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Observation of Novel Low-Field FMR modes in Permalloy Antidot Arrays[1] LANCE DE LONG, VINAYAK BHAT, BARRY FARMER, JUSTIN WOODS, Department of Physics and Astronomy, University of Kentucky, TODD HASTINGS, Department of Electrical and Computer Engineering, University of Kentucky, JOSEPH SKLENAR, JOHN KETTERSON, Department of Physics and Astronomy, Northwestern University — Permalloy films of thickness 23 nm were patterned with square arrays of square antidots (AD) with feature size D = 120 nm, and lattice constants d = 200, 300, 500 and 700 nm (total sample area = 2 mm x 2mm), using electron beam lithography. Our broad-band (frequencies f = 10 MHz-15 GHz) and narrow-band (9.7 GHz) FMR measurements of even dilute (D/d $<<$1) AD lattices (ADL) reveal remarkably reproducible absorption spectra in the low-frequency, hysteretic regime in which disordered domain wall (DW) patterns and unsaturated magnetization textures are expected for unpatterned films, but in the present case are strongly affected by the periodic ADL. Other modes in the saturated regime exhibit strong dependence on the angle between the applied DC field H and the ADL axes, as confirmed by our micromagnetic simulations. Novel modes are observed at DC fields above that of the uniform mode, which simulations indicate are localized at AD edges. Other novel modes are observed for DC fields below that of the uniform mode, which simulated power and phase maps indicate are confined to ADL interstices oriented parallel to H. These results show even dilute AD concentrations can effect strong control of DW evolution.

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