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Exact Diagonalization of a Quantum Ising Model with Long-Range Interactions SHANNA MUEHE, THOMAS GUNN, Univ of West Florida, C.C.-JOSEPH WANG, None, CHRISTOPHER VARNEY, Univ of West Florida — Due to the rapid advance of quantum spin simulators in ultra-cold ions, the varying interaction for spin models in two-dimensional lattices have become feasible for experimental exploration for exotic states of collective states of multiple spins. It is particularly interesting for the case of a triangular lattice with antiferromagnetic interaction between spins. When the Ising spin-spin interaction is uniform and restricted between nearest neighbors, the spins are geometrically frustrated. When the system interaction becomes long ranged, the geometric frustration is lost but the spins are frustrated by the long-range interaction. In the latter case, the underlying orders present in the ground state are unclear and understanding these states in finite spin systems is crucial for the benchmarking of experimental observations. Here, we investigate the quantum dipolar Ising model with exact diagonalization to analyze the ground state, order parameters, and excitations and provide a baseline for comparison with experiments.

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