Abstract Submitted
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Direct determination of transient heating in a nanoconfined environment by ultrafast electron diffraction[1] RYAN A. MURDICK, RAMANI K. RAMAN, YOSHIE MUROOKA, RICHARD J. WORHATCH, CHONG-YU RUAN, Michigan State University — Temperature is generally ill-defined at the statistical limit, such as on the ultrashort time scale and in mesoscopic systems. Understanding the thermal energy relaxation and transport at such limits is key to nanoelectronics and energy research. We report on the development of *local* temperature determination on the atomic scale using the technique of ultrafast electron diffraction. Lattice heating characteristics are elucidated by determining the dynamical Debye-Waller factor and local bond stretches, allowing the time scale of electron-phonon coupling and local heating at different length scales to be detailed. We compare these measured temperatures with predictions from two-temperature model (2TM) and determine that strongly coupled 'hot' phonons dominate lattice heating at short times (10 ps), and cannot explained by 2TMs. Models beyond the 2TM are developed to explain our data. We also discuss other novel heating scenarios at the statistical limits.

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