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Direct observation of the ice rule in demagnetized artificial kagome spin ice YI QI, TODD BRINTLINGER, JOHN CUMINGS, Materials Science and Engineering, University of Maryland, College Park, PAULA MELLADO, OLEG TCHERNYSHYOV, Johns Hopkins University — Artificially designed magnetic structures have proven to be good analogs for the study of spin ice. We studied an artificial kagome spin ice, which is lithographically patterned using permalloy elements ∼23nm thick, ∼100nm wide, and ∼500nm long. Lorentz TEM is used to unambiguously determine each local pseudospin. Even with a rigorous randomizing demagnetization process, we directly observe an exclusive ice rule and ice-like short range correlations. This is the first time that the ice rule has been confirmed by direct counting of the nearest-neighbors in any ice system, real or artificial. The further-neighbor correlations we observe are larger in magnitude than predicted for a random ice-rule ensemble, and we attribute this to the effects of dipolar interactions. Further, we investigate the entropy associated with artificial kagome spin ice based on the general concept of Shannon entropy [1]. These results will be presented and compared with relevant theoretical studies. [1] C.E. Shannon, Bell System Technical Journal, 27, 379 (1948)

Yi Qi
Materials Science and Engineering, University of Maryland, College Park

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