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Supplementary information

Out-of-equilibrium ultrafast electron and phonon energy transfer dynamics in metals: The role of non-thermal effect

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1. The validation of Wannierization

1.1 Electronic and phononic band structures of gold

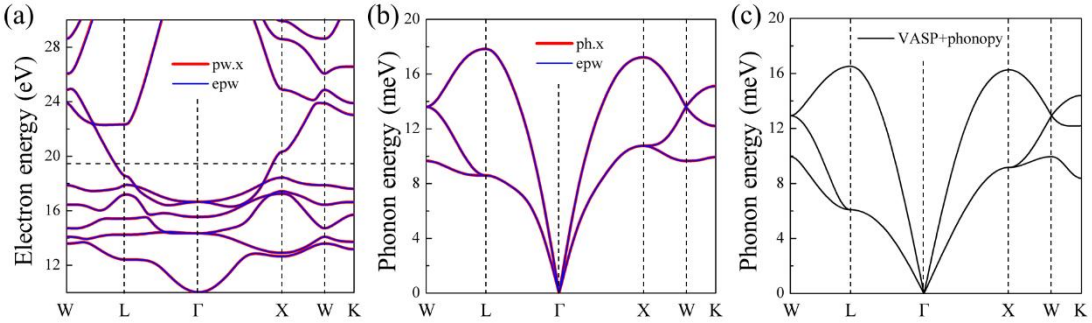

Figure S1. (a) Electronic and (b-c) phononic band structures of gold calculated by DFT and their Wannier interpolation. The horizontal dashed line in (a) represents the Fermi energy.

1.2 Electronic and phononic band structures of silver

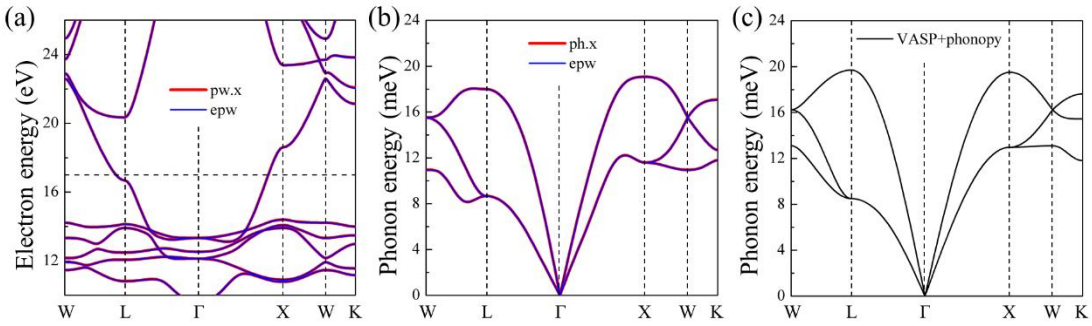

Figure S2. (a) Electronic and (b-c) phononic band structures of silver calculated by DFT and their Wannier interpolation. The horizontal dashed line in (a) represents the Fermi energy.

1.3 Electronic and phononic band structures of aluminum

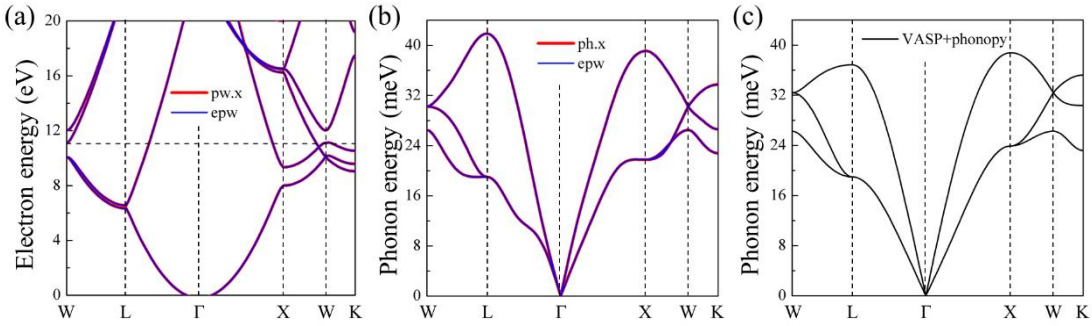

Figure S3. (a) Electronic and (b-c) phononic band structures of aluminum calculated by DFT and their Wannier interpolation. The horizontal dashed line in (a) represents the Fermi energy.

