Abstract Submitted
for the SES17 Meeting of
The American Physical Society

Ultrafast Electron And Lattice Dynamics OMADILLO ABDURAZAKOV, AVINASH RUSTAGI, North Carolina State University, JAMES FREERICKS, Georgetown University, ALEXANDER KEMPER, North Carolina State University — The electron-lattice interactions have been subject to intense study since the dawn of condensed matter physics. Recent advances in the pump-probe spectroscopy brought about a fresh perspective into their fundamental role in the normal and emergent phases of matter. We study the ultrafast dynamics of the excited electron populations in a 2D band by a laser pump field when coupled to the optical phonons with the fixed and dynamically updated properties. The trARPES spectra of photoexcited electrons indicate that the inclusion of phonon dynamics strongly influences the single particle as well as many-body properties. The spectra acquire a diffused and broad structure owing to the increased phonon occupation. We also observe that the kink, traditionally regarded as the strength of the electron-phonon interaction, is strongly weakened. The population decay rates are found to be time-dependent; they are enhanced below the phonon frequency due to phase space considerations. The pump field also induces temporal modifications in the phononic properties. These are seen in the transient stiffening of the phonon frequency and the decay rates. Our results have implications in controlling and characterizing the charge carrier and structural dynamics with ultrashort pump pulses.

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Date submitted: 27 Sep 2017 Electronic form version 1.4