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Comparison of the Supercooled Spin Liquid States in the Pyrochlore Magnets $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$ ANNA EYAL, AZAR B. EYVAZOV, RITIKA DUSAD, Cornell University, TIMOTHY J. S. MUNSIE, GRAEME M. LUKE, McMaster University, J.C. SÉAMUS DAVIS, Cornell University, Brookhaven National Laboratory, University of St. Andrews, University College Cork — Despite a well-ordered crystal structure and strong magnetic interactions between the Dy or Ho ions, no long-range magnetic order has been detected in the pyrochlore titanates $Ho_2Ti_2O_7$ and $Dy_2Ti_2O_7$ [1]. The low temperature state in these materials is governed by spin-ice rules. These constrain the Ising like spins in the materials, yet does not result in a global broken symmetry state. To explore the actual magnetic phases, we simultaneously measure the time- and frequency-dependent magnetization dynamics of $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$ using toroidal, boundary-free magnetization transport techniques. We demonstrate a distinctive behavior of the magnetic susceptibility of both compounds, that is indistinguishable in form from the permittivity of supercooled dipolar liquids. Moreover, we show that the microscopic magnetic relaxation times for both materials increase along a super-Arrhenius trajectory also characteristic of supercooled glass-forming liquids. Both materials therefore exhibit characteristics of a supercooled spin liquid. Strongly-correlated dynamics of loops of spins is suggested as a possible mechanism which could account for these findings. Potential connections to many-body spin localization will also be discussed. [1] J. S. Gardner, et al., Rev. Mod. Phys., 82, 53 (2010).

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