Light-induced Terahertz Phonons in the Td Phase of Multilayered WTe_2 and $Mo_{1-x}W_xTe_2$ Probed via Femtosecond Electron Diffraction

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Understanding non-equilibrium lattice dynamics in solids can provide key insights into processes such as structural phase transitions. Here, we probe the lattice dynamics of the layered transition metal dichalcogenide WTe_2 and alloy $Mo_{1-x}W_xTe_2$ ($x=0.18$) in response to optical or THz excitation via ultrafast electron diffraction (UED) at room temperature. We observe large amplitude interlayer shear oscillations as well as long-lived acoustic breathing oscillations. This large amplitude, coherent shear motion occurs along the phase transition pathway between the orthorhombic and monoclinic phases of the material, of which the orthorhombic phase (Td phase) has recently been proposed as a type II Weyl semimetal. These findings are a step towards designing a topological phase change material as well as the first direct observation of an interlayer shear mode in a quasi-2D material with a structural probe.