Microscopic Ferromagnetic and Antiferromagnetic Clusters in \( \text{Pr}_{0.7}\text{Ca}_{0.3}\text{MnO}_3 \) HAO SHA, JIANDI ZHANG, Florida Intl. Univ., FENG YE, JAIME FERNANDEZ-BACA, ORNL, PENGCHENG DAI, Univ. of Tenn. and ORNL, Y. TOMIOKA, CERC, Japan, Y. TOKURA, Univ. of Tokyo and CERC, Japan — “Colossal” magnetoactive manganite \( \text{Pr}_{0.7}\text{Ca}_{0.3}\text{MnO}_3 \) (PCMO30) is an ideal system to test the microscopic phase separation scenario because it has an inhomogeneous low-temperature insulating metastable state where ferromagnetic (FM), antiferromagnetic (AF), and charge/orbital (CO-OO) phases coexist. On cooling from room temperature, a CO-OO state occurs below \( T_{\text{CO-OO}} \sim 200 \) K, followed by AF ordering below \( T_N \sim 140 \) K. Below \( T_C \sim 110 \) K, the magnetic structure develops a FM component coexisting with AF ordering. We have used neutron scattering to study FM, AF and CO-OO phase transitions in a single-crystal PCMO30. The diffuse scattering of FM component demonstrates the presence of short-range ferromagnetic clusters both above and below \( T_C \), while no diffuse component in the CO-OO scattering peaks has been observed near \( T_{\text{CO-OO}} \). Interestingly, the short-range AF correlations associated with Mn\(^{4+}\) sites but not with Mn\(^{3+}\) sites are observed for both above and below \( T_N \), indicating that the local AFM clustering is directly associated with doped holes in this system. The work was supported by NSF-DMR0453804, NSF-DMR0346826, DE-FG02-05ER46202, and DOE DE-FG02-04ER46125. ORNL is managed by UT-Battelle, LLC, for the U.S. DOE under contract DE-AC05-00OR22725.

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