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Title:
Signatures of fractionalization in dipolar-octupolar quantum spin ice

Abstract:
The local moments in magnetic insulators may carry higher-rank multipolar moments due to the spin-orbit coupling and local symmetry of the crystal- electric-field environment. The interaction between such moments on frustrated lattices may promote novel quantum spin liquids.

We discuss a multipolar quantum spin ice state, a three-dimensional quantum spin liquid with emergent gauge field, that may have been realized in Ce2Zr2O7 and Ce2Sn2O7, where Ce3+ ions carry dipolar-octupolar moments. We present a theoretical analysis of possible quantum spin ice states in this system and compare the theoretical results of dynamical spin structure factors with recent neutron scattering experiments on Ce2Zr2O7 and Ce2Sn2O7. We show that the dynamical spin structure factor computed for the so-called pi- flux quantum spin ice state exhibits clear signatures of fractionalization and is compatible with the recent polarized neutron scattering experiments.