MAX PLANCK INSTITUTE
FOR THE STRUCTURE AND DYNAMICS OF MATTER

Date & Time: **FRIDAY, JULY 10th at 11:00am**

Location: **MPSD 900.EG.136**

Speaker: **KASRA AMINI**

Max-Born-Institut

qcmd - Seminar

mpsd

Ultrafast electron diffraction imaging of femtosecond structural dynamics in solids, liquids, and gases

Ultrafast electron diffraction (UED) enables direct observation of structural dynamics in photoexcited solids, liquids, and gases on femtosecond timescales [1-6]. In this talk, I will tell you about our recent efforts to push UED across complementary keV and MeV regimes. I will focus primarily on our new 90 keV instrument, where radiofrequency (RF) compression allows us to generate high-brightness electron pulses with unprecedented high throughput. By synchronizing the RF compression to the drive laser with better than 6 fs (FWHM) precision [9], we achieve 50-114 fs (FWHM) electron pulses at 40-100 kHz [10,11]. I will show you how shot-noise limited UED is powerful in tracking ultrafast structural dynamics in solids, using aluminium thin films as a model system, where we resolve non-thermal lattice dynamics governed by short- or long-range interactions [12,13]. In the final part of the talk, I will briefly turn to complementary 30 fs MeV UED experiments [7,8] in molecules and liquids. I will highlight how the combination of elastic and inelastic electron scattering gives access to the coupled electronic-nuclear dynamics [14] in the photochemistry of gas-phase aldehydes. I will also reveal the charge transfer and nuclear dynamics in donor-acceptor molecules in highly polar liquid environments, illustrating the powerful combination of keV and MeV UED to study photochemical reactions across all three states of matter with femtosecond temporal and picometre spatial resolutions.

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