2. The convergence of the relaxation dynamic with k-/q- grid in gold

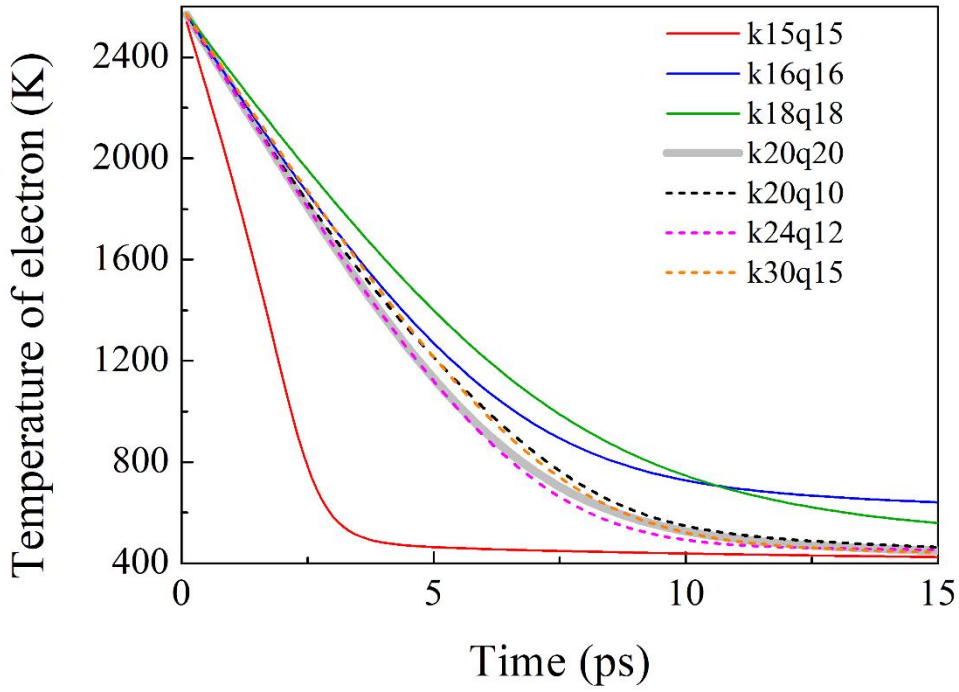

Figure S4. Electron temperatures during relaxation with $\tau_{e\text{-}e}$ = 40 fs, from 0 to 15 ps in gold. For example, k20q10 means that the k-mesh and q-mesh density is 20 × 20 × 20 grid and 10 × 10 × 10 grid, respectively.

3. Long-time out-of-equilibrium dynamics in gold

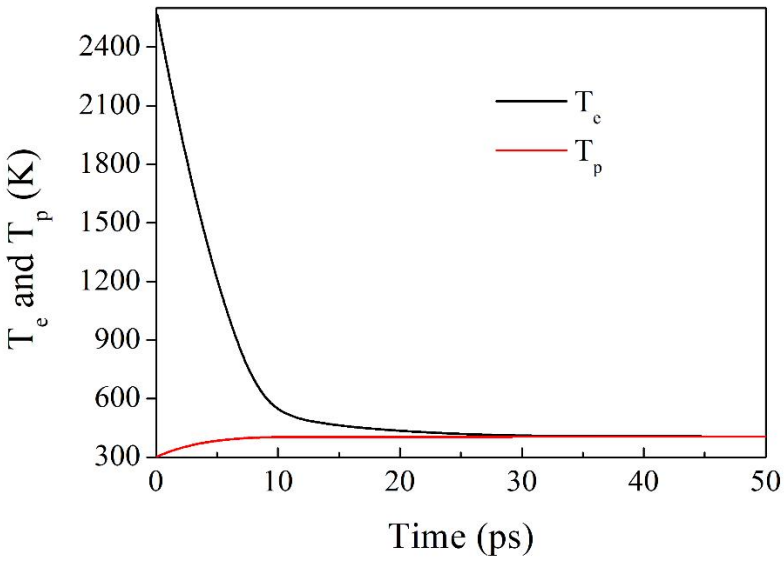

Figure S5. Electron (black line) and phonon (red line) temperature during relaxation with $\tau_{e\text{-}e}$ = 40 fs, from 0 to 50 ps in gold.

4. The electron heat capacity in gold

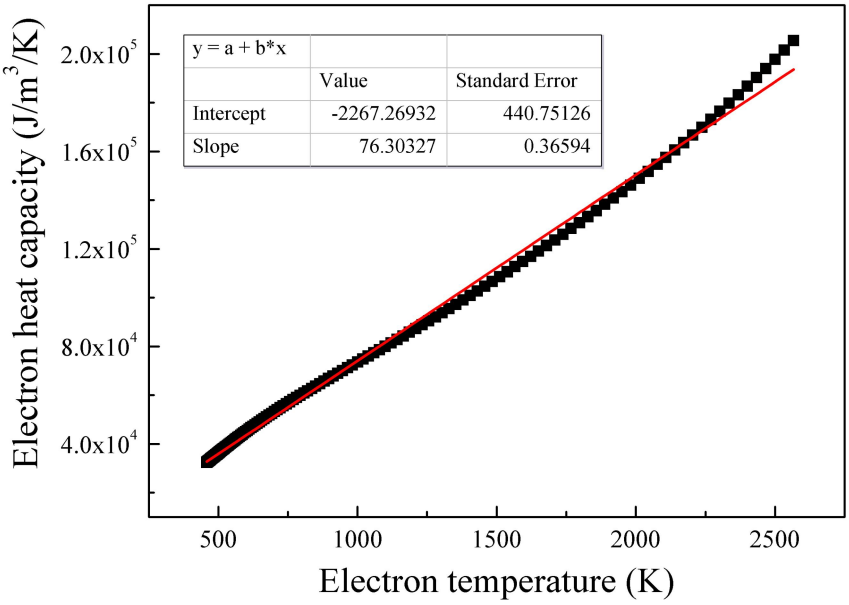

Figure S6. Electron heat capacity as a function of the electron temperature (T_e) in gold. The electron specific heat constant is determined as the slope of a linear fit.