Shifts in the skyrmion stabilization due to curvature effects in dome- And antidome-shaped surfaces

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Abstract
The study of curvature-induced effects on the properties of nanostructures has become a cornerstone of magnetism. However, several methodologies usually used for studying nanoscale magnetic systems present difficulties for adequately describing curvature. In this work, we present a method that allows studying, under specific conditions, curved dome/antidome surfaces using an equivalent system without curvature. From the described methodology we obtain the phase diagram between easy-normal and skyrmionic magnetization configurations, as a function of spin-orbit coupling, Dzyaloshinskii-Moriya interaction (DMI), and curvature. The effective DMI of the dome structure increases with the curvature. Nevertheless, the effective anisotropy presents the opposite behavior, decreasing with curvature. These results allow us to conclude that an increase in the skyrmion stability is observed in nanostructures having positive curvature. The presented results propose a route that could facilitate the study of curved nanofilms with intrinsic DMI from comparing them with their planar counterparts.

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