



BSc/MSc thesis

at the University of Freiburg

in the field of **femtosecond dynamics of molecules and clusters**

The working mechanisms of many optoelectronic devices, like photovoltaic cells depend sensitively on the ultrafast dynamics of excited molecules interacting with neighboring molecules. These dynamics include charge-transfer processes, exciton migration, annihilation and splitting and a multitude of other radiative and non-radiative decay processes. This project aims at studying these dynamics of molecules and clusters isolated in the gas phase or in superfluid helium nanodroplets. Helium nanodroplets facilitate the formation of molecular clusters and form an ideal weakly interacting matrix for spectroscopic studies at mK temperatures. The clusters studied can be considered sample systems of the minimal size for these processes to occur, and allow deep insights into these processes on the molecular level. A femtosecond pump-probe setup in combination with a photoelectron velocity map imaging (VMI) and an ion time-of-flight (TOF) spectrometer enables us to track the complex dynamics triggered by electronic excitation or ionization of the molecules or clusters. In particular, we focus on fundamental aspects of charge transfer processes in clusters of organic molecules related to challenges in organic photovoltaic applications and solar energy conversion and study how the decay mechanisms in small clusters differ from the processes occurring in single molecules.

Experiments involving IR, VIS and UV radiation are currently in process and a further extension into the deep UV is being prepared. A major improvement of the spectrometer to allow coincidence detection of ions and electrons is in the design stage.

We are regularly looking for BSc and MSc students who are highly motivated to work in the field of experimental Atomic and Molecular Physics. Typically, available projects focus on experimental work with a high vacuum machine consisting of a molecular beam apparatus and photoelectron and photoion spectrometer and a femtosecond laser system.

For further information please contact:

Dr. Sebastian Hartweg

sebastian.hartweg@physik.uni-freiburg.de

or

Prof. Frank Stienkemeier

stienkemeier@uni-freiburg.de

University of Freiburg - Institute of Physics

Hermann-Herder-Str. 3,

79104 Freiburg

www.nanophysics.uni-freiburg.de

