

Micromagnetic investigations on metastable skyrmions in permalloy nanodomes

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Recent advances in curvilinear magnetism have focused on the idea of stabilization of different magnetic textures by the combined effect of curvature of the geometry and the choice of the magnetic material. Permalloy dome-shaped nanostructures provide a unique platform for stabilizing non-collinear spin textures such as skyrmions without intrinsic Dzyaloshinskii-Moriya interaction (DMI) and perpendicular magnetic anisotropy (PMA) [1,2]. This work employs micromagnetic simulation technique to analyze the metastability of skyrmions in permalloy nanodomes and investigate their magnetization reversal pathways highlighting the effect of thickness of the geometry. The magnetization reversal in such a system happens via the nucleation of vortex and the annihilation of skyrmion. Furthermore, the thickness modulation helps in tuning these critical transition fields by modifying the demagnetizing energy landscape. Both Finite Difference and Finite Element discretization methods were employed in the simulations, yielding similar observations regarding magnetization reversal. In summary, this work demonstrates the effect of geometry on controlling the topology, stability and critical fields of different topological magnetic textures in soft curved nanostructures [3].

References:

- [1] E. Berganza *et. al.*, Scientific Reports 12 (2022) 3426
- [2] E. Berganza *et. al.*, Nanoscale 12 (2020) 18646
- [3] V. Pradeep and S. Thomas, "Metastable skyrmion states in soft magnetic permalloy nanodomes" (Manuscript under review)

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