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Femtosecond Spectroscopy of $LuMnO_3$ SHITAO LOU, Department of physics and Astronomy, Rutgers University, FRANK M. ZIMMERMANN, ROBERT A. BARTYNSKI, NAMJUN HUR, SANG-WOOK CHEONG, Department of Physics and Astronomy, Rutgers University — Hexagonal $LuMnO_3$ manganite is a ferroelectric and strongly frustrated antiferromagnetic crystal. Strong coupling between lattice, electronic, and magnetic degrees of freedom makes it a promising electronic material. We have used femtosecond pump-probe spectroscopy to study the interaction of electron excitations with lattice vibrations in real time. Optical excitation of a Mn $d_{(x^2-y^2),(xy)} \rightarrow d_{(3z^2-r^2)}$transition served as the primary excitation step. With both pump and probe beam polarization perpendicular to the c axis, the probe reflectivity shows a sharp drop due to saturation of the transition, recovering on a timescale of 1 ps. We also observed displacive excitation of a coherent optical phonon vibration at 3.6 THz, which is assigned to an A1 symmetry mode involving Lu ion motion along the c axis. This mode was excited in longitudinal (LO) and transverse mode (TO) geometries. While the LO-TO frequency splitting is small (<0.1 THz), a remarkable phase reversal of the reflectivity curve was observed. This is attributed to a large linear electro-optic effect (Pockels effect), induced by the THz electric field associated with the LO mode.

Shitao Lou
Department of physics and Astronomy, Rutgers University

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