



IMPRS UFAST Call for PhD applications 2023/2024

NR1- Towards attosecond X-ray absorption spectroscopy of XFEL-created warm dense matter



Title of PhD Project	Towards attosecond X-ray absorption spectroscopy of XFEL-created warm dense matter
Type	Experimental
Supervisor(s)	Dr. Laurent Mercadier, Prof. Dr. Nina Rohringer and Dr. Andreas Scherz
Affiliation(s):	European XFEL, UHH, DESY
Number of positions:	1
Abstract:	<p>Intense X-ray Free-Electron Laser (XFEL) pulses can trigger strong excitations in the electronic subsystems of condensed matter on femtosecond (fs) or even sub-fs timescales. This can bring solid targets into the warm dense matter (WDM) state, a state at the frontier between a plasma and a condensed phase that is key to astrophysics, planetary science and inertial confinement fusion research. Understanding such transient WDM is a particularly challenging task of modern physics. This project aims at both creating and characterizing WDM with two XFEL pulses in a pump-probe fashion, via soft X-ray absorption spectroscopy (XAS) with fs to sub-fs resolution. At these time scales, not only the nucleus and electrons are strongly out of equilibrium, but also the electrons are not thermalized. Since XAS strongly relies on the accurate measurements of both the incoming and transmitted photons, the existing self-referencing scheme using diffraction optical elements at the SCS instrument will be extended to allow broadband, ultrashort and intense XFEL pulses. Investigations on the validity of temperature diagnostics at high intensities, ionization potential depression and the role of non-thermal electrons on ionization dynamics will be supported by theory with the active participation of the PhD student.</p>
Contact person for scientific questions about the project:	Dr. Laurent Mercadier: laurent.mercadier@xfel.eu