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Spin and orbital order separation in colossal magnetoresistive transition M.A. HOSSAIN, SLAC National Accelerator Laboratory and Lawrence Berkeley National Laboratory, M.H. BURKHARDT, SLAC National Accelerator Laboratory, E. WESCHKE, Helmholtz-Zentrum Berlin für Materialien und Energie, E. SCHIERLE, Helmholtz-Zentrum Berlin für Materialien und Energie,, M.S. GOLDEN, Van der Waals-Zeeman Institute, University of Amsterdam, Y. TOMIOKA, National Institute of Advanced Industrial Science and Technology (AIST), Japan, Y. TOKURA, University of Tokyo, J. STÖHR, H.A. DÜRR, SLAC National Accelerator Laboratory — Understanding the Colossal magnetoresistive (CMR) process in manganites is one of the grand challenges of modern physics. While the metallic ferromagnetic phase is relatively well understood, the triggering mechanism of the metal-insulator transition is not clear and it is believed that lattice strain in term of polarons play an important role in the mysterious insulating phase. Lattice strain occurs in the charge-orbitally ordered insulating phase via the Jahn-Teller type distortion and therefore, to understand the CMR it is critical to understand the interplay of ferromagnetism and orbital order during the CMR transition itself. In this letter, with high magnetic field dependent Resonant Soft X-ray Scattering measurements, we show that during the CMR process, an insulating antiferromagnetic phase, which is extremely susceptible to magnetic field and temperature, directly competes with metallic ferromagnetism while the robust CE type spin and orbitally ordered regions act as a catalyst to seed these antiferromagnetic regions. This allows us to construct a picture of the competing forces at the heart of CMR.

Muhammed Hossain
SLAC National Accelerator Laboratory and
Lawrence Berkeley National Laboratory

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