

# Diploma thesis

## State-of-the-art high-power laser development: Beam stabilization for high-field applications

**Background:** In the Laboratory of Attosecond and High-Field Physics (LAP) at the Max-Planck-Institut für Quantenoptik (Garching, Germany), a number of ultrahigh-power laser systems are currently in operation or under development. Such short-pulse, ultrahigh peak-power laser systems are used to investigate laser-plasma interactions with the main emphasis on the development of compact (table-top) laser-driven particle accelerators and high-harmonic generation from solid surfaces with the final aim of ultra-intense attosecond pulses. These systems comprise ATLAS, one of the current work horses at LAP-MPQ, a conventional Ti:Sapphire laser system, as well as the Petawatt Field Synthesizer (PFS), a large-scale project presently under construction. The latter system is based on optical parametric amplification to allow for ultrabroad amplification bandwidth as well as high pulse energies, designed to deliver few-cycle pulses with petawatt-scale peak powers. Apart from the cutting-edge light-source development, PFS represents the future driver for a variety of applications. Therefore, it is essential that the operation of both ATLAS and PFS is reliable and as simple as possible. While the alignment of ATLAS is relatively straightforward and can be carried out by one person, PFS will require significantly more effort, knowledge and manpower for day-to-day operation.

**The Diploma student's task** will be to develop and design a beam diagnostic and stabilization system which can be implemented for both ATLAS and PFS. Since ATLAS is currently in operation the implementation can be tested immediately. This work will be performed in close collaboration with the ATLAS/PFS teams for optimum outcome.

**Prerequisites:** Strong interest in experimental work and programming is necessary. Some knowledge of optics would be an advantage, and programming skills especially in LabView would also be useful.

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