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Dynamics of the electronic and lattice parts of the order parameter in density wave systems

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Numerous advanced materials, like e.g. high-temperature-superconductors or colossal magneto-resistance compounds, owe their unique macroscopic properties to the existence of a delicate balance among different interactions on nanoscale. Thus, the study of interplay between various degrees of freedom in such system is crucial for their understanding. Charge-Density-Wave (CDW) systems , with their inherently multicomponent order parameter (a modulation of the electron density accompanied by a periodic lattice distortion (PLD)), present an ideal model system for studying these cooperative phenomena. Utilizing femtosecond time-resolved optical spectroscopy [1,2] and femtosecond electron diffraction [3] an interplay between the electronic and lattice parts of the order parameter has been studied. The results suggest, that following photoexcitation with an intense optical pulse, the electronic and lattice parts of the order parameter are decoupled on the timescale shorter than the characteristic vibrational periods. The implication of these results on the interpretation of the nature of the low lying collective modes is addressed.

[1] A. Tomeljak, et al., Phys. Rev. Lett., 102, 066404 (2009).
[2] H. Schäfer, et al., Phys. Rev. Lett. 105, 066402 (2010).
[3] M. Eichberger, et al., Nature 468, 799 (2010).

Author: DEMSAR, Jure (Universität Konstanz, FB Physik, D-78457 Konstanz)

Co-authors: TOMELJAK, A.; MORIENA, G.; SCIAINI, G.; BERGER, H.; SCHÄFER, H.; BILJAKOVIC, K.; BEYER, M.; EICHBERGER, M.; KRUMOVA, M.; MILLER, R. J. D.; KABANOV, V. V.

Presenter: DEMSAR, Jure (Universität Konstanz, FB Physik, D-78457 Konstanz)

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