Vortex Dynamics in Confined Magnetic Nanodots

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Since spiraling magnetization configurations in patterned soft magnetic dots - the so-called magnetic vortices were experimentally observed [1], it has rapidly been a growing interest due to its stable core magnetization of either upward or downward orientation. Furthermore, recent studies on ultrafast switching of the vortex cores driven by oscillating or pulsed magnetic fields [2-8] and currents [9,10] with extremely low power provide opportunities for the practical applications for nonvolatile memory devices[11].

In this presentation, I will review recent findings on novel dynamic properties of vortex-core switching from the experimental and numerical studies, including the mechanism [4-5], the physical origin [6], and the universal criterion [7] from the fundamental perspective. I will further discuss the universal phase diagram with respect to the frequency and strength of circularly rotating fields from the technological point of view [7]. Moreover, I report a conceptual design of the new class of an information storage device, vortex random access memory (VRAM), on the basis of an array of vortex-state nanodots [8,11].

This work offers physical understandings of vortex dynamics in depth and the reliable means of information recording and readout which practically make the concept of VRAM possible. This work was supported by Creative Research Initiatives (ReC-SDSW) of MEST/KOSEF.

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