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Static Spin Disorder and Field-Induced Low Dimensionality in the Spin Ice Phase of $Ho_2Ti_2O_7$ JACOB RUFF, SARAH DUNSIGER, BRUCE GAULIN, HANNA DABKOWSKA, YANG ZHAO, McMaster University, JASON GARDNER, YIMING QIU, JOHN COPLEY, NIST Centre for Neutron Research — The pyrochlore magnet $Ho_2Ti_2O_7$ displays a disordered, geometrically frustrated state at low temperature known as "Spin Ice." This short-range correlated magnetic state is so named because it maps onto the proton-disorder problem in water ice. Unique to spin ice, as opposed to water ice, is the tunable parameter of applied magnetic field, which allows a new dimension of its phase behavior to be studied [Fennell et.al, PRB 72, 224411(2005)]. We report time-of-flight neutron scattering experiments probing the magnetic field-induced behavior of $Ho_2Ti_2O_7$ with the field applied along a crystallographic [110] direction. These results show elastic short-range correlations in $Ho_2Ti_2O_7$ in zero field, and a decomposition of the pyrochlore lattice into two orthogonal sets of weakly interacting chains in the presence of a [110] magnetic field. One of these subsystems of the pyrochlore lattice undergoes a 3D to 1D crossover with applied field. We compare our results with expectations for a dipolar spin ice model, and with recent results for the antiferromagnetic sister compound $Tb_2Ti_2O_7$.

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