Photo-induced ultrafast phenomena in electron-electron and electron-phonon correlated systems

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It is well known that, in electron-electron and electron-lattice correlated systems, several electronic and structural phases compete with each other and huge fluctuations for multi-degrees of freedom appear at vicinity of the phase boundary. Thus, gigantic and exotic changes phenomena are expected by a tiny amount of external perturbation. High temperature superconductivity in cuprates and the colossal magnetoresistance in manganites are the examples. Ultrafast optical techniques open up a new frontier for research of the phase transition. Photo-induced phase is transient and highly nonequilibrium photo-induced phenomena in correlated electron systems offer large possibility of new hidden phases which do not realize in the thermal equilibrium state, and prompt several theoretical challenges.

In this talk, I will introduce recent our theoretical works for photo-induced ultrafast phenomena in electron-electron and electron-phonon correlated systems. 1) Photo induced suppression of the metallic state is observed in the two leg ladder cuprates [1]. We find this is attributed to the reduction of hole pair coherent motion. 2) Dynamical hole doping in the antiferromagnetic long range order is studied. We examine how dope bare hole is transferred into a quasi particle associated with the magnon clouds [2]. 3) Photoinduced phenomena in double exchange system is investigated [3]. A hidden charge disordered and antiferromagnetic state is realized. 4) Photo dynamics in the frustrated charge ordered state coupled with lattice disagree of freedom is calculated [4]. Both the charge frustration and the electron-lattice interaction play crucial roles in the photoexcited state.

References

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