Controlling the Vortex: a Novel Way to Create Switches

July 3 2006

Researchers at the University of Arkansas have found a way to create switching in nanoscale materials, opening the path to using these new properties for memory devices, nanomotors, nanoswitches or nanosensors.

Researchers Sergey Prosandeev, Inna Ponomarena, Igor Kornev, Ivan Naumov and Laurent Bellaiche, professor of physics in the J. William Fulbright College of Arts and Sciences, report their findings in an upcoming issue of *Physical Review Letters*.

“The properties of nanoscale objects are often different from the properties of objects at the macroscopic scale,” Prosandeev said. A nanometer is a billionth of a meter – things found at the nanoscale are smaller than bacteria, and possibly the size of a virus, atom or molecule. “We try to study the new properties of objects at the nanoscale to understand how to apply them to technology.”

Prosandeev and his colleagues study piezoelectric compounds, materials that change shape in an electric field, or create an electric field when they change shape. Such materials, currently used in medical ultrasound and naval sonar, appear to lose these properties at the nanoscale because they lose their polarization.

However, this “loss” is governed by a vortex within the nanodot, where the charges, which swirl in an almost circular motion, cancel one another.

The researchers decided to calculate the possibility of switching the direction of the vortex, which would open up the possibility of using these nanoscale materials in switches, sensors and other devices.

“We use very complex but extremely close to nature computations,” Prosandeev said. The researchers looked at what would happen if they used an inhomogeneous electric field arising, for example, from two different charges located away from the nanodot.

They found that the charges directed the vortex of the nanodot: when the charges were moved, the vortex moved, and when they swapped the two charges, the vortex adopted an opposite direction.

This vortex can be used to influence the change from electrical to mechanical energy and back, which is what drives piezoelectric compounds at the macro scale, Prosandeev said.

Source: University of Arkansas

Citation: Controlling the Vortex: a Novel Way to Create Switches (2006, July 3) retrieved 27 April 2024 from https://phys.org/news/2006-07-vortex.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.