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**Frustration in a patterned array of nanoscale ferromagnetic islands: Artificial Spin Ice**[1]

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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. Our group has performed extensive studies of spin ice materials, and we have developed and studied an *artificial geometrically frustrated magnet* which shares many of the properties of the spin ice materials. This artificial frustrated system is 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. We have extended these studies to include theoretical analysis of the disordered state of moments. We have also used these arrays to analyze the process of demagnetization, which is necessary to access low energy collective states in our arrays and in many other magnetic systems. Our results shed light on the nature of frustration in patterned arrays and correspondingly demonstrate that artificial frustrated magnets can provide a rich new arena in which to study the physics of frustration. References: R. F. Wang *et al.* (Nature 2006 and Journal of Applied Physics 2007); C. Nisoli *et al.* (Physical Review Letters 2007).

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