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Return Point Memory in Artificial Spin Ice[1] IAN GILBERT, University of Illinois at Urbana-Champaign, GIA-WEI CHERN, Los Alamos National Laboratory, BRYCE FORE, YUYANG LAO, University of Illinois at Urbana-Champaign, CRISTIANO NISOLI, Los Alamos National Laboratory, PETER SCHIFFER, University of Illinois at Urbana-Champaign — Return point memory, in which the spins of a magnet return to their original configuration after the magnet is driven through a hysteresis loop, has been studied extensively with theory, simulations, and bulk experimental probes. However, due to the difficulties associated with directly imaging single spins, microscopic experimental examination of return point memory has proven to be elusive. Here we describe a study of return point memory in arrays of single-domain nanomagnets known as artificial spin ice. In this system, the individual moments can be experimentally resolved by magnetic force microscopy (MFM), so we can both verify the existence of return point memory and explore the mechanism by which it develops. We find that, in artificial spin ice, magnetic monopole excitations drive the development of return point memory through a ratchet-like interaction with the local field produced by the surrounding nanoislands. The number of hysteresis loops required to produce return point memory can be adjusted by tuning the applied magnetic field and array geometry.

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