Dynamic Control of Electronic Order in Mott and Charge-Density Wave Systems

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Résumé

The interplay of correlations that leads to electronic order in the Mott transition or Charge Density Wave states is one of the key challenges in correlated electron systems. It gives rise to the large variety of different ground states ranging from bad metallic states to superconductivity. Here we set out to control these electronic order using high intensity light pulses in prototypical systems. In a 1D Mott insulator, the organic ET-F2TCNQ we use NIR light pulses to excite charge carriers above the Mott gap to induce a photo-metallic state. In this observe an ultrafast dynamics of a doublon-holon system based on the nearest neighbour interactions V. In contrast to that if we excite the system at mode selective molecular vibrations of the ET molecule in the MIR we achieve control of the onsite electronic wavefunction. In that way we modulate the on-site two particle Coulomb repulsion and change the Mott criterion U/t. This drives the system to a less correlated state as observed by fill in of spectral weight into the Mott-gap. Finally, using photo-excitation in a 2D Mott and CDW system 1T-TaS2 we map out the ultrafast response of electronic correlations and order in the Mott and CDW state using time and angle resolved photoemission with sub 30 fs XUV pulses. Besides the ultrafast melting of the Mott gap we also find an ultrafast response of the electronic order in the CDW which melts before the underlying structural distortion relaxes. This decoupling of charge and lattice modulation challenges the view of Fermi surface nesting for the CDW formation and the hierarchy of electronic order in this system.

Mots-Clés: Mott, insulator, Mott, transition, Photo, I

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