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Dynamical mean-field analysis of the photo-induced insulator-metal transition in correlated electron systems — pump-probe spectroscopy NAOTO TSUJI, TAKASHI OKA, HIDEO AOKI, Department of Physics, University of Tokyo — Recent pump-probe spectroscopy experiments have revealed that photo-excitation can trigger a ‘phase transition’ from an insulator to a metal in various strongly correlated materials. The transition, occurring inherently out of equilibrium, is distinct from conventional phase transitions. In order to identify the nature of the states emerging during the irradiation of an intense laser, we employ the dynamical mean-field theory combined with the Floquet technique for ac fields, which enables us to take account of both the electron correlation and the nonlinear electric-field effect, two essential ingredients in the photo-induced phenomenon. We apply the method to the Falicov-Kimball model, one of the simplest models of correlated electrons, coupled to an ac pump light. The derived optical conductivity spectrum exhibits a Drude-like peak in the low-energy region indicative of metalization. We have also obtained the nonequilibrium distribution of electrons, which turns out to very much deviate from the Fermi distribution, so that the phenomenon is distinct from the heating effect picture. Interestingly, a dip structure is found to emerge in the charge transfer peak, which is shown to come from the vertex correction. We also discuss the dependence of the optical conductivity on the photon energy of the pump light.

Naoto Tsuji
Department of Physics, University of Tokyo

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