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Femtosecond Electron Diffraction: Direct and Real-Time Probing of Coherent and Thermal Atomic Motions XUAN WANG, ZHAO HAO, HYUK PARK, SHOUHUA NIE, RICK CLINITE, JIM CAO, Florida State University — Recent developments in time-resolved diffraction have led to the capability of directly observing the laser-induced loss of long-range order on the ps and sub-ps time scale. However, a clear picture of atomic motions during the phase transition remains obscure. Here we report a direct and real-time measurement of both coherent and thermal atomic motions in thin- film aluminum using femtosecond electron diffraction. It showed a coherent lattice vibration with a period of 8 picoseconds starting immediately after the optical excitation with a concurrent heating of the lattice, reaching its final equilibrium temperature 5 picoseconds later. These observations provide a clear atomic-level view of laser-induced lattice dynamics.

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