Abstract Submitted
for the MAS17 Meeting of
The American Physical Society

Photoinduced Nonequilibrium Dynamics in Charge Density Wave Materials LINGHUA ZHU, KEUN HYUK AHN[1], New Jersey Inst of Tech, TSEZAR F. SEMAN, MICHEL VAN VEENENDAAL, Northern Illinois University Argonne National Laboratory, ARGONNE NATIONAL LABORATORY COLLABORATION — We study the dynamics of photoinduced phase transitions in charge density wave (CDW) systems of the Peierls instability and analyze the interplay among electrons, periodic lattice distortions, and a phonon thermal reservoir in nonequilibrium states. Simulations based on a tight-binding Hamiltonian and Boltzmann equations reveal partially decoupled oscillations of the CDW order parameter and the periodic lattice distortion during CDW melting, and nonthermal electron distribution during CDW refreezing. The cooling rate of the electron system is found to be sensitively dependent on the CDW gap dynamics. The CDW melting becomes more energy efficient with lower photon energy and the coherent oscillation becomes slower with the lower pump fluence, consistent with the Kohn anomaly. Qualitative agreement is found between key features of the simulations and experiments, which demonstrates the intricate nonequilibrium dynamics in CDW materials.

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Date submitted: 26 Sep 2017 Electronic form version 1.4