Kagome Quantum Spin Liquids : the case of Herbertsmithite

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Herbertsmithite $ZnCu_3(OH)_6Cl_2$ is known as one of the most emblematic and deeply studied quantum spin liquid representative of the Quantum Kagome Heisenberg Antiferromagnet (KHAF) Hamiltonian physics. On the theory side, the ground state has been heavily debated for more than 30 years with no definitive solution to-date. As all of its variants, herbertsmithite suffers from the presence of magnetic Cu's on the interlayer site. We'll present site-resolved ^{17}O NMR experiments on herbertsmithite single crystals using contrast methods analogous to MRI ones, which clearly separate slow from fast relaxing sites [1]. The dominant fast relaxing and gapless spectral contribution represents a ∼60-65% that we attribute to O probing the least impurity-disturbed Cu sites. This, in our opinion, strongly argues in favor of a gapless model for the KHAF.

Recent specific heat data obtained at very high fields allow to get rid of the contribution from defects [2]. The major outcome is again that of a gapless state, yet questioning the Dirac scenario which was recently promoted as the energetically favored spin liquid phase. Our results will be put into perspective of other experiments especially recent Cu NQR ones on herbertsmithite and NMR on Zn-barlowite [3] which both again clearly reveal below 30 K two components, one fast relaxing, the other one slowly relaxing. The need of including defects which are ubquitous in all compounds - but which defects ? - into models represents a difficult task but one of the most promising avenues to conclude on the ground state of the pure KHAF.

If time permits, I'll shortly present a recent study on the anisotropic kagome lattice of one of the Y-substituted versions which seems to be at the verge of a Quantum Spin Liquid state [4].

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