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Title: **Spin Ice: an Emergent Magnetic Electrolyte**

Spin ice materials are frustrated magnets in which spin directions map onto proton positions in water ice. Spin ice therefore forms a disordered and highly correlated low temperature magnetic state. In 2008 it was predicted theoretically that defects in the spin ice take the form of nearly point-like magnetic charges or "monopoles", analogous to water ice's ionic defects. In 2009 several experimental papers confirmed this prediction. In particular we proposed that spin ice should be classified as a weak magnetic electrolyte and tested the idea that a universal property of weak electrolytes - the Onsager-Wien field dissociation effect - should occur in spin ice. Our observation of this effect with muon spin rotation enabled us to observe monopole currents and to measure the monopole charge [2]. More recently we have created and measured magnetic monopole currents using a SQUID device and shown how these are controlled by quasi-chemical equilibria. Our results indicate that spin ice is an almost ideal magnetic electrolyte, exhibiting both `emergent electricity' (`magnetricity') as well as `emergent chemistry'!

[1] Castelnovo Moessner & Sondhi, Nature, 2008.
[2] Bramwell, Giblin et al., Nature 2009.