Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Understanding the Origin of Ferromagnetism in Strained $LaCoO_3$ Thin Films J.X. MA, J. SHI, Department of Physics, University of California at Riverside, J.W. FREELAND, Advanced Photon Source, Argonne National Laboratory — Using strain to control the behavior of strongly correlated materials offers new opportunities to control fundamental properties. For the case of magnetism, $LaCoO_3$ offers the ability to use strain through thin film growth to manipulate directly the spin-state of Co in this system. Here we present the results of a detailed polarized x-ray spectroscopy study of $LaCoO_3$ thin films grown on $SrTiO_3$(001) and $LaAlO_3$ (001) substrates. X-ray diffraction from 25 nm thin films confirm the films are fully strained in both cases and, for films under tensile strain, total moment magnetometry shows a clear transition to ferromagnetic state at ∼80K. X-ray absorption shows that the films grown from a $LaCoO_3$ target are slightly hole doped due to non-stoichiometry generated during growth (effective doping ∼ 0.1 holes per unit cell), which in the bulk is sufficient to destroy the low-spin state. However, even though the films are slightly hole doped, the films under tensile strain show long range ferromagnetic order unlike the bulk system. Since the films are insulating, these results are consistent with a ferromagnetic insulating state arising due to superexchange. Work at UCR is supported by ONR/DMEA under award H94003-08-2-0803.

John W. Freeland
Advanced Photon Source, Argonne National Laboratory

Date submitted: 19 Nov 2008 Electronic form version 1.4