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A Measure of Monopole Inertia in the Quantum Spin Ice $Yb_2Ti_2O_7$ LIDONG PAN, N. J. LAURITA, Institute for Quantum Matter, Department of Physics and Astronomy, Johns Hopkins University,, KATE A. ROSS, Institute for Quantum Matter, Department of Physics and Astronomy, Johns Hopkins University; NIST Center for Neutron Research, EDWIN KERMARREC, Department of Physics and Astronomy, McMaster University, BRUCE D. GAULIN, Department of Physics and Astronomy; and Brockhouse Institute for Materials Research, McMaster University; Canadian Institute for Advanced Research, N. PETER ARMITAGE, Institute for Quantum Matter, Department of Physics and Astronomy, Johns Hopkins University, — We report a time domain terahertz spectroscopy study of quantum spin ice material $Yb_2Ti_2O_7$. We measure the complex dynamic susceptibility of $Yb_2Ti_2O_7$ in the temperature range between 1.4K and 20K. The data are consistent with a picture where the emergent magnetic monopoles are the principle degrees of freedom. Among other measures, we observe a zero crossing in the real part of the frequency dependent susceptibility. Such a feature is not possible without introducing inertial effects e.g. a mass dependent term to the equations of motion. Through a comparison of the magnetic spectral weight with numerical data that estimates the low temperature monopole density, we derive a value for the magnetic monopole mass.

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