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Monopole Dynamics in Spin Ice

CLAUDIO CASTELNOVO, Royal Holloway University of London

The last couple of years have witnessed intense interest in spin ice materials due to the unique nature of its low energy excitations, which take the form of emergent magnetic monopoles. Through combined theoretical and experimental work, it has become increasingly apparent that an effective description of these excitations in terms of free, Coulomb interacting point-like quasiparticles is essential to develop an understanding of the thermodynamic properties of these materials beyond numerical simulations. On the other hand, we are only just beginning to unravel the repercussions of such exotic excitations on the dynamics of spin ice, in relation for instance to how the system relaxes when driven out of equilibrium, or in relation to thermal transport experiments. In this talk we review some of the latest theoretical and experimental results on the out of equilibrium properties of spin ice materials, ranging from thermal and field quenches [Castelnovo, Moessner, & Sondhi, PRL 104, 107201 (2010) and ongoing work] to thermal runaways in response to a varying magnetic field [Slobinsky *et al.*, arXiv:1010.4143v1]. In particular, we discuss how these phenomena can be understood as consequences of the specific nature of the low energy excitations.