

# Electromagnetic responses of Higgs mode in superconductors

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Optical manipulation of quantum systems has gained a growing interest over decades. With the recent development of ultrafast advanced light sources, the concept is now being applicable to complex condensed matter systems with avoiding thermalization in a finite temporal region. In particular in superconductors, the light-control of superconducting order parameter is a fascinating subject as it potentially elucidates the hidden phases which are inaccessible by other static perturbations, and enables the disentanglement of intertwining degree of freedoms. Light-induced Higgs mode oscillation would pave a unique pathway for such an external control of superconducting order parameter. In this talk, I will review our observation of the Higgs mode, namely the collective amplitude mode of the order parameter in conventional s-wave [1,2] and unconventional d-wave superconductors [3,4], which have been made possible by nonlinear terahertz spectroscopy, with making an emphasis on the recent progress on the understanding of light-Higgs couplings [5]. As an alternative method to observe the Higgs mode, I also report on the supercurrent-induced method where the Higgs mode becomes visible in linear response to the probe terahertz field [6,7].

## References:

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