Ultrafast dynamics in charge density wave compounds: a view from time-resolved X-ray diffraction

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In correlated electron systems or in systems with coupled electronic and lattice degrees of freedom, the effects of excitations induced by ultra-short visible or infrared pulses take various remarkable forms, such as in-phase atomic vibrations (coherent phonons) and ultra-fast symmetry changes (photo-induced phase transitions).

In this seminar, I will present X-ray diffraction studies of those phenomena in two prototypical charge density wave (CDW) compounds:

→ In the one-dimensional blue bronze $K_{0.3}MoO_3$, photo-excitation drives coherent motions of atoms along the generalized coordinate of the CDW amplitude mode. The analysis of those atomic motions allows retrieving the shape of the interatomic potential in the photo-excited state [1].

→ In the two-dimensional tantalum disulfide 1T-TaS_2, intense laser pulses were found to induce a phase transition between two distinct CDW states. In this case, a detailed analysis of the Bragg peak profiles allows describing the mechanism of the photo-induced phase transition, including nucleation and growth as well as coarsening processes on sub-ns timescales [2].

[1] T. Huber *et al.,* PRL **113** 026401 (2014)
[2] C. Laulhé e*t al.*, PRL **118** 247401 (2017)