

LACUS day

Correlations between electronic and crystal structure studied by x-rays

Urs Staub, Swiss Light Source, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland

The interaction between the electronic and the crystal structure will be addressed using ultrafast x-ray diffraction and absorption experiments performed on XFEL's. The first part does concentrate on the ultrafast dynamics of photo induced octahedral rotations in perovskites. It is shown that the octahedral rotation dynamics is ultrafast and electronically driven even though the underlying 2nd order structural phase transition occurring as a function temperature is originated by a softening of a phonon and not caused by an underlying electronic transition. Interesting is that the actual degree of rotation reflecting the structural order parameter can either increase or decrease, and depends on the excitation scheme, e.g. on the perovskite (SrTiO₃ [1] vs. EuTiO₃ [2]). In the second part, I will show results from a pilot experiment from SwissFEL, where we address the question of how fast we can localize electrons with a fs laser excitation. That electrons delocalize on the time scale of an optical excitation pulse is well known. The opposite process, localizing electrons out of the conduction band has not really been investigated. Here we show by ultrafast X-ray absorption combined with diffraction that we can localize electrons on Lanthanide f-states significant faster than 1 ps by fs laser excitation.

[1] Porer et al., Phys. Rev. Lett. **121**, 055701 (2018)

[2] Porer et al. arXiv : 1901.08388 (2019)