Master thesis: Polarization-controlled active fiber-based retroreflector for laser spectroscopy of atomic deuterium
Laser spectroscopy division (Prof. T. W. Hänsch), Max Planck Institute of Quantum Optics

Precision laser spectroscopy of atomic hydrogen and deuterium has long been used to determine physical constants and to test fundamental theories, owing to the simple structure of atoms allowing comparison with precise calculations. We are continuously improving constraints on these tests and shine light on possible discrepancies, such as the proton radius puzzle [1]. At the moment, we are working towards measuring the 2S-6P transition in deuterium which allows for determination of the deuteron radius and further tests of quantum electrodynamics. To reach the required fractional uncertainty of a few parts in $10^{12}$ of the transition frequency, a sophisticated control over systematic effects such as quantum interference is required [2].

Though similar to a hydrogen measurement, the spectroscopy of deuterium requires careful control of the laser polarization and a detailed understanding of the atomic line shape. We are looking for a master student for the deuterium spectroscopy experiment who is interested in working with a typical atomic physics toolkit, including optics, lasers, fibers and electronics. More specifically, the master student would investigate imperfect polarization in our active fiber-based retroreflector [3] and explore possibilities to extend the setup for circular polarization. Furthermore, a fiber-based polarization controller could be used to stabilize polarization. Though theoretical understanding and simulations of how imperfect polarization enters the 2S-6P deuterium spectroscopy could be also part of the thesis, the project includes mostly hands-on experimental work.

If you are interested in joining our team and want to learn more about the project, do not hesitate to contact Vitaly Wirthl (vitaly.wirthl@mpq.mpg.de). Please send your application along with your CV to Prof. Thomas Udem (thu@mpq.mpg.de) with CC to Vitaly.

Key references