KIRCHHOFF-INSTITUT FÜR PHYSIK | INSTITUT FÜR UMWELTPHYSIK | MAX-PLANCK-INSTITUT FÜR KERNPHYSIK

Master's Thesis – Novel Laser Spectroscopy

Working on an exciting quantum optics spectroscopic technique for greenhouse gas measurements above the city of Heidelberg

Background

The project ***Spectroscopy for Environmental Research*** is a joint project of the *Atmospheric Remote Sensing* group led by André Butz at the Institute of Environmental Physics, the *Atomic Quantum Systems* group led by Markus Oberthaler at the Kirchhoff-Institute for Physics, and the *Quantum Dynamics* group led by Thomas Pfeifer at the Max Planck Institute for Nuclear Physics. We bring together expertise in precision laser spectroscopy and atmospheric science to address open questions about greenhouse gas emissions and environmental processes. In this framework we operate and continuously improve a Dual Comb Spectroscopy setup, designed to measure greenhouse gas concentrations above the city of Heidelberg. A laser beam is sent 3 km across the city of Heidelberg, and the absorption properties of different molecules allow us to infer their concentrations with high temporal resolution. This is a novel method for monitoring urban areas, which are major sources of greenhouse gas emissions worldwide. Accurate measurements are essential to achieve net-zero emissions in the coming decades.

We are looking for a motivated Master's student interested in working with us on setting up a second light path above the city and the analysis of possible differences in measured CO_2 concentrations.

Work Content

The candidate will install a second telescope as shown above to realize a second light path above Heidelberg. In a first step, the second telescope will point to the same mirror as the first one. The candidate will analyze whether differences in measured CO_2 concentrations between the two parallel light paths with a small offset exist. Afterwards the telescope can be pointed in different directions to observe and analyze spatial gradients in CO_2 concentrations above the city.

Prerequisites

A strong interest in working in the lab and developing experimental optical setups, as well as analyzing and interpreting experimental data, is necessary, as is a full-time commitment to the research project. A background (e.g., through coursework) in atomic, molecular, and optical physics and ideally environmental physics is preferable.

Contact

For any questions or if you are interested in working on this exciting project, please get in touch with us:

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15.06.2026