Time-resolved X-ray Diffraction on Density-Waves systems

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Spin- (SDW) and Charge-density waves (CDW) systems are ubiquitous states in solid state physics. They both correspond to a modulation of the spin- or the charge-density, with twice the Fermi wave vector of the electron gas. Both states are gapped, which make them sensitive to impulsive absorption of laser infrared pulses. Interestingly enough, CDW are generally coupled to the lattice, which make them easy to observe by X-ray diffraction.

In this work, we compare the dynamical behavior of CDW after an infrared laser pulse in three different DW systems: Chromium [1], $K_{0.3}MoO_3$ (so-called blue bronze) [2], and 1T-TaS_2 [3]. In all three cases, the CDW is strongly depressed after the pulse in an ultrafast way, which could lead either to a melting of the state, or to a photo-induced phase transition towards another CDW state. In the 1T-TaS2 case, it has been possible to watch the birth of a CDW phase with a nucleation-growth-coarsening process [3].

The recovery of the initial CDW state follows different mechanisms which depend on the compound.

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