# Magnetic Vortex Switch Leads to Electric Pulse

April 8 2009

(PhysOrg.com) -- Researchers at the University of Arkansas have shown that changing the chirality, or direction of spin, of a nanoscale magnetic vortex creates an electric pulse, suggesting that such a pulse might be of use in creating computer memory and writing information.

Physicists Sergey Prosandeev and Laurent Bellaiche reported their findings in Physical Review Letters.

“This is new physics,” Prosandeev said. “There are many possibilities that can follow from this.”

The researchers looked at ferromagnets, a class of materials with novel properties at the nanoscale that have the potential to create new, efficient devices. They focused on the recently discovered vortex structure found at the nanoscale, investigating if a possible electric field can be generated when the vortex changes chirality.

“We change the magnetic structure but measure the associated electric field,” Prosandeev said.

They found that switching the direction of the vortex from clockwise to counterclockwise produced a positive electric pulse - and that switching the vortex in the opposite direction created an electric pulse with a negative sign. The resulting electric pulse can thus serve as the fingerprint indicating that switches of vortices did occur, as such a switch is difficult to directly observe.

Switching of some physical properties such as polarization or magnetization currently is used in computer memory and writing and storing information, but because of the larger scale, it requires more energy and materials. Being able to create switches of vortices with less material and energy could create more efficient devices.

The researchers have derived a formula showing the relationship between the magnetic vortex and the electric pulse and have shown how it occurs graphically over time. The next step will be experiments to see this phenomenon in action.

“Theoreticians show what can be the next step,” Prosandeev said. “These relationships can then be applied to technology.”

Provided by University of Arkansas (news : web)