Inelastic neutron scattering study of S=1/2 kagome lattice single crystals

T. H. Han[a], J. S. Helton[a], A. Prodi[a], C. Mazzoli[b], P. Muller[c], D. K. Singh[d], J. A. Rodriguez[d], C. Broholm[e], D. G. Nocera[c], S. Chu[f], and Y. S. Lee[a]

[a]Department of Physics, MIT, Cambridge, MA 02139 USA
[b]ESRF, 6 rue Jules Horowitz, 38043 Grenoble, France
[c]Department of Chemistry, MIT, Cambridge, MA 02139 USA
[d]NCNR NIST, Gaithersburg, Maryland 20899 USA
[e]Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD 21218 USA
[f]Center for Material Science and Engineering, MIT, Cambridge, MA 02139 USA

Recent success in the single crystal growth of mineral Herbertsmithite paves the way in the search for quantum spin liquid in a 2D magnet. Single crystal herbertsmithite displays a magnetic susceptibility that is anisotropic at high temperatures, indicating the presence of spin Hamiltonian terms in addition to the isotropic Heisenberg exchange. Synchrotron x-ray scattering puts restrictions on the proposed valence bond solid state and rules out the long debated Zn-Cu antisite disorder. Inelastic neutron scattering has been performed and the observed dynamic structure factor is consistent with a spin liquid ground state. An excitation continuum has been observed which sheds light on the possibility of long-sought 2D spinons. Application of a magnetic field induces a spectral weight shift which provides additional information on the long-debated role played by the interlayer non-magnetic impurities.