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Exploration of Phonon Behavior in PbTe from Ultrafast Time-Resolved Pump-Probe Measurements MASON JIANG, Stanford University, MATTHIAS HOFFMANN, SLAC National Accelerator Laboratory, ANDREW MAY, OLIVIER DELAIRE, BRIAN SALES, Oak Ridge National Laboratory, ROBERTO MERLIN, University of Michigan, IVANA SAVIC, EAMONN MURRAY, STEPHEN FAHY, Tyndall National Institute, DAVID REIS, Stanford University — We report femtosecond-resolution measurements of phonon dynamics on photo-excited PbTe, an incipient ferroelectric. PbTe is a leading thermoelectric material with an unusually low thermal conductivity, which has been attributed to strongly anharmonic phonon interactions. In an attempt to understand in detail the nature of these interactions, we perform time-resolved pump-probe measurements using combinations of THz- and optical-based excitation and optical- and x-ray-based probes in variable temperature environments. Several interesting observations are highlighted. In IR pump/IR probe, anomalous oscillations are seen near 1.4 THz and just below 1 THz, with their relative amplitudes varying with temperature and pump fluence. The frequencies fall close to the Raman-forbidden TO phonon mode. Additionally, we use single-cycle THz pulses centered near 1 THz in an attempt to drive the TO mode. Probing with IR results in unexpected modulations with oscillatory behavior that last for a few picoseconds, fluctuate at a rate just below 1.4 THz, and grow in strength with decreasing temperature. This talk will discuss possible explanations for these effects and their impact on further understanding the relationship between anharmonicity and high temperature thermoelectric behavior.

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