

Abstract Submitted
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Direct measurement of non-equilibrium phonon occupations in femtosecond laser heated Au films TYLER CHASE, MARIANO TRIGO, ALEXANDER REID, RENKAI LI, THEODORE VECCHIONE, XIAOZHE SHEN, STEPHEN WEATHERSBY, RYAN COFFEE, NICK HARTMANN, DAVID REIS, XIJIE WANG, HERMANN DURR, SLAC - Natl Accelerator Lab — We use ultrafast electron diffraction to detect the temporal evolution of phonon populations in femtosecond laser-excited ultrathin single-crystalline gold films. From the time-dependence of the Debye-Waller factor we extract a 4.7 ps time-constant for the increase in mean-square atomic displacements. We show from the increase of the diffuse scattering intensity that the population of phonon modes near the X and K points in the Au fcc Brillouin zone grows with timescales of 2.3 and 2.9 ps, respectively, faster than the Debye-Waller average. We find that thermalization continues within the initially non-equilibrium phonon distribution after 10 ps. The observed momentum dependent timescale of phonon populations is in contrast to what is usually predicted in a two-temperature model.

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