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Natural and Artificial Spin Ice¹

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Geometrical frustration among spins in magnetic materials can lead to exotic low temperature states including “spin ice”, in which the local moments mimic the frustration of hydrogen ion positions in frozen water. We have performed extensive studies of spin ice materials and related compounds, and recently have begun study of an *artificial geometrically frustrated magnet* which shares many of the properties of the spin ice materials. This artificial frustrated system is based on an array of lithographically fabricated single-domain ferromagnetic islands. The islands are arranged such that the dipolar interactions between them are analogous to those in spin ice. Images of the magnetic moments of individual elements in this correlated system allow us to study the local accommodation of frustration. We see both ice-like short range correlations and an absence of long range correlations, behavior which is very similar to the low temperature state of spin ice. These results demonstrate that artificial frustrated magnets can provide a rich new arena in which to study the physics of frustration. References: J. Snyder *et al.* (PRL 2003, and PRB 2004); R. F. Wang *et al.* (Nature, in press). This research was supported by the Army Research Office and the National Science Foundation.

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