Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Thermal effects in artificial spin ice JASPER DRISKO, Department of Physics, University of Maryland, STEPHEN DAUNHEIMER, JOHN CUMINGS, Department of Materials Science and Engineering, University of Maryland — Frustrated systems, typically characterized by competing interactions that cannot all be simultaneously satisfied, are ubiquitous in nature and display many rich phenomena and novel physics. Artificial spin ices (ASIs), arrays of lithographically patterned Ising-like single-domain magnetic nanostructures, are highly tunable systems that have proven to be a novel method for studying the effects of frustration and associated phenomena. Recently, thermal activation of ASI systems has been demonstrated [1, 2], introducing the spontaneous reversal of individual magnets and allowing for new explorations of novel phase transitions and phenomena using these systems. We have fabricated ASI samples made from thin film $FePd_3$, which possesses simultaneously a high magnetic moment and a relatively low Curie temperature, and we investigate them using Lorentz Transmission Electron Microscopy. We observe thermally activated reversal of individual magnets when they are heated close to the Curie temperature of the film. Our analysis of Kagome spin ice arrays reveals signatures of competing interactions between vortex formation on the edges of the structures and magnetic charge ordering within the theoretically predicted Kagome ice-II state [3]. These observations are consistent with the emergent frustration of these systems.

[1] S. Zhang et al., *Nature* **500**, 553-557 (2013)
[2] A. Farhan et al., *Nature Phys.* **9**, 375-382 (2013)
[3] G.-W. Chern et al., *Phys. Rev. Lett.* **106**, 207202 (2011)

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Date submitted: 04 Nov 2013 Electronic form version 1.4