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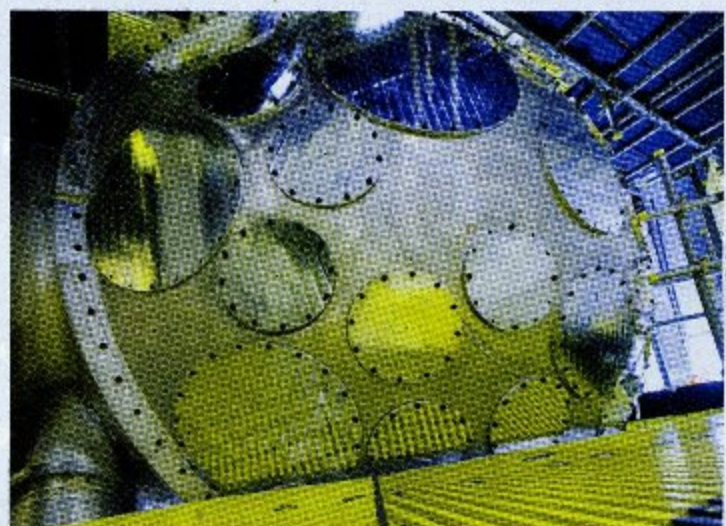
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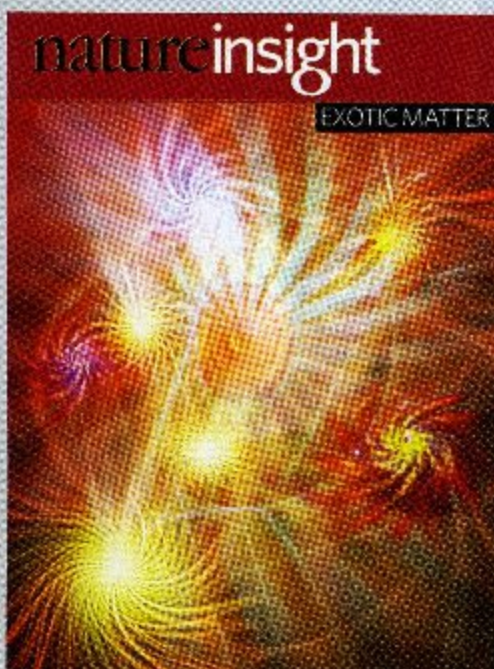
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Bring together a large number of particles and they can order themselves in unusual ways. This can give rise to emergent phenomena that cannot be understood solely in terms of the interactions that rule at the microscopic level — a theoretical and experimental playground for physicists in which the maxim 'more is different' holds true in particularly striking ways.



A simplified representation of the knotted three-dimensional electronic band structure of a topological insulator, p. 195.

EXOTIC MATTER

REVIEW

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S. Balibar

A 'supersolid' is a material that can be both solid and a superfluid at the same time — part of its mass can flow without friction whereas the rest remains solid. The theoretical possibility that such an enigmatic state of matter might exist has been around for more than four decades, and recent experiments on helium seem finally to confirm that supersolidity is a real phenomenon. But the precise origins of this phenomenon are still very much a mystery.

PERSPECTIVE

183 Superconductivity gets an iron boost

I. I. Mazin

The recent discovery of superconductivity in a series of iron-based materials is at odds with the 'rules of thumb' adopted by physicists in their search for new high-temperature superconductors. These guiding principles may now need to change.

REVIEW

187 Non-Abelian states of matter

A. Stern

Elementary particles, such as electrons and photons, are either fermions or bosons, and this determines their well-understood quantum statistical behaviour. But the collective behaviour of ensembles of these fundamental entities can yield new particle-like excitations (termed 'quasiparticles') that behave as neither fermions nor bosons. There is an ongoing quest to realize one particularly exciting class of quasiparticle: so-called non-Abelian states, whose exotic quantum statistical properties make them attractive candidates for constructing a quantum computer.

PERSPECTIVE

194 The birth of topological insulators

J. E. Moore

Recent years have seen the emergence of a new class of electronic material, the topological insulator. The ordering of electrons within these insulators exhibits an unusual knotted geometry. But such knots are essentially 'cut' at the surface of a topological insulator, yielding exotic metallic states that could lend themselves to applications in spintronics and quantum computing.

REVIEWS

199 Spin liquids in frustrated magnets

L. Balents

When the geometric (typically triangular) arrangement of localized magnetic moments is such that the energetically favoured orientations of neighbouring spins cannot all be satisfied, the system is said to be 'frustrated'. This gives rise to the theoretical possibility of a quantum spin liquid: a network of spins, the orientations of which will continue to fluctuate even at absolute zero. The ongoing experimental search for this exotic state of matter has brought to light some intriguing spin phenomena along the way.

209 Electron liquids and solids in one dimension

V. V. Deshpande, M. Bockrath, L. I. Glazman & A. Yacoby

The behaviour of electrons in bulk metallic systems lends itself to a simple description, encapsulated in the well-known Fermi liquid theory. But such a description breaks down when these electrons are confined to narrow channels (such as in nanowires and nanotubes), providing fresh challenges to both theory and experiment.

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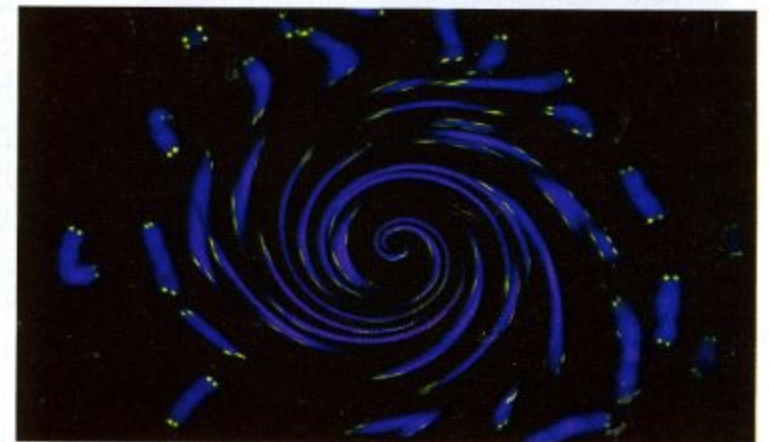
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ON THE PODCAST

This week, Geoff Brumfiel on his visit to the United Kingdom's nuclear weapons labs at Aldermaston, soon to welcome academic researchers to use the new laser facility. Also more on how 'half-sider' birds combine male and female somatic cells in one body, and a cosmological scale demonstration of general relativity. Go to iTunes or download from:

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