Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Low-temperature orbital ordering and dynamical frustration of spins in $KCuF_3$: Experimental[1] JAMES C.T. LEE, SHI YUAN, SIDDHARTHA LAL, YOUNG IL JOE, YU GAN, SERBAN SMADICI, PAUL M. GOLDBART, S. LANCE COOPER, PETER ABBAMONTE, University of Illinois at Urbana-Champaign, KEN FINKELSTEIN, Cornell High Energy Synchrotron Source, Cornell University, YEJUN FENG, Advanced Photon Source, Argonne National Laboratory, ANDRIVO RUSYDI, National University of Singapore — We present new Raman and x-ray scattering evidence for the existence of a structural phase transition at 50 K in $KCuF_3$. Phonon modes associated with the F-ions in CuF_6 octahedra soften with decreasing temperature down to 50 K, at which temperature there is a splitting of the E_g phonon. Above $T_N = 40$ K, diffuse resonant magnetic scattering from critical fluctuations was observed at the Cu L_3 edge. Below T_N, orbital reflections seen by 8.8 keV x-ray scattering exhibit diffuse scattering that is hysteretic with temperature, indicating glassy orbital disorder. The phase behavior of $KCuF_3$ above T_N is dominated by coupled orbital/lattice fluctuations that are likely associated with dynamical rotations of the CuF_6 octahedra. A model with interactions between orbital, spin and lattice degrees of freedom explain these observations.

[1]Funding provided by grants from US DOE and NSF.

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Date submitted: 09 Dec 2009 Electronic form version 1.4