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Quench of the electronic order in VTe2 by enhanced lattice fluctuations

Charge-density-wave (CDW) materials, in which electrons and phonons cooperatively interact to form a new symmetry-broken state, stand as ideal candidates to study the mechanisms governing the melting of a macroscopically ordered phase. Furthermore, given their sensitivity to external stimuli, CDW materials constitute a promising platform to investigate the possibility of controlling their properties. Particularly interesting, although little explored, is the case in which the CDW phase transition is determined by the presence of a strong momentum dependent electron-phonon coupling, since it can lead to significant modifications of the properties of these compounds.
TR-ARPES experiments performed on the TMDC compound VTe2 have revealed that the closure of the CDW gap is not driven by the amplitude modes (AMs) of the system, but is instead dominated by an incoherent process. By applying a so-called three-temperature model (3TM), we demonstrated that the quench of the CDW gap arises a consequence of the excitation of a subset of strongly-coupled phonon modes which determine a loss of the long-range CDW order. These results therefore suggest that the photoinduced phase transition is determined by non-CDW phonons that interact with the CDW order, thus highlighting the role played by the phonon-phonon interactions.

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