Vortex quasi-crystal formation in dynamic transient states in soft magnetic nano-disks

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We report, based on micromagnetic numerical calculations, the discovery of vortex quasi-crystals in a variety of dynamic transient states in soft magnetic nano-disks. A simple method entailing the application of spin-polarized dc currents perpendicularly to the disk plane leads to many different vortex quasi-crystal transient states of a few tens of ps period, without consideration of the external bias magnetic field, magnetic anisotropy or Dzyaloshinskii-Moriya interaction. The below figure is a topological-density-based image of an example of vortex quasi-crystal states. What actualizes such novel spin textures in confined nano-magnets are intrinsic dipolar interaction and exchange coupling, as assisted by spin torque and the Zeeman field. This work provides a further, crucial step towards a fundamental understanding of vortex crystal formation and the interaction between topological solitons.

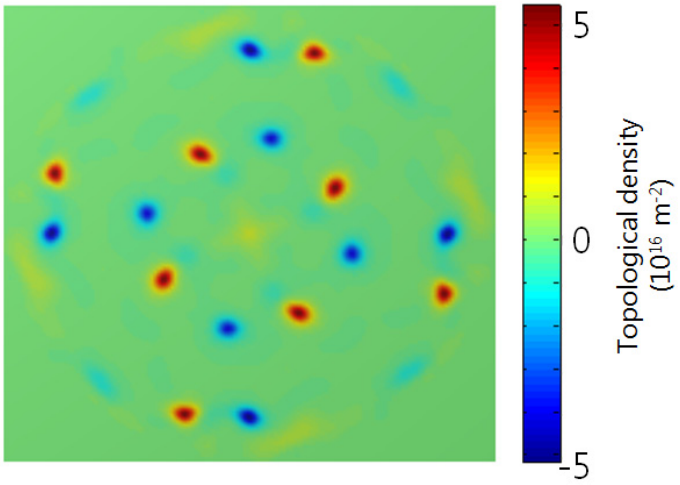

Fig: Plane-view image of topological-density in a vortex quasi-crystal state