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Kapellasite: a kagome quantum spin liquid with competing interactions

EDWIN KERMARREC, Laboratoire de Physique des Solides, Universite Paris Sud

In recent years, the search for an experimental quantum spin liquid in two dimensions has attracted much interest in the community. Magnetic frustration and quantum fluctuations are believed to be key ingredients to stabilize such a spin liquid ground state in 2D. The $S = \frac{1}{2}$ kagome lattice combines these two ingredients. Among the materials available with this geometry, herbertsmithite has proven to be a very promising candidate. There, the antiferromagnetic nearest neighbor coupling J_1 is dominant. In this talk, I will explore the effect of frustration generated by competing interactions on the quantum kagome lattice, based on experiments performed on kapellasite $Cu_3Zn(OH)_6Cl_2$, a polymorph to herbertsmithite. The system Hamiltonian, determined from a fit of a high-temperature series expansion to magnetic susceptibility and specific heat data, points to competing interactions with a ferromagnetic nearest neighbor exchange J_1 and an "across-hexagon" antiferromagnetic one J_d, with a ratio $|J_d/J_1| \simeq 0.85$. Local probes (μSR, ^{35}Cl-NMR) and inelastic neutron scattering (INS) experiments evidence a gapless spin-liquid state down to 20 mK, showing unusual dynamic short-range correlations characteristic of a 12 spin sublattices antiferromagnetic state called Cuboc2. We further investigate the spin dynamics at different timescales by NMR, μSR and INS measurements and discuss our results within the context of theoretical calculations using the Schwinger-Boson mean field approach.