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Thermal Demagnetization on Artificial Spin Ice

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Artificial spin ice systems, consisting of two-dimensional arrangements of single-domain nanomagnets, allow the study of frustration and emergent magnetic monopoles [1, 2]. Synchrotron x-ray photoemission electron microscopy allows direct imaging of the magnetic state of each nanomagnet, having moments pointing in one of two orientations parallel to their long axis.
Our recent studies of the basic building blocks of an artificial Kagome spin ice, consisting of permalloy or cobalt islands, indicated that as the number of rings is increased there is a decrease in the ability to achieve the low-energy states following demagnetization [1]. More recently, we have demonstrated the existence of emergent magnetic monopoles and their associated Dirac strings in a quasi-infinite nanomagnet array [2].
We now wish to study systems where we can observe thermally driven moment fluctuations and with these systems try to achieve long range order in large area arrays. First results indicate that we are indeed able to observe moments flipping on a timescale of a few minutes.

[1] E. Mengotti, et al., Phys. Rev. B 78, 144402 (2008)
[2] E. Mengotti, at al., Nature Physics 7, 68 (2011)

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