Abstract Submitted
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Size dependence and thermal stability of chiral states in ferromagnetic nanoparticles deposited on a ferromagnetic substrate[1] NAOISE GRISEWOOD, JOHN EVES, HANS-BENJAMIN BRAUN, University College Dublin — Chiral magnetization profiles are observed in many low dimensional systems such as nanoscale particles, thin films, or bulk systems such as multiferroic samples, that are characterized by a lack of inversion symmetry. These spiraling spin structures are often size-dependent and can be attributed to the competition between exchange and anisotropic, or parity breaking Dzyaloshinskii-Moriya (DM) terms. To utilize such spiraling magnetization profiles in novel spintronic devices, it is necessary to understand the mechanisms under which these spiral spin configurations form and how they can be harnessed via an external field. Here we present exact analytic solutions for the magnetization profiles and the associated energies and energy barriers for ferromagnetic nanoparticles deposited on a ferromagnetic substrate. Our method allows us to determine the critical length at which spiral solutions are supported in such samples, which we find to be $l_c = (\pi/2)\sqrt{A/K_e}$ for vanishing applied field and a misfit angle of $\pi/2$ between substrate and nanoparticle anisotropy axis. We also demonstrate that in absence of further pinning effects, the nanoparticles are exclusively in a uniform state for $l < l_c$. We show that our theory is in good agreement with recent experiments.

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