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Rethinking the Orbital Ordering Transition: Using Coherent Soft X-ray Scattering to Study Dynamics in the CMR Manganites JOSHUA TURNER, University of Oregon and Advanced Light Source, JESSICA THOMAS, JOHN HILL, Brookhaven Lab, MARK PFEIFER, University of Oregon and Advanced Light Source, KARINE CHESNEL, Advanced Light Source, Y. TOKURA, Correlated Electron Research Center and University of Tokyo, Y. TOMIOKA, Correlated Electron Research Center, STEVE KEVAN, University of Oregon — The colossal magnetoresistance (CMR) phenomenon has baffled physicists since its discovery over a decade ago. Central to the puzzle is the short-range orbital ordering that arises in certain hole concentrations of the manganese oxides, even for low temperatures. We have used a Coherent Soft X-ray Scattering (CSXS) technique to resonantly enhance the orbital ordering contrast and measure speckle patterns from the domain structure of the self-assembling Mn d-orbitals. Our dynamics measurements suggest that the orbital domains remain static through the orbital ordering transition temperature – challenging the previous belief of a mediation through slow, glass-like characteristics. Our experiments force us to rethink the role and nature of the orbitally-ordered state in the manganites, intrinsic to CMR.

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