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Charge density wave formation in multi-band systems RUDI HACKL, HANS-MARTIN EITER, MICHELA LAVAGNINI, Walther Meissner Institut, 85748 Garching, Germany, ELIZABETH A. NOWADNICK, ALEXANDER F. KEMPER, THOMAS P. DEVEREAUX, JIUN-HAW CHU, JAMES G. ANALYTIS, IAN R. FISHER, Stanford University, Stanford CA 94305, USA, LEONARDO DEGIORGI, ETH Zurich, 8093 Zurich, Switzerland — Charge and spin density waves are among the most abundant low-temperature ordered phases in condensed matter. The Fermi surface topology is widely believed to determine the ordering direction. However, several recent experimental and theoretical studies show that nesting is only one out of various other driving forces behind these instabilities. We use Raman scattering to demonstrate in which way an enhanced electron-lattice interaction can contribute to or even determine the selection of the ordering vector in the model charge density wave (CDW) system $ErTe_3$ and other rare-earth tri-tellurides. In our joint experimental and theoretical study we exploit the symmetry properties of the electron-photon and electron-phonon coupling vertex and establish a relation between the selection rules of the electronic light scattering spectra and the enhanced electron-phonon coupling in the vicinity of band degeneracy points. The proposal shown here for CDW formation, may be of more general relevance in multi-band systems for driving phase transitions into other broken-symmetry ground states. For example, the iron-based superconductors exhibit a similar phenomenology close to the intersection points of the backfolded electron bands.

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