Development of a mid-IR GDD measurement setup

Type: Master project
Timeframe: 6 months, start January 2020
Supervisor: Dr. Ajanta Barh
Reference: 1903MA

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1. Project Description

Prof. Ursula Keller's group at ETH Zurich is pioneered in developing and characterising ultrafast lasers with pulse width typically in order of 10's to 100's of femtosecond. A finite second order chromatic dispersion broadens the temporal width of an ultrashort pulse. Exact knowledge of this so called Group delay dispersion (GDD) is crucial for the generation of ultrashort pulses.

This project is aiming to develop a novel GDD measurement setup based on traditional white light interferometry, working at wavelengths above 2 µm. Fig. 1 depicts the schematic of a GDD setup in the 1 µm range. A Michelson type interferometer enables the measurement of the phase and thus dispersion introduced by a device under test (sample).

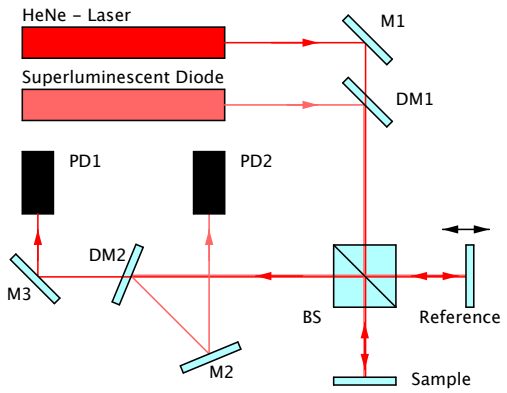

Fig. 1. Schematic of the GDD measurement setup working at 1 µm wavelength.

This setup will be used to characterize optical components used in a femtosecond laser cavity like mirrors or semiconductor saturable absorbers (SESAMs). The primary task is to assemble the setup, characterize the noise and develop an efficient data analysis scheme.

As a successful candidate, you will learn techniques applied in ultrafast laser physics (free space optics, interferometry, dispersion management, data processing, application of the Fourier transformation). You will get hands-on experience in cutting edge optical research within the ULP group. Moreover, you will be a part of a vibrant research team, consisting of PhDs and postdocs providing sufficient help in completing the project successfully.

2. Project Scope and Goals

- Build a mid-infrared broadband GDD setup (optics)
- Develop a suitable data acquisition and processing scheme (electronics)
- Test the setup using real samples, e.g. dielectric mirrors and semiconductor chips

3. Requirements

- Interest in experimental lab work with both optics and electronics
- Matlab or similar programming skills for data analysis
- Basic knowledge of lasers, interferometers, and ultrafast optics
- Ideally attended the ULP lecture

4. References & Further Reading

[1] A. Gosteva, M. Haiml, R. Paschotta, and U. Keller, J. Opt. Soc. Am. B 22, 1868 (2005).
[2] F. Habel, M. Trubetskov, and V. Pervak, Opt. Express 24, 16705 (2016).