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Femtosecond Spectroscopy of Electron-Lattice Coupling in $LuMnO_3$ SHITAO LOU, FRANK M. ZIMMERMANN, ROBERT A. BARTYNSKI, N. HUR, S.W. CHEONG, Rutgers University — Hexagonal manganite $LuMnO_3$ is a ferroelectric ($T_c \approx 900$ K) and strongly frustrated antiferromagnetic ($T_N \approx 90$ K) crystal. Strong coupling between lattice, electronic, and magnetic degrees of freedom make it a promissing electronic material. We have used femtosecond pump-probe spectroscopy to observe the interaction of electron excitation and lattice vibration in real time. Optical excitation at a sharp absorption peak at 800 nm corresponding to a Mn $d_{(x^2-y^2),(xy)} \rightarrow d_{(3z^2-r^2)}$transition served as the primary excitation step. Reflectivity changes as a function of delay time reveal electronic relaxation and coherent oscillations of several optical phonon modes. Electron and phonon excitation and relaxation dynamics were studied using different polarization geometries and symmetry analysis. The interaction mechanisms of photons, electrons, and coherent phonons are discussed.

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