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Localized Edge Modes in Permalloy Square Antidot Arrays J.B. KETTERSON, J. SKLENAR, Northwestern University, V.S. BHAT, L. DELONG, University of Kentucky, Lexington, O. HEINONEN, Northwestern University, Argonne National Laboratory — We have carried comprehensive experiments on and simulations of the ferromagnetic resonance spectrum of various thin films of permalloy patterned with a periodic array of holes on a square lattice. These so-called antidot lattices show a rich multi-line spectrum covering a wide range of frequencies and magnetic fields; they also exhibit striking angular dependences. One mode that is predicted in our simulations is highly localized at the edges of the holes. Our simulations further show that for a fixed field or excitation frequency the angular dependence of this mode strongly depends on the shape of the holes in the antidot array. It has been suggested[1] that, in comparison to other more extended modes, this localized mode would be difficult to find experimentally due to: i) the effects of varying shape and roughness present in an actual array, and ii) the fact that the mode is concentrated within a small fraction of the unit cell of the sample. Our experiments, performed with a broadband meanderline-based ferromagnetic resonance (FMR) spectrometer,[2] show a very weak resonance (requiring extensive signal averaging) that is in rough agreement with the simulations, which we propose as a candidate for this elusive edge mode.

[1]S. Neusser, B. Botters and D. Grundler, Phys. Rev. B, 78, 054406 (2008).
[2]C. C. Tsai, J. Choi, S. Cho, B. K. Sarma, C. Thompson, O. Chernyashevskyy, I. Nevirkovets, and J. B. Ketterson, Rev. of Sci. Instr. **80**, 023904 (2009).

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