The role of oxygen in the colossal magnetoresistance in manganites

M.A. HOSSAIN, M.H. BURKHARDT, SIMES, Stanford, S. SARKAR, H. OHLDAHG, S. DE JONG, SLAC, A. SCHOLL, A.T. YOUNG, A. DORAN, Y.-D. CHUANG, Berkeley Lab, D. DESSAUU, U. Colorado, J. MITCHELL, Argonne Lab, H.A. DÜRR, J. STÖHR, SLAC — We have used Low temperature Photo-Emission Electron Microscopy (PEEM) measurements on the bi-layered manganite compound La$_{1.8}$Sr$_{1.2}$Mn$_2$O$_7$ to explore the origin of the colossal magnetoresistance (CMR) effect. It is generally agreed that CMR cannot be explained by double exchange only, and that other interactions mediated by oxygen atoms such as polarons must be important. We have imaged the magnetic domain structure by x-ray magnetic circular dichroism PEEM spectro-microscopy at both the O and Mn sites. By probing the ferromagnetic domain formation below $T_c$, we find that the insulator-to-metal transition is mediated by magnetic interactions involving a strong magnetic moment on oxygen. The spatially resolved oxygen K-edge XMCD signal reveals the role of the in-plane and out-of-plane $e_g$ orbitals in the magnetic transitions and thereby sheds light on the very origin of CMR.

$^1$DOE, NSERC

Muhammed Hossain
Stanford Institute for Materials and Energy Science, SLAC

Date submitted: 26 Nov 2010
Electronic form version 1.4