far enough from other spins to avoid decoherence. Gaebel and colleagues embedded N_2^+ molecular ions into diamond, where the molecules split up to form closely spaced single nitrogen atoms (N). This process also creates vacancies (V) in the diamond lattice, and during annealing at 900 °C the vacancies move and can become trapped next to nitrogen atoms in the diamond



A substitutional nitrogen centre (N) and a neighbouring vacancy (V), which form the structure of the NV centre in diamond.

lattice to form an NV centre. This has an electron spin, which could be used as a qubit, the basic element of a quantum computer; it also has an optical transition that can be used to control it and read it out.

As the yield of NV centres created is low, the researchers demonstrated the potential of the approach by studying the coherent coupling between NV centres and nearby nitrogen atoms. They found a characteristic decay time for coherence of about 350 ms at room temperature. Already a long time, this seems to be limited only by the carbon-13 content of the diamond. This indicates that an array of NV centres, in principle, could be manipulated optically to build a quantum computer.

Further reading

Torsten Gaebel *et al.* 2006 *Nature Physics* **2** 408.

Research reveals why life is left-handed

A long-standing puzzle in biology is the predominance of left-handed amino acids over right-handed ones – a huge violation of parity, which physicists have tried at various times to link to the parity violation well known in the weak interaction. This has often involved invoking sensitive processes far from equilibrium to amplify the incredibly tiny (but nonzero) difference in energies between left- and right-handed amino acids.

Martin Klussmann of Imperial College London and colleagues have now brought us closer to understanding how this imbalance may have occurred. They found that even in

equilibrium, there are reactions catalysed by amino acids that involve some tricky thermodynamics of both solid and dissolved amino acids, and these can result in enormous asymmetries of one handedness of amino acid over the other. As well as helping to understand a basic fact of biology, the work could lead to improved synthesis of medically important molecules, many of which have different properties depending on their handedness.

Further reading

Martin Klussmann *et al.* 2006 *Nature* **441** 621.

Science gets closer to the invisible man

It sounds like science fiction, but a new idea could lead to a form of shielding that would make an object effectively invisible. Ulf Leonhardt of the University of St Andrews in Scotland and John Pendry of Imperial College London and colleagues argue that suitable “metamaterials” could be constructed, at least in the microwave region of the spectrum, that could bend electromagnetic radiation in such a way as to deflect it around an object and then send it on its way as if there had been nothing there.

Normal materials with the required properties are unlikely to be found, so complexes of metal rings and wires would be used to generate the appropriate exotic behaviour. Of course even if this idea works for microwaves, it may not be possible to engineer the right sort of material for the optical region of the spectrum, or for a range of frequencies wide enough to make something that Harry Potter could use.

Further reading

U Leonhardt 2006 *Science* **312** 1777.
J B Pendry, D Schurig and D R Smith 2006 *Science* **312** 1780.

Superlattice mirror forms a sonic laser

Researchers from the University of Nottingham in the UK and the Lashkarev Institute of Semiconductor Physics in Ukraine have made what may be a sonic laser, demonstrating sound amplification by stimulated emission of radiation, that is, a SASER.

Anthony Kent and his colleagues created the device out of stacks of thin layers of AlAs/GaAs that form a superlattice. The layering plays the role of an acoustic mirror, and an electrical

input drives the production of phonons via a rather complicated process involving quantum wells. The operating frequency is in the terahertz range, with wavelengths of a few nanometres making this potentially attractive for many applications, including imaging.

Further reading

A J Kent *et al.* 2006 *Phys. Rev. Lett.* **96** 215504.



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