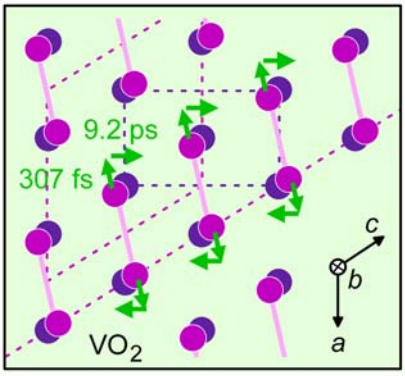
Munich-Centre
for Advanced Photonics (MAP)

Doktorarbeit / PhD Thesis

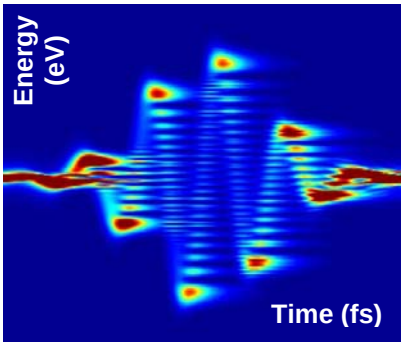
THz Science and Ultrafast Electron Diffraction



Baum, Yang, Zewail, Science 318, 788 (2007).

Changes and reactions of matter require the motion of atoms and electrons from initial to final positions. This happens within femtoseconds for atoms and within attoseconds for electron densities. The method of ultrafast electron diffraction allows to visualize such processes in all four dimensions of space and time. This is made possible by the picometer-sized de Broglie wavelength of keV-electrons, resulting in a '4D-movie' of atoms/electrons in motion (see Figures).

However, only such dynamics can be probed that can also be initiated. Currently, femtosecond Ti:Sa lasers and their harmonics are used, but these are not well suited to initiate many of the most interesting motions, especially electronic processes. Infrared and terahertz fields are required there.



Your task will be to combine few-cycle terahertz science with our existing femtosecond diffraction setup. This combination of techniques will be unique, and will for the first time allow to directly observe the motion of charge in nanostructures, molecules, or condensed matter crystals, in all four dimensions.

Our research is located at the Max-Planck-Institute of Quantum Optics and LMU in Garching, and is part of the MAP excellence cluster. We require experience with terahertz pulses or femtosecond lasers, enthusiasm for experimental work, and excellent grades. Please contact us with a CV!
(gerne auch auf deutsch)

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