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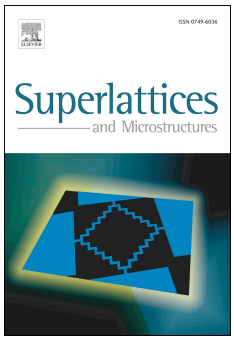

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Vortical Structures for Nanomagnetic Memory Induced by Dipole-Dipole Interaction in Monolayer Disks

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Abstract

It is well known that magnetic domains in nanodisks can be used as storage units for computer memory. Using two quantum simulation approaches, we show here that spin vortices on magnetic monolayer nanodisks, which are chirality-free, can be induced by dipole-dipole interaction (DDI) on the disk-plane. When DDI is sufficiently strong, vortical and anti-vortical multi-domain textures can be generated simultaneously. Especially, a spin vortex can be easily created and deleted through either external magnetic or electrical signals, making them ideal to be used in nanomagnetic memory and logical devices. We demonstrate these properties in our simulations.

Keywords: Spin Vortex, Magnetic memory, Dipolar Interaction

1. Introduction

The long-range ferromagnetic order in a magnetic device tends to disappear when the energy due to thermal fluctuation becomes comparable to the anisotropic and exchange energy terms. This is a well known superparamagnetic limit imposed on the miniaturization of magnetic devices [1].

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