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Far from equilibrium behaviour of spin ice materials CLAUDIO CASTELNOVO, TCM group, Cavendish Laboratory, University of Cambridge, SARAH MOSTAME, Department of Chemistry and Chemical Biology, Harvard University, RODERICH MOESSNER, Max Planck Institute for the Physics of Complex Systems, SHIVAJI SONDHI, Department of Physics, Princeton University — Non-equilibrium physics in spin ice is a novel setting which combines kinematic constraints, emergent topological defects, and magnetic long range Coulomb interactions. In spin ice, magnetic frustration leads to highly degenerate yet locally constrained ground states. Together, they form a highly unusual magnetic state – a "Coulomb phase" – whose excitations are pointlike defects – magnetic monopoles – in the absence of which effectively no dynamics is possible. At low temperatures, the monopoles are sparse and dynamics becomes very slow. These systems are therefore prone to falling out of equilibrium at low temperatures, for instance following comparatively rapid changes in temperature or applied magnetic field. In this regime, a wealth of dynamical phenomena occur, including reaction diffusion behaviour, slow dynamics due to kinematic constraints, as well as behaviour that mimic the deposition of interacting dimers on a lattice. The situation is further complicates by the presence of disorder that, even at small densities, appears to have a sizeable effect on the low-temperature dynamics of these systems. Here we investigate some of these phenomena and we propose how to effectively extend existing theories to to describe spin ice far from equilibrium.

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