CFEL SCIENCE

SEMINAR

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CFEL-bldg. 99, seminar room III

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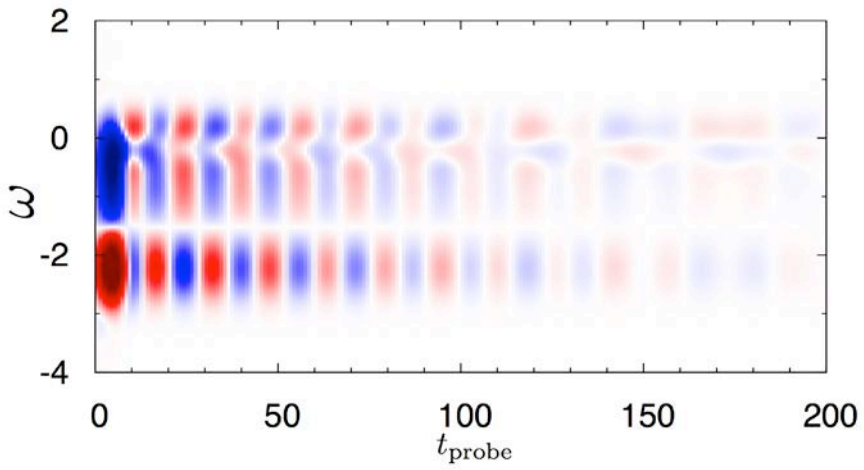
Nonequilibrium dynamics of strongly coupled phonon-mediated superconductors

Recent developments in ultra-fast laser techniques allow experimentalists to reveal intriguing aspects of the dynamics of superconductors such as the Higgs oscillations (amplitude oscillations of the order parameter) and photo-induced superconductivity. These experiments demonstrate the interesting possibility of manipulating superconductivity in nonequilibrium settings. However, the properties of nonequilibrium superconductors are not fully understood, and further theoretical explorations are needed. In this talk we discuss our recent work on the dynamics of strongly-coupled phonon-mediated superconductors. Our studies are based on the nonequilibrium Migdal approximation (the GW approximation for electron-phonon systems) implemented in the framework of dynamical mean-filed theory, which enables us to study the phonon dynamics as well as the electron dynamics. Based on an analysis of weak excitations, we discuss the energy scale and the lifetime of the amplitude Higgs mode beyond the conventional BCS regime, and explain the effects of the phonon dynamics on the Higgs mode. We also predict a new type of amplitude oscillation in the strong-coupling regime. In the case far from equilibrium, we show that there exists an additional critical point other than the thermal one, which controls the relaxation dynamics.



Host: Martin Eckstein – MPSD-CFEL Theory