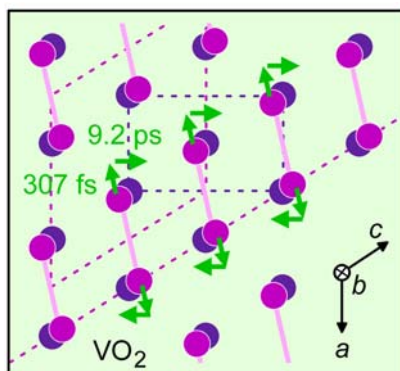


## Munich-Centre for Advanced Photonics (MAP)

Doktorarbeit / PhD Thesis

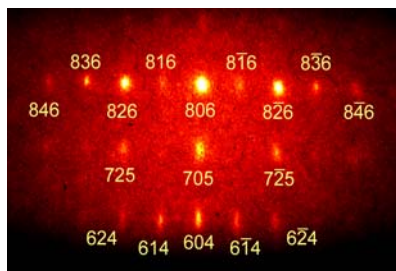
### Ultrafast Single-Electron Diffraction



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

Join ultrafast science! We investigate the motion of atoms and electrons during macroscopic changes in matter. The relevant length and time scales are *picometer* and *femtoseconds*; electrons can move as fast as within *attoseconds*. With electron diffraction, we can visualize atomic-scale motions in all four dimensions of space and time – to make a ‘movie’ of what happens during processes like phase transformations, chemical reactions, or electronic transitions in condensed matter (see figures).

We recently succeeded in using only single electrons for ultrafast diffraction; this avoids space charge and the associated temporal broadening of the electron pulses. Your task will be the application of this world-leading capability to questions of interest in chemistry, condensed matter physics, and attosecond science. Possible first samples to study are dye-covered solar cells, nonlinear optical materials, molecular crystals, nanostructures, or biomolecular monolayers, depending on your interest.



$$S(hkl) = \sum_j f_j \exp \left[ -2\pi i \left( \begin{matrix} h \\ k \\ l \end{matrix} \right) \cdot \begin{pmatrix} x_j \\ y_j \\ z_j \end{pmatrix} \right]$$

Working with us involves state-of-the-art femtosecond laser technology, electron optics, and ultrafast condensed matter physics. Yet all experiments are table-top and will be operated by yourself and our small team. 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 enthusiasm for experimental work, scientific thinking, and excellent grades. Please contact us with a CV! (gerne auch auf deutsch)

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