Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

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Non-equilibrium dynamics driven by 1.5-cycle strong light field in strongly-correlated organic conductor

Optical responses of strongly correlated organic compounds has attracted much attention, because they exhibit ultrafast changes in the conducting and/or dielectric properties upon photo-excitations [1-4]. Recent progress in several fs optical pulse enables us to drive various new aspects of the strongly correlated system [5-7]. Dynamical localization[8,9], i.e., reduction of the intersite electronic transfer integral t by an AC electric field, E(ω), is a promising strategy for controlling strongly correlated systems with a competing energy balance between t and the Coulomb repulsion energy[10]. Here we describe a charge localization induced by the 9.3 MV/cm instantaneous electric field of a 1.5 cycle (7 fs) infrared pulse in an organic conductor α-(ET)2I3 [7]. A large reflectivity change of > 25% and a coherent charge oscillation along the time axis reflect the opening of the charge ordering gap in the metallic phase. This optical freezing of charges , which is the reverse of the photoinduced melting of electronic orders, is at tributed to the ∼10% reduction of t driven by the strong, high-frequency (ω∼t/h_bar) electric field.

[1] Iwai, Yamamoto et al., PRL98, 097402(2007). , PRB 77, 125131(2008).
[2] Yamamoto, Iwai et al., JPSJ77, 074709(2008).
[3] Kawakami, Iwai et al., PRL103, 066403 (2009).
[4] Kawakami, Iwai et al., PRL105, 246402(2010).
[5] K. Itoh, Iwai, PRL110, 10640(2013).
[6] H. Itoh, K. Itoh, Iwai et al., APL (2014).
[7] Ishikawa, Iwai et al., Nature Commun. accepted
[8] D. H. Dunlap and V. M. Kenkre, Phys. Rev. B34, 3625(1986).
[9] K. Nishioka and K. Yonemitsu, J. Phys. Soc. Jpn. 83, 024706 (2014)
[10] Aoki, Tsuji, Eckstain et al., Rev. Mod. Phys.86,779(2014).

Host: Martin Eckstein

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