Spin dynamcis of a quantum-spin-liquid $ZnCu_3(OH)_6Cl_2$ probed by NMR

M. Jeong, F. Bert, and P. Mendels

Laboratoire de Physique des Solides, Université Paris-Sud 11, UMR CNRS 8502, 91405 Orsay, France.

In quantum spin-liquids, the interacting spins remain fluctuating down to absolute zero due to strong quantum fluctuations. High geometrical frustration combined with strong quantum fluctuations can help to stabilize such spin-liquid phases in dimensions larger than one. Mineral Herbertsmithite $ZnCu_3(OH)_6Cl_2$, a quantum (S=1/2) Heisenberg antiferromagnet on the kagomé lattice, is one of a few materials which host a two-dimensional spin-liquid. Various experimental techniques have identified its ground-state as a gapless (critical) spin-liquid with the power-law temperature dependence of spin-correlations. Now the focus lies on unconvering the origin and nature of this spin-liquid ground-state. We investigate the spin dynamics of Herbertsmithite in various magnetic fields up to 13 T using ^{17}O NMR. Since oxygen locates on the superexchange path bridging Cu^{2+} magnetic ions, ^{17}O is an excellent probe to the spin-liquid physics intrinsic to the kagomé planes. We also present the ^{35}Cl NMR results on oriented powder which elucidate the defect physics of Herbertsmithite. Clearly, these two nuclei probe provide complementary information essential to understand Herbertsmithite. We discuss the implications of our work in the context of theoretical proposals.