

# Upgrading an x-ray attosecond pump-probe beamline with an active stabilization interferometer

Are you curious about how atoms and electrons move on the fastest timescales imaginable? Join the Attosecond Science Group (<https://atto.cfel.de>) at the Center for Free-Electron Laser Science (CFEL), where we create and harness ultrashort laser pulses with durations in the attosecond ( $1 \text{ as} = 10^{-18} \text{ s}$ ) and few-femtosecond ( $1 \text{ fs} = 10^{-15} \text{ s}$ ) range. These pulses allow us to observe and manipulate ultrafast dynamics in systems ranging from bio-relevant molecules to clusters and nanoscale materials. By exploring these fundamental processes, we aim to deepen our understanding of the earliest steps in photochemistry and pave the way for potential control over these ultrafast reactions.

## What You'll Do:

In this project, you'll gain hands-on experience with experimental techniques designed for time-resolved ultrafast experiments on the femtosecond and attosecond timescales. A key aspect of these experiments is ensuring the beamline's stability for long-duration scans. You will:

- Build an interferometer using a leakage of the IR main driving field in both arms of our in-vacuum beamline.
- Develop methods to stabilize the beamline, ensuring precise alignment and timing control for extended data collection.
- Apply programming skills to automate the system and maintain temporal overlap of both beams with attosecond precision.

This project offers an exciting opportunity to work on both the hardware and software aspects of ultrafast laser experiments, contributing directly to the enhancement of cutting-edge pump-probe techniques.

## Who Should Apply:

We welcome motivated master's students with a background in physics, optics, engineering, or related fields. Familiarity with interferometry, laser systems, or vacuum technology is an advantage. Additionally, programming experience (e.g., Python, LabVIEW, or similar) will be valuable for automating the stabilization system. Most importantly, we're looking for students with a passion for experimental research and a desire to work at the forefront of ultrafast science.

## Group

FS-ATTO

## Project Category

A5. Lasers and optics

## Special Qualifications

## DESY Site

Hamburg

**Primary authors:** SANCHEZ, Aurelien (FS-ATTO); ROBERTSON, Kate (FS-ATTO)

**Presenters:** SANCHEZ, Aurelien (FS-ATTO); ROBERTSON, Kate (FS-ATTO)