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A Model Quantum Spin Ice: Phase Diagram Construction for Quantum Spin Ice Under the Transverse Ising Model with Exact Diagonalization and Numerical Linked Cluster Methods[1] JESSICA JIANG, Smith College, YUTAN ZHANG, RAJIV SINGH, University of California, Davis — In this poster, we present calculations of properties at $T = 0$ of the quantum spin ice checkerboard lattice under the Transverse Ising model using Exact Diagonalization (ED) Numerical-Linked Cluster (NLC) methods up to order six. We use Exact Diagonalization methods to calculate properties for the finite system (4×4 lattice) and a combination of ED and NLC methods to approximate them for an infinite quantum spin ice lattice. Our results reproduce the expected behavior of the lattice for the magnetization M, the entanglement entropy S_E, the Néel state order parameter $S_{\pi,\pi}$, the susceptibility χ_F, and the fidelity susceptibility χ_F at different values of the applied magnetic field, h, and the ratio of the far and near neighbors bond strength, J_2/J_1. We additionally calculate the system's self-consistent x-direction magnetization to estimate the critical field value h_c at which a second order phase transition occurs. Ongoing work will extend this analysis and construct a complete phase diagram for the system using these methods.

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