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Higgs-spectroscopy of 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-Tc 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 [1,3,4]. As time-resolved technique THz-Higgs spectroscopy also allows probing transient superconducting states driven by ultrashort light pulses [5] and applying a 2D THz-third harmonics spectroscopy disentangles different sources of third harmonics generation. A novel and direct view on Higgs can be opened by non-equilibrium Raman spectroscopy in the anti-Stokes channel [6].

- [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] M.-J. Kim et al. Sci. Adv. 10, eadi7598 (2024)
- [6] T. Glier et al. arxiv:2310.08162

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