Title:	Magnetic Hamiltonian and phase diagram of the quantum spin liquid Ca10Cr7 O28
Authors:	Singh, Yogesh (/jspui/browse?type=author&value=Singh%2C+Yogesh)
Keywords:	Magnetic Hamiltonian Phase diagram Quantum spin
Issue Date:	2017
Publisher:	American Physical Society.
Citation:	Physical Review B, 95(17)
Abstract:	A spin liquid is a new state of matter with topological order where the spin moments continue to fluctuate coherently down to the lowest temperatures rather than develop static long-range magnetic order as found in conventional magnets. For spin liquid behavior to arise in a material the magnetic Hamiltonian must be "frustrated", where the combination of lattice geometry, interactions, and anisotropies gives rise to competing spin arrangements in the ground state. Theoretical Hamiltonians which produce spin liquids are spin ice, the Kitaev honeycomb model, and the kagome antiferromagnet. Spin liquid behavior, however, in real materials is rare because they can only approximate these Hamiltonians and often have weak higher-order terms that destroy the spin liquid state. Ca10Cr7O28 is a new quantum spin liquid candidate with magnetic Cr5+ ions that possess quantum spin number S=½. The spins are entirely dynamic in the ground state and the excitation spectrum is broad and diffuse, as is typical of spinons which are the excitations of a spin liquid. In this paper we determine the Hamiltonian of Ca10Cr7O28 using inelastic neutron scattering under high magnetic field to induce a field-polarized paramagnetic ground state and spin-wave excitations that can be fitted to extract the interactions. We further explore the phase diagram by using inelastic neutron scattering and heat capacity measurements and establish the boundaries of the spin liquid phase as a function of magnetic field and temperature. Our results show that Ca10Cr7O28 consists of distorted kagome bilayers with several isotropic ferromagnetic and antiferromagnetic interactions where, unexpectedly, the ferromagnetic interactions are stronger than the antiferromagnetic ones. This complex Hamiltonian does not correspond to any known spin liquid model and points to new directions in the search for quantum spin liquid behavior
Description:	Only IISERM authors are available in the record.
URI:	https://journals.aps.org/prb/abstract/10.1103/PhysRevB.95.174414 (https://journals.aps.org/prb/abstract/10.1103/PhysRevB.95.174414) http://hdl.handle.net/123456789/2550 (http://hdl.handle.net/123456789/2550)
Appears in Collections:	Research Articles (/jspui/handle/123456789/9)