Institute of Optics & Quantum Electronics JENA
Friedrich Schiller University

Abbe School of Photonics JENA
Friedrich-Schiller-Universität

Internship / Research Lab Work / Master Thesis open positions

Topic: Nonlinear pulse compression by self-phase modulation in hollow core fibers

An interesting manifestation of the intensity dependence of the refractive index in nonlinear optical media occurs through self-phase modulation (SPM), a phenomenon that leads to spectral broadening of optical pulses. Such interaction of atomic and molecular gases with ultrashort infrared laser pulses generates new frequencies. The central idea of this project is to develop experimental set up to broaden the input spectrum and achieve pulse compression to generate few cycle pulses at 800 nm.

The experiment uses a femtosecond laser system producing pulses with sub-35 fs duration at 800 nm wavelength and energies up to 2 mJ at a repetition rate of 1kHz. The laser pulses are coupled into 1.5 meter long gas filled hollow core fiber [ref Fig. 1]. This broadband output will be characterized using autocorrelator / FROG and spectrometers.

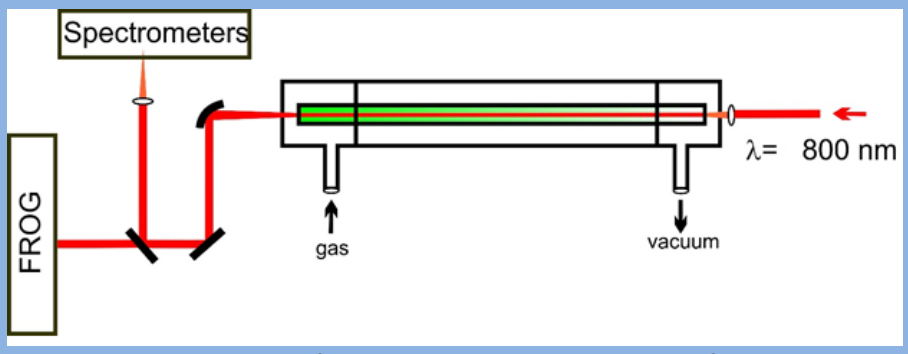

Figure 1. Experimental set up for spectral pulse broadening by self-phase modulation.

This project offers hands on experience in nonlinear ultrafast fiber optics. You will be introduced to handling of the fibers, beam stabilization system, pulse compression and pulse characterization. Programming skills in Matlab / LabView will be an advantage if you are interested to write short scripts to integrate the opto-electronic devices into computer control. Additionally, you will also be exposed to working with vacuum and pressure systems.

Contact person for student

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References:

[1] T. Balciunas, et. al. “A strong-field driver in the single-cycle regime based on self-compression in a kagome fibre”, Nature Communications.6:6117 (2015).

[2] R. Sollapur, et. al., "2.5 Cycle Pulses Obtained With Self Compression At 1.8 µm In Antiresonant Waveguides," in Conference on Lasers and Electro-Optics, OSA Technical Digest (online) (Optical Society of America, 2018), paper SW3N.3.