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'Magnetic electricity' discovered

"Magnetricity" only exists inside special types of crystals

Researchers have discovered a magnetic equivalent to electricity: single magnetic charges that can behave and interact like electrical ones.

The work is the first to make use of the magnetic monopoles that exist in special crystals known as spin ice.

Writing in Nature journal, a team showed that monopoles gather to form a "magnetic current" like electricity.

The phenomenon, dubbed "magnetricity", could be used in magnetic storage or in computing.

Magnetic monopoles were first predicted to exist over a century ago, as a perfect analogue to electric charges.

Although there are protons and electrons with net positive and negative electric charges, there were no particles in existence which carry magnetic charges. Rather, every magnet has a "north" and "south" pole.

Current event

In September this year, two research groups independently reported the existence of monopoles - "particles" which carry an overall magnetic charge. But they exist only in the spin ice crystals.

These crystals are made up of pyramids of charged atoms, or ions, arranged in such a way that when cooled to exceptionally low temperatures, the materials show tiny, discrete packets of magnetic charge.

The loops of a magnetic field can be seen in the arrangement of iron filings

Now one of those teams has gone on to show that these "quasi-particles" of magnetic charge can move together, forming a magnetic current just like the electric current formed by moving electrons.

They did so by using sub-atomic particles called muons, created at the Science and Technology Facilities Council's (STFC) ISIS neutron and muon source near Oxford.

The muons decay millionths of a second after their production into other sub-atomic particles. But these resulting particles "remember" the direction of the muons.

The team, led by Stephen Bramwell, from the London Centre for Nanotechnology, implanted these muons into spin ice to demonstrate how the magnetic monopoles moved around.

They showed that when the spin ice was placed in a magnetic field, the monopoles piled up on one side - just like electrons would pile up when placed in an electric field.

Professor Bramwell told BBC News that the development is unlikely to catch on as a means of providing energy, not least because the particles travel only inside spin ices.

"We're not going to be seeing a magnetic light bulb or anything like that," he said.

But by engineering different spin ice materials to modify the ways monopoles move through them, the materials might in future be used in "magnetic memory" storage devices or in spintronics - a field which could boost future computing power.