

Characterization of femtosecond pulses via frequency-resolved optical gating

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Miller Group's research is devoted to understanding the ultrafast chemical and biological processes with some of the world's brightest electron sources. Femtosecond lasers are indispensable tools in such fundamental and advanced research. It is critical to precisely characterize the femtosecond laser pulses during its generation and usage. A technique called Frequency-Resolved Optical Gating (FROG) has the capability to retrieve both the amplitude and phase information of the laser pulse, in both temporal and spectral domains. One version of FROG is based on measuring the spectrogram of second harmonic signal of a pulse with its replica in a nonlinear medium. By recording the spectrograms at varying delays between the two pulses, full characterization of the laser pulse is possible with a proper two-dimensional phase-retrieval algorithm.

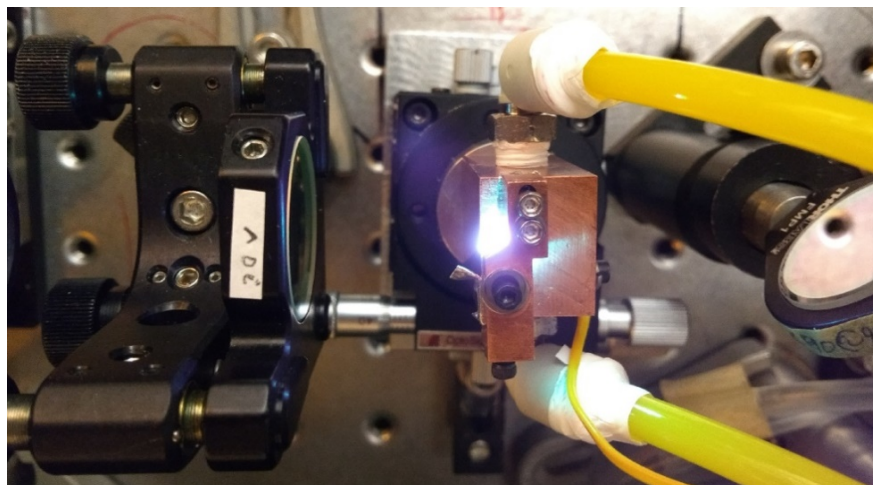


Image showing the Yb doped gain medium of the femtosecond laser under development

The goal in this project is to incorporate new algorithms for phase-retrieval of femtosecond (fs) pulses. The task of the student is to develop the code and possibly a new algorithm for reconstruction of the amplitude and phase of fs pulses from the measured spectrograms. The FROG setup is partially developed, and the pulse reconstruction program can be tested and optimized by recording the spectrograms of the available femtosecond pulses.

Dr. Hua, the senior scientist in the group will mentor the student in pulse characterization experiments. This project is suited for a 3rd or 4th year Physics student and students with good computer programming skills and some basic knowledge of optics are encouraged to apply. The student will learn about femtosecond laser technology and data analysis techniques. Conditioned on completion of the project, the student will be a co-author on papers of the laser development sub-group to be published in peer reviewed journals.

For more information, please contact Dr. Renzhong Hua, rzhua@lphys.chem.utoronto.ca