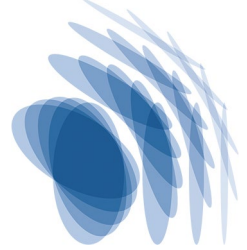


# Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter



## IMPRS UFAST Call for PhD applications 2024/2025

### TH1 - Sensing of relativistic electrons with chip-integrated photonics



<b>Title of PhD Project</b>	<b>Sensing of relativistic electrons with chip-integrated photonics</b>
<b>Type</b>	Experimental
<b>Supervisor(s)</b>	Prof. Tobias Herr / Prof. Franz Kärtner
<b>Affiliation(s):</b>	DESY / UHH
<b>Number of positions:</b>	1
<b>Abstract:</b>	<p>Nonlinear optical effects can be utilized to manipulate light with light. In chip-integrated nonlinear photonic waveguides, this nonlinear coupling can be drastically enhanced. This thesis will explore and develop a novel chip-integrated photonic sensor for relativistic electrons in free-electron lasers (FELs). Specifically, we aim at detecting the interaction between the electrons' electric field and the electric field of an ultrashort laser pulse, to provide precise timing and spatial information of the relativistic electrons - a critical prerequisite e.g., for time-resolved atomic-resolution imaging of biomolecules. The photonic chip-integrated platform is expected to boost the current sensitivity by orders of magnitude and may also be used to study fast and non-repetitive phenomena in chemistry and biology.</p> <p>The thesis will leverage experimental, numerical, and analytical techniques at the forefront of integrated photonic technology, ultrafast lasers and nonlinear optics. It includes the design of advanced chip-integrated laser systems as well as experiments in our state-of-the-art laboratory. It combines exploration of unknown physics with the development of immediately relevant and meaningful optical technologies. We present our work frequently at international conferences and work closely with other research groups across scientific disciplines.</p> <p><b>References:</b> Ludwig et al., Nature Comm. in press, arXiv:2306.13609 (2024) Ulanov et al., Nature Photon. 18, 294-298 (2024) Steffen et al., Rev. of Sci. Instr., 91, 045123 (2020)</p>
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