

„Higgs Spectroscopy on Superconductors“

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High-field THz-pulses allow accessing the Higgs mode, the amplitude mode of the order parameter, in superconductors. Using a phase-resolved THz-high-harmonics-spectroscopy we perform a complex Higgs-spectroscopy of the order parameter dynamics, symmetry and interaction with other collective modes [1,2]. In high-T_c cuprates and NbSe₂ this allows investigating the interplay of charge density waves (fluctuations) and superconductivity based on a generalised Fano-interference of the driven order parameters [1,3-6]. Different interplays of charge order and superconductivity observed directly in the time-domain HHG-signal are being discussed.

As time-resolved technique THz-Higgs spectroscopy also allows probing transient superconducting states driven by ultrashort light pulses. Applying a 2D THz-third harmonics spectroscopy disentangles different sources of third harmonics generation [7].

[1] H. Chu et al. Nat. Commun. 11, 1793 (2020).

[2] L. Schwarz et al. Nat Commun. 11, 287 (2020).

[3] H. Chu et al. Nat Commun. 14, 1343 (2023).

[4] L. Feng et al. PRB 108, L100504 (2023).

[5] L. Feng et al. arxiv.2504.11947 (2025).

[6] S. Kumbhakar et al arxiv.26.03.03980 (2026).

[7] M.-J. Kim et al. Sci. Adv. 10, eadi7598 (2024).