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Non-equilibrium state in strongly correlate electron system in solid

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Strong electron correlation and non-equilibrium state are the recent fascinating topics in solid state physics. Ultrafast photo-induced electron dynamics in strongly correlated electron systems have significantly attracted much attention, since a number of time-resolved experimental techniques and theoretical calculation methods for non-equilibrium states are rapidly developed in the last decade. In this talk, we show the following two theoretical results in correlated electron systems [1].

1) We study the ultrafast optical manipulation of magnetism in correlated magnets [2-6]. We analyze the double-exchange interaction which has been recognized as the typical ferromagnetic interaction since more than half century. By photoirradiation, an initial ferromagnetic metallic state is changed into an almost perfect Neel state. This is highly in contrast to the conventional double exchange interaction picture. Through the Floquet Green function analyses, we find that the highly nonequilibrim electron distribution enhances the Stoner excitation at the antiferromagnetic momenta, and contributes to the magnon softening. It is shown that the topological spin texture appear in the photoinduced transient state as shown in Fig. 1.

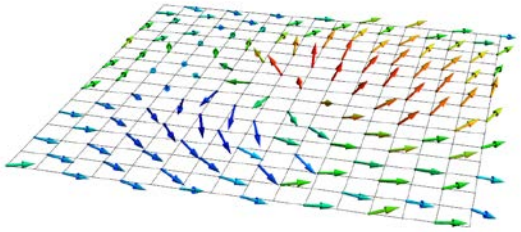

Fig. 1 A topological spin texture induced by photoirradiation.

2) We study the higher harmonic generation (HHG) in correlated electron systems [7]. The HHG has been studied so far in the atomic gas and in the semiconductor crystalline system. We study HHG in an interacting fermion system in the low dimensional system with

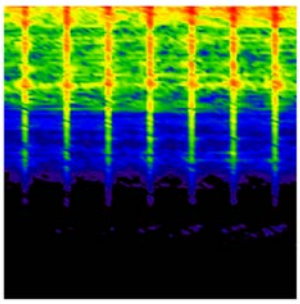

Fig. 2 HHG spectra in the interacting dimer model.

dimer type lattice structure. We find that HHG appear in the charge ordered state without the space inversion symmetry. This originates from the kink-antikink motion, in highly contrast to the electron motion in the Bloch energy bands in conventional semiconductors (Fig. 2).

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