COUPLED VORTEX GYRATIONS IN NANOMAGNET NETWORKS

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In current semiconductor technologies of information storage and processing devices, the electron charge is the basic operational unit. However, the significant electron leakage, with the inevitable energy loss, in cases of nanoscale electron channels, is a major limitation of this technology. Additional research into new, practical alternatives, therefore, is a priority. One such alternative is to use switchable magnetization states in nanomagnet networks [1]. In this presentation, our group and colleagues propose a robust mechanism of information signal transfer based on magnetic-vortex-state networks and experimentally measure coupled vortex oscillations by a state-of-the-art measurement probe, soft X-ray transmission microscopy through XMCD contrast [1-3]. Herein, collective vortex gyration modes, as studied and elucidated by micromagnetic simulations and analytical derivations, vary with different polarization and chirality ordering between neighboring disks [1,4,5]. The advantages of this mechanism are unlimited signal transfer endurance, low energy dissipation, and low-power signal inputs via resonant vortex excitation [5]. This work paves the way for novel, magnetic-vortex-state-networks-based signal transfer and logic operations applicable to spin-based information-signal-processing devices.

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