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Ultrafast quench of the electronic order in the strongly coupled charge-density-wave system VTe2

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The coexistence of strong electron-phonon coupling and non-trivial topological physics in quantum materials can lead to new exciting phenomena, and the study of the interplay of these multiple quantum orders constitute a new paradigm in condensed matter. Here, by combining time and angle-resolved photoemission spectroscopy (TR-ARPES) and broadband time resolved optical spectroscopy (TR-OS), we investigate the effect of an optical excitation on the electronic and structural properties of the strong-coupling charge-density-wave (CDW) system VTe2. Using TR-OS measurements we unveil the presence of two independent amplitude modes (AM) of the CDW phase [1]. Moreover, by performing TR-ARPES experiments, we show that at high excitation fluences the closure of the gap is not controlled by the excitation of the CDW amplitude modes, but it takes place on a much slower time scale. This time scale could suggest that the gap dynamics is mainly governed by the excitation of high-frequency strongly-coupled optical phonons which result in loss of long range order of the CDW phase [2,3].

References

[1] Tuniz, M. et al. Phys. Rev. Research 5, 043276 (2023).
[2] Maklar, J. et al. Nat. Commun. 12, 2499 (2021).
[3] Tuniz, M. et al. In preparation.

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