



Thursday, September 22<sup>nd</sup> 2016 - 2:30 pm  
CFEL Seminar room IV, Bldg. 99

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## Correlations in the zone: ultrafast electronic dynamics and vibrational symmetry breaking in quantum materials

The physics of the “ultra-fast” and “ultra-small” are often closely linked, motivating experiments that access these extremes. In this talk, I will discuss the application of ultrashort light pulses, from THz to X-rays, to the study of dynamics and emergent correlations in quantum materials. In particular, transition-metal oxides exhibit an intriguing self-organization of charges into nanoscale “stripes”, whose driving forces and role in high  $T_c$  superconductivity remain unresolved. I will present recent mid-IR and THz experiments that track the initial steps of charge ordering in stripe-phase nickelates. Here, transient multi-THz spectroscopy allows us to capture the symmetry-breaking dynamics due to zone-folded lattice vibrations, exposing a complex electronic and structural coupling during stripe melting and formation. In the second part, I will discuss our development of a setup for time- and angle-resolved photoemission spectroscopy based on a bright 50-kHz source of narrowband, extreme-UV pulses around 22.3 eV. The high repetition-rate and flux of this setup opens the path for rapid band mapping and sensitive measurements of dynamics throughout the Brillouin zone. First applications to the study of the electronic structure and momentum-resolved dynamics of transition metal dichalcogenides will be presented.

Host: Andrea Cavalleri

