PHYSICS
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Ground State Selection in Quantum Pyrochlore Magnets

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Abstract

The pyrochlore lattice, a network of corner-sharing tetrahedra, is one of the most pervasive crystalline architectures in nature that supports geometrical frustration. We and others have been interested in a family of rare earth pyrochlore magnets, that can display quantum S=1/2 magnetism on such a lattice. The ground states for some of these materials may be described by a model known as "spin ice", a model with the same frustration and degeneracy as solid ice (the kind you skate on), as well as by a quantum version of this model known as "quantum spin ice" that possesses an emergent quantum electrodynamics. I'll describe how this comes about and how we can understand these materials, with an emphasis on modern neutron scattering. I'll also discuss a generalized phase diagram for the ground states of these materials, with emphasis on the Yb2Ti2O7, Er2Ti2O7, and Er2Pt2O7.