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Two-color X-ray pump-probe experiments at SwissFEL

Friday 15 November 2024 11:40 (20 minutes)

Multi-color X-ray pulses with adjustable delay allow to follow ultrafast charge and energy transfer in time and space due to the state selectivity of X-ray photoabsorption. With two freely tunable X-ray pump-probe energies from the Athos line, we can excite at one atomic site and monitor subsequent relaxation processes throughout a system at another site. In this talk, I will show results from our first two-color experiment on small gas-phase molecules. We employed transient absorption and ion-time-of-flight spectroscopy to track the core-excitation induced dynamics in nitrous oxide by exciting the molecules with a pump pulse tuned to the nitrogen K-edge and probing with a pulse tuned to the oxygen K-edge. Pushing the pulse duration into the few to sub-fs regime will give access to study X-ray induced dynamics on sub-Auger lifetimes. This is crucial to understand processes like charge migration or the initial steps of radiation damage, and to implement non-linear X-ray spectroscopy techniques.

Significance

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Session Classification: Ultrafast or time-resolved