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Propagation of monopole defects and flux channels in an artificial square spin-ice lattice YIMEI ZHU, V.V. VOLKOV, SHAWN POLLARD, Brookhaven National Laboratory — The recent development of artificial lattices of magnetic islands in which competing interactions give rise to macroscopic analogs of atomically frustrated spin ices has opened up a new field of research, in which the interaction, frustration and evolution of individual magnetic elements can be directly observed in real space. We investigate the magnetic reversal along the (11) symmetry axis of permalloy islands in an artificial "square" spin-ice geometry with in-situ Lorentz transmission electron microscopy. Novel differential transport-of-intensity allows for the identification of "monopole"-like defects and flux channels, similar to Dirac strings, that link them. We track the growth and propagation of these defects and flux channels throughout the reversal process. Simulations are used to compare with experiment to show how nucleation and propagation of defects affect the reversal of the lattice as a whole. We find that interactions between defects and flux channels can explain the saturation of defect populations at low net magnetizations. This work was supported by U.S. Department of Energy, Office of Basic Energy Science, Material Sciences and Engineering Division, under Contract No. DE-AC02-98CH10886.

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