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Spin dynamics of a magnetic antivortex

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Topological spin textures in patterned magnetic nanostructures including magnetic vortices and skyrmions are currently attracting a great deal of attention because they exhibit a variety of interesting properties, especially in the dynamic regime. The magnetic antivortex, the topological counterpart of a vortex that involves spins that sweep in from two opposite sides (e.g. the top and bottom) and out toward the other two (e.g., left and right), has received much less attention, in part because it is more difficult to stabilize. Here, we investigate the dynamic behavior of a magnetic antivortex stabilized at the intersection of orthogonal microstrips made of Permalloy using a combination of micro-focus Brillouin light scattering (micro-BLS) and micromagnetic simulations. The simulations show a rich dynamic response that includes analogs of the gyrotropic, azimuthal, and radial modes of a magnetic vortex. Additional complexities are, however, observed due to coupling between the antivortex excitations and propagating spin waves in the attached microstrips. We have detected several of these modes by micro-BLS [1]. A comparison of measurements made with an antivortex vs. a saturated spin configuration at the intersection shows that intersection spin state can be used to influence the mode structure in the microstrips, which suggests new possibilities for spin wave manipulation and generation.

[1] G. A. Riley, H. J. Liu, M. A. Asmat-Uceda, A. Haldar, and K. S. Buchanan, Phys. Rev. B 92, 064423 (2015).

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