

Monopoles and Magnetricity in Spin Ice

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The analogy between spin configurations in spin ice materials like $\text{Ho}_2\text{Ti}_2\text{O}_7$ and $\text{Dy}_2\text{Ti}_2\text{O}_7$ and proton configurations in water ice, H_2O , has been appreciated for many years¹. However it is only in the last few years that this equivalence has been extended into the realm of electrodynamics². A particularly interesting aspect of the problem is the magnetic field induced transport of magnetic charges or ‘monopoles’ in spin ice to give so-called ‘magnetricity’³. In this talk I shall describe our recent experimental work that identifies these transient magnetic currents and demonstrates the role of universal Coulombic correlations. It is found that the latter lead to systematic deviations from Ohm’s law in the form of a magnetic equivalent of the Onsager-Wien effect, well known in electrochemistry.

¹Bramwell and Gingras, *Science*, **294**, 1495, 2001

²Castelnovo *et al.*, *Nature* **451**, 42 (2008); Ryzhkin, *J. Exp. and Theor. Phys.* **101**, 481 (2005)

³Bramwell *et al.*, *Nature* **461** 956 (2009); Giblin *et al.* *Nature Physics* **7** 252 - 258 (2011)