Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Mapping the fluctuating Ir^{4+} dimers across the phase diagram of $Cu(Ir_{1-x}Cr_x)_2S_4$ ($0 \leq x \leq 0.6$)[1] E.S. BOZIN, Brookhaven National Laboratory, Y.S. HOR, J.F. MITCHELL, Argonne National Laboratory, S.J.L. BILLINGE, P. JUHAS, Brookhaven National Laboratory, Columbia University — Elucidating the role of fluctuations in systems with competing interactions, such as $Cu(Ir_{1-x}Cr_x)_2S_4$, enables comprehensive understanding of their physical properties. While $CuIr_2S_4$ exhibits complex behavior with metal-insulator transition accompanied by charge ordering and Ir^{4+}-spin-dimerization at 226 K, $CuCr_2S_4$ displays ferromagnetic metallic behavior ($T_C \sim 377$ K) understood within the double exchange model. Intermediate composition range sees suppression of end-member properties, with broad features observed in susceptibility around 180 K attributed to Cr^{3+} low spin to high-spin crossover [1]. Robust fluctuating Ir^{4+} dimers are detected and their evolution examined across the phase diagram by the X-ray atomic pair distribution function method. Although their long range order is destroyed already by $x \approx 0.05$, Ir^{4+} dimers exist locally at low temperature at all compositions studied. We provide detailed account of the Cr-doping and temperature dependence of the local dimers, and estimate characteristic length-scale on which they are observable. Fluctuating dimers disappear on heating, for intermediate compositions at temperatures above 180 K.

[1] R. Endoh et al., Phys. Rev. B **68**, 115106 (2003).

[1]Work at BNL and ANL is supported by DOE-OS contracts DE-AC02-98CH10886 and DE-AC02-06CH11357 respectively.

E.S. Bozin
Brookhaven National Laboratory

Date submitted: 15 Nov 2011 Electronic form version 1.4