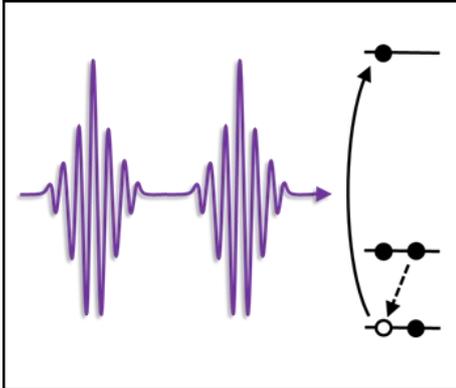




## PhD position in Ultrafast nonlinear XUV and X-ray spectroscopy



The extreme ultraviolet (XUV) and X-ray spectral domains provide exceptional temporal and spatial resolution: temporally reaching the attosecond regime, where the fastest electronic processes can be resolved, and spatially down to the atomic scale via element-specific core-level transitions and chemical shifts. These capabilities open unprecedented opportunities to study and control matter on the nanoscale. The development of ultrafast spectroscopy and coherent control techniques in the XUV and X-ray regime is therefore at the forefront of modern photon science. While progress was historically limited by the lack of sufficiently bright light sources, the advent of free-electron lasers (FELs) has fundamentally transformed the field and enables now entirely new experimental approaches.

In this rapidly evolving area, our group has contributed several key advances in recent years:

- [1] A. Wituschek et al., Nat Commun 11, 883 (2020)
- [2] D. Uhl et al., J. Phys. Chem. Lett. 13, 8470 (2022)
- [3] F. Richter et al., Nature 636, 337 (2024)

### The project:

The PhD project will build on these developments. The central goal is the realization of a novel XUV/X-ray spectroscopy technique capable of mapping ultrafast molecular reactions with high temporal, spectral, and structural resolution. The method will combine interferometric concepts with advanced pulse-shaping techniques developed in our laboratories at the University of Freiburg. The experiments will ultimately be implemented at the FEL facilities FLASH (Hamburg) and FERMI (Trieste, Italy), with which we maintain strong collaborations. The PhD candidate will benefit from extended research stays at these international large-scale facilities and gain hands-on experience with state-of-the-art photon science infrastructure.

Beyond the scientific training, we actively support career development, complemented by the structured career workshops offered by the University of Freiburg.

### Your profile:

Candidates should have strong interest in optics and atomic and molecular physics. **Skills for designing and implementing experimental setups are essential.** Likewise, good communication skills are needed. Experience in the use of ultrafast lasers as well as basic programming skills (python/matlab) is desired.

Applications including a letter of motivation, a CV, certificates of your university degree (including grades), a transcript of records and contact details of two references should be sent in a **single** pdf file to the email contact in the box. Please indicate the subject "PhD FEL" in your email. The position will remain open until filled.

### Contact:

#### PD Dr. Lukas Bruder

University of Freiburg – Institute of Physics  
Hermann-Herder-Str. 3  
79104 Freiburg

Phone +49 761 203-8405

sekretariat.stienkemeier@physik.uni-freiburg.de