Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Two Dimensional Incommensurate and Three Dimensional Commensurate Magnetic Order and Fluctuations in $La_{2-x}Ba_xCuO_4$[1] JEROD WAGMAN, GREG VAN GASTEL, KATE ROSS, McMaster University, ZAHRA YAMANI, Chalk River Laboratories, YANG ZHAO, National Institute of Standards and Technology, ANN KALLIN, EMMA MAZUREK, Brockhouse Institute for Materials Research, YIMING QIU, JOHN COPLEY, National Institute of Standards and Technology, HANNA DABKOWSKA, Brockhouse Institute for Materials Research, BRUCE GAULIN, McMaster University — We present neutron scattering measurements on single crystals of $La_{2-x}Ba_xCuO_4$, with $0 \leq x \leq 0.035$. These experiments reveal the evolution of the magnetism: from a three dimensional (3D) commensurate (C) antiferromagnet, with a relatively high T_N, to a two dimensional (2D) incommensurate (IC) antiferromagnet with finite range static correlations, with relatively low effective T_Ns. At low temperatures, the 2D IC magnetism co-exists with the 3D C magnetism for Ba concentrations as low as x = 0.0125. We find that 3D C magnetism disappears by x = 0.025; consistent with the limit of x $\sim$ 0.02 observed in the sister family of doped Mott insulators $La_{2-x}Sr_xCuO_4$. We construct a phase diagram based on magnetic order parameter measurements, which displays much of the complexity of standard high temperature superconductivity phase diagrams discussed in the literature. Analysis of high energy-resolution inelastic neutron scattering shows the low energy dynamic susceptibility to fall off with temperature on a scale much higher than the effective 2D IC T_Ns in the sample. This effect is such that appreciable dynamic 2D IC magnetic fluctuations inhabit much of the "pseudogap" regime of the phase diagram.

[1]NSERC

Jerod Wagman
McMaster University

Date submitted: 07 Dec 2011 Electronic form version 1.4