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Control of Ground State Order in Artificial Square Ice JASON MORGAN, University of Leeds, AARON STEIN, CFN, BNL, SEAN LANGRIDGE, ISIS, RAL, CHRIS MARROWS, University of Leeds — Anisotropy in nanomagnet arrays can be tailored to enforce geometrical frustration, so that analogs of spin-ice materials can be fabricated [1-2]. We have studied artificial square ice, which consists of interlinked vertices of four Ising moments. Previously, energy minimisation via ac demagnetization has received significant attention, however, the long-range ordered ground state (GS) is inaccessible via this method. Furthermore, equilibriation is disallowed in the athermal limit so far explored. We show it is possible to realise GS order in as-prepared arrays, fabricated via electron beam lithography and evaporation, due to early-growth thermalization [3]. Monopole and string-like excitations from the GS are seen to be Boltzmann factor-weighted. Monopole propagation and interactions can be inferred within an energy band structure. Lattice spacing and buffer material allow control of ordering.

[1] Wang et al., Nature (2006), **439**, 303-306
[2] Harris et al., PRL (1997), **79**, 2554-2557
[3] Morgan et al., Nature Phys. (at press)

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