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Long-range Coulomb interactions and monopole population inversion following thermal quenches in spin ice MARIANNE HAROCHE, CLAUDIO CASTELNOVO, University of Cambridge — In spin ice materials, such as rare earth titanate pyrochlores Dy2Ti2O7 and Ho2Ti2O7, magnetic frustration leads to a highly degenerate ground state that can be seen as a topologically ordered magnetic vacuum whose elementary excitations take the form of point-like magnetic charges. Numerical simulations have predicted the emergence of monopole-rich metastable states following a thermal quench, which have been recently observed in experiments. This metastability arises from a population inversion between what are called free monopoles and noncontractible pairs. In this work we investigate in detail the origin of the population inversion by simulating an effective spin ice model with explicit Coulomb interactions between the monopoles. Our results demonstrate that the long-range tail of the Coulomb interaction is responsible for the population inversion, and thence for the dynamical arrest. We also build a mean field analytic model of the monopole population dynamics to explain the different regimes observed.

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