

Micromagnetic study of Skyrmion and Antiskyrmion stability

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Skyrmions (Sk) are chiral nanoscale topological magnetic solitons. Sk are stabilized by the Dzyaloshinskii-Moriya interaction (DMI) [1-2] or by dipolar interactions. Antiskyrmions (ASk) can be stabilized when an anisotropic DMI with opposite sign along perpendicular directions ($D_x = -D_y$) is present [3-4]. Sk and ASk show a different distribution of dipolar volume charges (Fig. 1). Therefore, when the dipolar interaction is comparable with the other energies, significant differences in energy and stability between Sk and ASk are predicted [5].

Micromagnetic simulations have been performed with a homemade modified version of Mumax3 open source software [6] containing the anisotropic DMI. The Sk and ASk stability has been studied by tuning the Dy/Dx ratio obtaining a Dx-Dy phase diagram. The phase diagram shows two different zones where Sk and ASk are stable. Moreover, a zone is found where a transition occurs between a Sk and an ASk when the Dy/Dx ratio is varied from positive to negative. The frontier where this transition takes place is studied as a function of the dipolar strength. Finally, a detailed study of the phase diagram allows us to determine under which conditions Sk and ASk are stable.

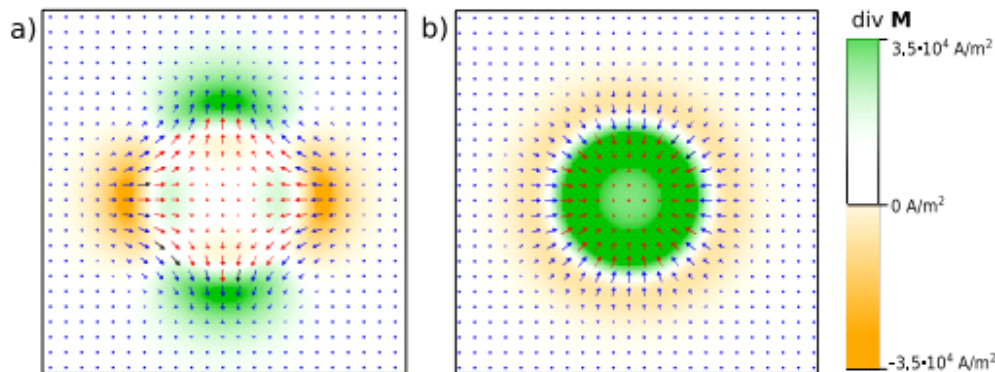


Figure 1 : Top view of a magnetic skyrmion **(a)** and an anti-skyrmion **(b)** in a nanodot with a lateral size of 115 nm. The colours represent the magnetic volume charges ($div \mathbf{M}$) as indicated in the scale bar. The arrows represent the out-of-plane magnetic components (red = up, blue = down). Taken from [5].

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