Ultrafast Phenomena in Superconductors Studied by Real-time Probes

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Abstract. In recent years numerous studies of non-equilibrium carrier dynamics in superconductors (SC) have been performed utilizing femtosecond real-time techniques. Research focused on the identification of relaxation processes and direct measurements of the relaxation times. The theoretical model that has been most commonly used to interpret the dynamics is a phenomenological Rothwarf-Taylor (RT) model which describes the evolution of quasiparticle (QP) and high frequency boson (HFB) populations via a set of two non-linear differential equations, which were shown recently to follow from the general set of kinetic equations for a SC. The approximate solutions of the RT model, which are in excellent agreement with numerical simulations, have been recently derived [1] enabling comparison to the experimental data. It was shown that the model can describe the relaxation dynamics in both conventional [2] and cuprate superconductors [1], as well as other systems with a narrow gap in the density of states, like charge density wave compounds and heavy electron systems [3].

In this talk we will present a detailed study of the evolution of the SC state following excitation by ultrashort laser pulse using the RT model, focusing on the results on high temperature superconducting cuprates. These results imply strong electron-phonon coupling and suggest that phonon act as pairing glue in high temperature superconductors.

REFERENCES

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