Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Thermodynamics of Polaronic States in Artificial Spin Ice[1] ALAN FARHAN, Lawrence Berkeley National Laboratory — Artificial spin ices represent a class of systems consisting of lithographically patterned nanomagnets arranged in two-dimensional geometries. They were initially introduced as a two-dimensional analogue to geometrically frustrated pyrochlore spin ice, and the most recent introduction of artificial spin ice systems with thermally activated moment fluctuations not only delivered the possibility to directly investigate geometrical frustration and emergent phenomena with real space imaging, but also paved the way to design and investigate new two-dimensional magnetic metamaterials, where material properties can be directly manipulated giving rise to properties that do not exist in nature. Here, taking advantage of cryogenic photoemission electron microscopy, and using the concept of emergent magnetic charges, we are able to directly visualize the creation and annihilation of screened emergent magnetic monopole defects in artificial spin ice. We observe that these polaronic states arise as intermediate states, separating an energetically excited out-of-equilibrium state and low-energy equilibrium configurations. They appear as a result of a local screening effect between emergent magnetic charge defects and their neighboring magnetic charges, thus forming a transient minimum, before the system approaches a global minimum with the least amount of emergent magnetic charge defects.

[1]This project is funded by the Swiss National Science Foundation

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Date submitted: 30 Sep 2016 Electronic form version 1.4