Higgs spectroscopy and transient nonlinear THz response in high Tc superconductors

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The Higgs mode of a superconductor is a collective excitation of the amplitude of the superconducting order parameter [1,2,3]. In recent experiments, using a phase resolved THz-THG scheme, we have shown a coupling of external modes, likely phonon mediated CDW fluctuations, in different families of cuprate high-Tc superconductors [4,5,6]. As such the new experimental scheme lays the foundation to a full Higgs Spectroscopy of the superconducting condensate.

As a new development, I will report on the extension of the Higgs Spectroscopy to transient states of superconductors. Non-equilibrium superconductivity typically is triggered by ultra-short tailored light pulses and applications range from ultrafast spectroscopy of the excitation dynamics of the superconducting gap [7] to light induced superconductivity by phonon or vibrational excitations in cuprates or organic superconductors [8]. Here probing such light induced states is realized in a pump-"drive" scheme of the forced Higgs oscillations.

References

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