

# Entropy and Emergence in Spin Ice

**Steven T. Bramwell**

*University College London and London Centre for Nanotechnology, Gordon Street, London, U. K.*

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In spin ice materials like  $\text{Ho}_2\text{Ti}_2\text{O}_7$  and  $\text{Dy}_2\text{Ti}_2\text{O}_7$ , spin correlations induced by many-body magnetic dipolar interactions become equivalent to those induced by an ice rules organising principle. This stabilises a low temperature magnetic state that has the same residual entropy as water ice. An applied magnetic field can be used to control the organising principle, and hence the entropy, while neutron scattering can be used to image the corresponding spin states. Spin ice thus offers a unique opportunity to probe, in microscopic detail, the physics of a highly correlated and disordered system. In this talk, I will describe how spin ice can be used to empirically test modern ideas of "emergence" in condensed matter.