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Wavevector dependent electron−phonon coupling drives the CDW formation in $TbTe_3$[1] S. ROSENKRANZ, Argonne National Laboratory, M. MASCHEK, F. WEBER, R. HEID, Karlsruhe Institute of Technology, A.H. SAID, Argonne National Laboratory, P. GIRALDO-GALLO, I.R. FISHER, Stanford University — The charge density wave (CDW) transition in the rare-earth tritellurides RTe_3 (R=rare earth) is commonly assumed to originate from a textbook Fermi surface nesting instability. Contrary to this weak coupling scenario, our investigation of the soft phonon mode in $TbTe_3$ provides direct evidence that the periodicity of the CDW superstructure in this canonical compound is defined by a strong momentum dependence of the electron-phonon coupling. Our high-resolution inelastic x-ray measurements reveal a renormalization of the soft-phonon energy and a strong broadening of the soft-phonon linewidth over a large part of reciprocal space adjacent to the CDW ordering vector. Our detailed theoretical calculations reproduce these observations very well and show that the position in reciprocal space of the phonon renormalization, and with it the CDW order wavevector, is not related to Fermi surface nesting. Our results demonstrate the importance of strongly momentum dependent electron-phonon coupling in defining the CDW order, which could also be relevant to many other systems.

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