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Title:
Magnetic pyrochlore oxides compounds: beyond Ising with hbar nonzero

Abstract:
Magnetic materials and models of magnetic systems have long afforded physicists with an exquisite platform to study the fundamental and generic, and at times even universal, principles that govern collective phenomena in Nature. The 1987 proposal by Philip Anderson that geometric frustration may lead to the discovery of magnetic systems disordered by large quantum fluctuation triggered the modern age of experimental and theoretical study of highly frustrated magnets and the search for quantum spin liquids.

In that context, systems with magnetic moments that reside on the sites of a two-dimensional or three-dimensional network of corner-sharing triangles or tetrahedra and interact with effective antiferromagnetic nearest-neighbor coupling have been the subject of numerous investigations, both on the experimental and theoretical front. Within the realm of three-dimensional systems, the pyrochlore lattice of corner-sharing tetrahedra with antiferromagnetically interacting spins has been recognized since the early 1990s as a unique setting to explore thermodynamic and magnetic phenomena caused by a large degree of magnetic frustration. From this perspective, the R2M2O7 pyrochlore oxides are particularly interesting since the R^{3+} and M^{4+} ions, with either or both being magnetic, reside on two independent and interpenetrating lattices of corner-sharing tetrahedra.

In this talk, I will review the evolution of our understanding of the R2M2O7 compounds from the late 1990s, when classical spin ice physics was discovered, to the current search for a U(1) quantum spin liquid, with deconfined "magnetic" and "electric" gauge charges and with the accompanying gauge photon, in the quantum material cousins of classical spin ices.