3:30 pm • Friday February 21, 2014 • 2241 Chamberlin Hall • Coffee at 4:30 pm

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Equilibrium and Driven Mesoscopic Dynamics in Complex Oxides

Department of Physics Colloquium

WISCONSIN

Complex oxide materials can exhibit a wide range of properties that are both fundamentally important and widely useful. The electrical polarization of complex oxide ferroelectrics is particularly interesting because the energetics of long-range interactions due to electrostatics and elasticity compete with much shorter-range interactions associated with the formation of defects and domain boundaries. This competition leads to a rich range of phenomena in nanoscale materials that are only now beginning to be explored. We describe a series of advances in experimental techniques based on the coherence and ultrafast time structure of synchrotron x-ray radiation that make it possible to explore the dynamics of these materials in a new regime. The competition of polarization and domain wall energies in nanoscale superlattices composed of alternating ferroelectric and dielectric layers of atomic-scale thicknesses leads to the formation of polarization domains. X-ray scattering show that these domains can be manipulated with applied electric fields and that the complex energy landscape leads to fluctuations in their configuration at room temperature. Future combinations of ultrafast time resolution and precise structural studies enabled by the spatial coherence of x-rays promise new insight into the dynamics of a wide range of other phenomena.

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