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Static Vortex-Antivortex Configurations in Dzyaloshinskii-Moriya Materials

Abstract: Magnetic vortices are local defects within the magnetic microstructure of solids. Their unique topological nature allows for increased stability and particle-like behavior. With typical sizes in the nanometer range, these structures are particularly suitable for high density information storage. Dzyaloshinskii-Moriya (DM) ferromagnets offer antisymmetric exchange between atomic spins facilitating the induction vortex-like structures. In particular, thin films with broken inversion symmetry or artificially interlaced materials enable application-oriented design and optimization. We present hitherto unknown finite-energy configurations based on Meron-Antimeron pairs relaxing to static vortex-antivortex states in accordance with magnetostatic effects. Furthermore, analytical and numerical methods reveal non-trivial spiral and intermediate phases of anisotropic DM ferromagnets.