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Topological Localization of FMR Modes by Antidot Arrays Patterned into Permalloy Thin Films[1] VINAYAK BHAT, JUSTIN WOODS, LANCE DE LONG, University of Kentucky, JOSEPH SKLENAR, JOHN KETTERSON, Northwestern University, OLLE HEINONEN, Argonne National Laboratory — We have observed novel broad-band FMR spectra for 25-nm-thick Permalloy films patterned with square arrays of diamond antidots with axes D_x= 1430 nm and D_y = 860 nm. The y-axis lattice spacing was held constant at d_y = 2000 nm, and variable x-axis lattice spacings d_x= 1730, 2000, 2267 and 2730 nm. The applied DC magnetic field H (in-plane at angle θ with respect to x-axis) spanned the hysteretic regime $|H| \leq 150$ Oe, to $|H| = 3$ kOe in the saturated regime, corresponding to mode frequencies $f \approx 250$ MHz to 14 GHz. In spite of hysteretic evolution of domain walls in the low-field regime, highly reproducible absorption peaks appear at $f <$ 3 GHz. Static and dynamic micromagnetic simulations agree with DC magnetization and FMR dispersion curves, and show domain pinning by the antidot edges is responsible for the reproducible spectra in the hysteretic regime. For H = 1 kOe along the x-axis, we observe two localized modes: one (f = 9 GHz) in a narrow gap between the accute vertices, and another (f = 10.25 GHz) between the oblique vertices, of adjacent diamonds. For $\theta = 45°$, one mode (f = 8.7 GHz) extends along the (-1,1) direction with strong angular variation of f, and a standing mode (f = 9.87 GHz) is localized between nearly parallel edges of adjacent antidots.

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Vinayak Bhat
University of Kentucky

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