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Coulombic Quantum Liquids in Spin-1/2 Pyrochlores

LUCILE SAVARY, University of California, Santa Barbara, LEON BALENTS, Kavli Institute for Theoretical Physics, University of California, Santa Barbara — We develop a non-perturbative “gauge Mean Field Theory” (gMFT) method to study a general effective spin-1/2 model for magnetism in rare earth pyrochlores. gMFT is based on a novel exact slave-particle formulation, and matches both the perturbative regime near the classical spin ice limit and the semiclassical approximation far from it. We show that the full phase diagram contains two exotic phases: a quantum spin liquid and a coulombic ferromagnet, both of which support deconfined spinon excitations and emergent quantum electrodynamics. Phenomenological properties of these phases are discussed.

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