

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 2025/2026

FK1 - THz generation in Lithium Niobate studied with UED



Title of PhD Project	THz generation in Lithium Niobate studied with UED
Type	Experimental
Supervisor(s)	Prof. Dr. Franz X. Kärtner
Affiliation(s):	DESY
Number of positions:	1
Abstract:	<p>We have developed an Ultrafast Electron Diffraction (UED) setup featuring a novel high gradient pin photocathode embedded in a compact S-band radio frequency (RF) cavity. Once optimized, the setup will be well suited for sub-100 fs atomically resolved dynamics studies of materials. Our UED initiative is part of a greater context involving generation of high energy Terahertz (THz) pulses based on cascaded optical rectification of optical laser pulses in Lithium Niobate, ultimately for purposes of THz based electron acceleration. In this project, we aim to get a better understanding of the THz absorption mechanisms currently limiting conversion efficiencies to a small fraction of what is theoretically possible. The associated phonon-electron and phonon-phonon coupling dynamics are to be elucidated with the UED technique. We seek candidates with a background/experience in at least one of the following fields: ultrafast and/or nonlinear optics, laser physics, materials/solid state physics, and accelerator/beam physics. Programming/numerical skills (Matlab, C++, LabView, Python) are highly advantageous. The successful candidate should be highly motivated and will work in a team with other PhD students, postdocs and research scientists in a first-class scientific environment on cutting-edge topics at the current frontiers of ultrafast science.</p> <p>D. Zhang et al., "Segmented THz electron accelerator and manipulator (STEAM)," Nat. Photonics 12: (6) 336 (2018). https://doi.org/10.1038/s41566-018-0138-z</p> <p>S. W. Jolly et al., "Spectral phase control of interfering chirped pulses for high-energy narrowband terahertz generation," Nature Communications 10, pp. 872-877 (2019). https://doi.org/10.1038/s41467-019-10657-4</p> <p>D. Zhang et al., "THz-Enhanced DC Ultrafast Electron Diffractometer," Ultrafast Science (2021); https://doi.org/10.34133/2021/9848526</p> <p>J. Ying et al., "High gradient terahertz-driven ultrafast photogun," Nat. Photonics (2024). https://doi.org/10.1038/s41566-024-01441-y</p>
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