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Spinning into Control?

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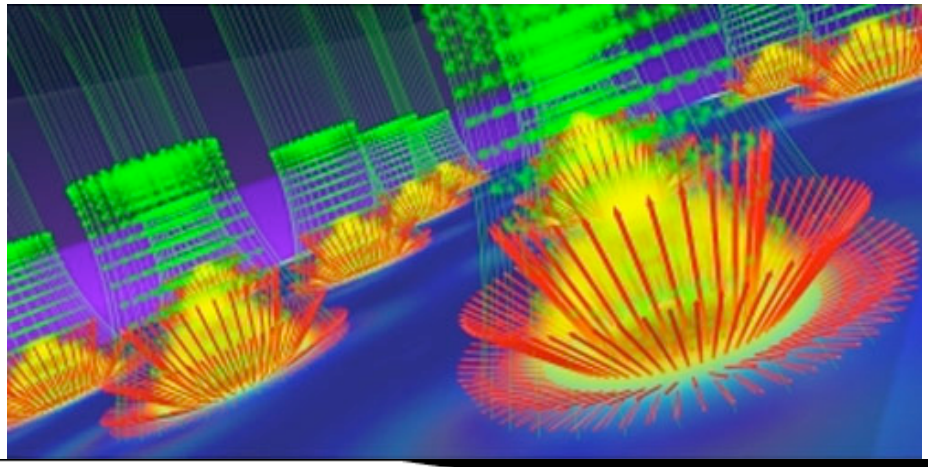

Spinning into Control?

A nanoscale technology called “spintronics” may help usher in a new era of nanosized – and more powerful – computer chips.

Current technologies carry information on an electron’s charge. Electrons also spin and researchers believe information could be encoded for by different types of spin. If that spin can be controlled and manipulated, researchers say, then devices built using spintronic technology could offer higher data processing speeds and lower electric consumption, among many other advantages. They may even be able to carry out quantum computations we have not yet seen the likes of.

Just one problem – no one can reliably control an electron’s spin.

Until now. University of Notre Dame physicist Boldizsar Janko and his colleagues believe they have figured it out.

First they build a device that is a series of layers, each only a few dozen nanometers thick. At the bottom is a diluted magnetic semiconductor material coated with metal atoms that contribute an extra electron spin to the material. Above that is an insulation layer and then a layer of superconducting material. This becomes a “flux tube,” and the electron spin patches at the bottom of each tube are available for encoding information.

When an electric current is sent through the superconductor, the electromagnetic force moves the flux tube to one side of the chip. As the tube moves, it drags along the patch of spins. When the current stops, the flux tube stays put. Likewise, a current flowing in the opposite direction moves the flux tube back to the other side.

Videos demonstrating both the structure of the flux tube and its movement can be seen here.

Janko and his colleagues have only tested this approach in computer simulations, but they are beginning experiments to demonstrate spintronics in the laboratory.

This research was published in the March 5, 2005, edition of the journal *Nature.*

--Bjorn Carey

Credit: Dr. Ovidiu Toader, University of Toronto