Photo-induced phenomena in spin-charge coupled systems

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A number of electronic phases and the phase transition between them are one of the central issues in correlated electron systems. In particular, materials with multi-degrees of freedom, such as charge, spin, orbital and so on, exhibit various exotic phenomena related to the phase transition. 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[1--5]. In this poster, I will present recent our theoretical results for the photo-induced phase transition in correlated electron systems.

We study the photo-induced dynamics in itinerant electrons coupled with the localized spins, motivated from the experiments in manganites [6]. In particular, the photo irradiation effects on the charge ordered state associated with the antiferromagnetic (AFM) order is examined. The extended double-exchange model at quarter filling is analyzed by the Lanczos method. In the case of low-density photoexcitation, the charge order is melted by the photo-carrier and the AFM order is collapsed by the carrier motion. On the other hand, in the case of the high-density photoexcitation, the AFM charge disordered state, which is a so-called "hidden" state, is realized. We interpret this novel photoexcitation-density dependence of the charge-spin dynamics from the view point of the inverse double-exchange interaction scenario.

The present work has been done in collaboration with J. Ohara (Tohoku Univ. and JST CREST), and Y. Kanamori (Tohoku Univ.).

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