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Second Frustration for Artificial Spin Ice CRISTIANO NISOLI, TAMMIE NELSON, Theoretical Division, Los Alamos National Laboratory — Since its introduction six years ago, artificial spin ice has been employed to successfully study frustration and disorder, to explore extensions of thermodynamics to granular systems, to investigate topological defects and information encoding, and has become ground for direct imaging of "magnetic monopoles." The research has concentrated so far on a few basic geometries (square, ladder, honeycomb, triangular) in which the frustration of the magnetic interaction at the vertices could (or not) bring about a degeneracy. Here we propose new topologically non-trivial geometries, which we call "of second frustration." In these arrays each vertex, while frustrated, has a unique low energy configuration, and is therefore non degenerate; yet a second frustration is regained globally and vertex excitations are topologically protected on loops inside the array. These topological excitations, which control the entropy, cannot be suppressed, can move, merge and exchange topological charge. As novel, more dynamical artificial spin ice is being developed by many, these new lattices could provide an interesting playground for driving and controlling topological excitations, and for taylor-design of probe-response properties.

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