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Non-equilibrium electron and lattice dynamics in Bi-2212 TATIANA KONSTANTINOVA, Brookhaven National Laboratory/ Stony Brook University, JONATHAN RAMEAU, Brookhaven National Laboratory, ALEXANDER REID, SLAC, LIJUN WU, GENDA GU, Brookhaven National Laboratory, ALEXANDER KEMPER, North Carolina State University, HERMANN DURR, SLAC, UWE BOVENSIEPEN, University Duisburg-Essen, PETER JOHNSON, Brookhaven National Laboratory, XIJIE WANG, SLAC, YIMEI ZHU, Brookhaven National Laboratory — Here I present a study of the non-equilibrium lattice dynamics in a cuprate system, Bi-2212, performed by combining time- and angle-resolved photoelectron spectroscopy and MeV ultrafast electron diffraction. We have conducted the one-to-one comparison between electron and lattice dynamics in this material with 100 fs temporal resolution and established a picture of the energy flow within these two subsystems from the 1.55 eV photon absorption till formation of the acoustic waves. At the sub-picosecond time scale the dynamics is dominated by the electron coupling to the hot phonon, which we have identified through the quantitative analysis of the diffraction pattern changes as the in-plane Cu-O bond-stretching mode. Later dynamics is dominated by the anharmonic decay of the hot phonon to the lower energy modes, while the coupling strength of the electrons to these modes is low. The analysis of the thermal diffuse scattering in the electron diffraction demonstrates that the higher energy optical branches populate faster than the lower energy optical and acoustic branches, leading to a non-thermal phonon distribution, that, along with other observations, questions the validity of the N-temperature model for the cuprates.

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