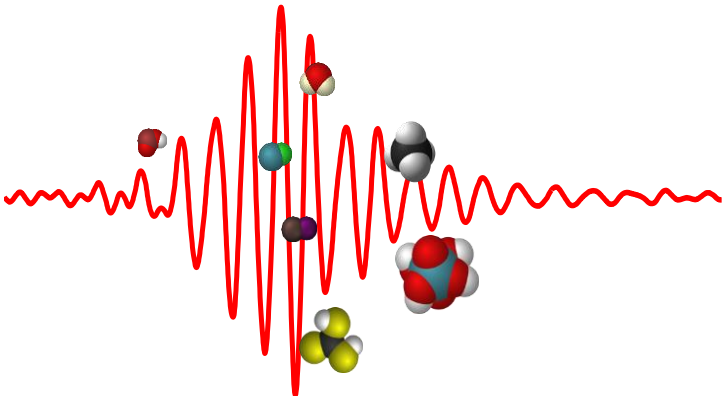
LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

MPQ

PhD & Postdoc Positions

At the Laboratory for Attosecond and High-Field Physics in the Division of Prof. Dr. Ferenc Krausz

Broadband Field-Resolved Spectroscopy in the Molecular Fingerprint Region



Biomolecular assemblies exhibit fundamental rotational and vibrational eigenmodes in the mid-infrared (MIR) wavelength range between 2 and 25 µm. The electric fields associated with these dynamics are rich in information relating to the molecular composition, structure and conformation, constituting a "fingerprint" of the sample under investigation. Molecular fingerprinting thus bares tremendous potential for breakthroughs in numerous fields ranging from basic to applied life sciences. Most prominently, MIR vibrational spectroscopy holds the promise of early detection and diagnosis of diseases like Alzheimer's or cancer via statistically-proven disease-specific spectral fingerprints [1], since any change in the structure of molecular constituents of a human cell invariably causes changes in the MIR absorption spectrum of the cell itself or of its metabolic products. However, limitations of the sensitivity and specificity of current MIR spectroscopies have so far severely restricted their applicability.

At the *Laboratory for Attosecond and High-Field Physics* we develop cutting-edge femtosecond laser technologies [2-5] and novel molecular fingerprinting techniques [6]. In particular, we trace the interaction of broadband, coherent MIR light pulses with biological samples on the level of the electric field, in the time domain, which affords regimes of unparalleled sensitivity and specificity for molecular fingerprinting, and promises insights into light-matter interactions at an unprecedented level.

For the development of next-generation bright, coherent, broadband MIR sources and of spectroscopy techniques employing those, we are looking for **PhD students** and **postdoctoral researchers**. The research activities will be in the fields of laser physics, nonlinear optics and field-resolved time-domain spectroscopy.

References:

[1] www.lasers4life.de
[2] O. Pronin et al., Nature Commun. **6**, 6988 (2015)
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[4] J. Zhang et al., Light Sci. Appl. 7, 17180 (2018)
[5] N. Lilienfein et al., Nature Photon., in press (2019)
[6] I. Pupeza et al., Nature Photon. **9**, 721 (2015)

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