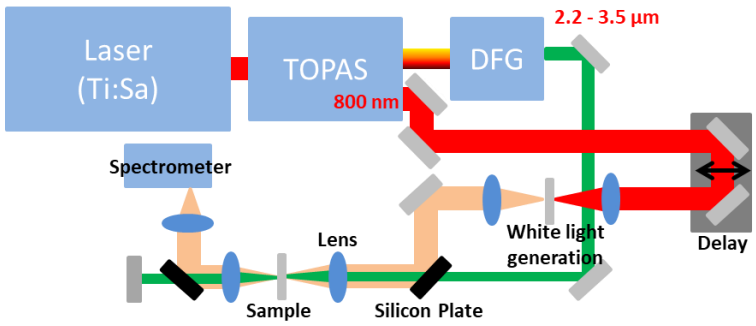
Internship or Bachelor / Master Thesis

Carrier dynamics in highly excited semiconductors: From multiphoton to tunnel excitation

The speed of semiconductor based electronics is mainly determined by the dynamics of excited electrons. Using strong femtosecond laser pulses we can highly excite semiconductors to study the correlation between the electron as well as thermalization and recombination processes on their natural time scale. The processes have a distinct signature in transient absorption spectrum such as red-shift of the measured spectra. Beside material related effects one expect modifications of the electronic structure due to strong field effects [1,2].

In this project the temporal dynamic of the transmission spectra of highly excited CdS and ZnO samples will be measured using an optical pump-white light probe technique. To differentiate the field and material related effects the material will be pumped in a wide wavelength range, reaching from the near (2.2µm) to the mid-IR (3.5µm). The students work comprising the following tasks:

- Lab work: Set up experiments (white light source and pump-probe setup), in our novel femtosecond laser lab.
- Implementation of all necessary lab software in LabView.
- Data acquisition and processing.



Experimental setup: The optical pump and white light probe beam are in a collinear geometry. The recombination of the two beams is realized with a silicon plate, showing high reflectivity in the visible and high transmission for the mid-IR pump pulses.

Literature:

[1] Claus T. Otobe, Y. Shinohara, S. A. Sato, and K. Yabana. "Femtosecond time-resolved dynamical Franz-Keldysh effect". Physical Review Letters B, Vol. 93, Iss. 4, (2016).

[2] Shambhu Ghimire, Anthony D. DiChiara, Emily Sistrunk, Urszula B. Szafruga, Pierre Agostini, Louis F. DiMauro, and David A. Reis. "Redshift in the Optical Absorption of ZnO Single Crystals in the Presence of an Intense Midinfrared Laser Field". Physical Review Letters B, Vol. 107, Iss. 16, (2011).

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