Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Effect of covalent bonding on magnetism and the missing neutron intensity in cuprates IGOR ZALIZNYAK, Brookhaven National Laboratory, ANDREW WALTERS, ESRF, TOBY PERRING, ISIS, Rutherford Appleton Laboratory, ANDREI SAVICI, Oak Ridge National Laboratory, GENDA GU, CHI-CHENG LEE, WEI KU, Brookhaven National Laboratory, JEAN-SEBASTIEN CAUX, U. Amsterdam — We report a detailed survey of magnetic excitations in the one- dimensional cuprate Sr2CuO3 using inelastic neutron scattering (INS). We show that although the overall shape of the experimental dynamical spin structure factor is well described by the exact theory [1] of the model spin-1/2 nearest-neighbour Heisenberg Hamiltonian typically used for cuprates, the magnetic intensity is strongly suppressed, by factor 2.5-3, compared to the ionic spin model. We further show that this dramatic modification results from strong hybridization of Cu 3d states with O p states, showing that the ionic picture of localized 3d Heisenberg spin magnetism is markedly inadequate. Our findings provide natural explanation for the puzzle of the missing INS magnetic intensity in cuprates and have profound implications for understanding current and future experimental data on these materials [2]. We observe no corrections to spin excitations spectral weight resulting from electron itineracy. [1] J.-S. Caux and R. Hagemans, J. Stat. Mech., P12013 (2006). [2] A. Walters, T. Perring, A. Savici, G. Gu, C. Lee, W. Ku, J.-S. Caux and I. A. Zaliznyak, Nature Physics 5 (2009).

Igor Zaliznyak
Brookhaven National Laboratory

Date submitted: 20 Nov 2009 Electronic form version 1.4