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Near Gap Excitation of Collective Modes in a Charge Density Wave DOMINIK LEUENBERGER, JONATHAN SOBOTA, SHUOLONG YANG, Stanford University, ALEXANDER KEMPER, Lawrence Berkeley National Laboratory, PAULA GIRALDO, ROB MOORE, IAN FISHER, PATRICK KIRCHMANN, THOMAS DEVEREAUX, ZHI-XUN SHEN, Stanford University — We present time- and angle-resolved photoemission spectroscopy (trARPES) measurements on the charge density wave system's (CDW) $CeTe_3$. Optical excitation transiently populates the unoccupied band structure and reveals a CDW gap size of $2\Delta = 0.59$ eV. In addition, the occupied Te-5p band dispersion is coherently modified by three collective modes. First, the spatial polarization of the modes is analyzed by fits of a transient model dispersion and DFT frozen phonon calculations. We thereby demonstrate how the rich information from trARPES allows identification of collective modes and their spatial polarization, which explains the mode-dependent coupling to charge order. Second, the exciting photon energy $h\nu$ was gradually lowered towards 2Δ, at constant optical excitation density. The coherent response of the amplitude mode deviates from the optical conductivity, which is dominated by direct interband transitions between the lower and upper CDW bands. The measured $h\nu$-dependence can be reproduced by a calculated joint density of states for optical transition between bands with different orbital character. This finding suggests, that the coherent response of the CDW amplitude mode is dominated by photo-doping of the charge ordering located in the Te-planes.

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