FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG
TECHNISCHE FAKULTÄT

AOT-TP

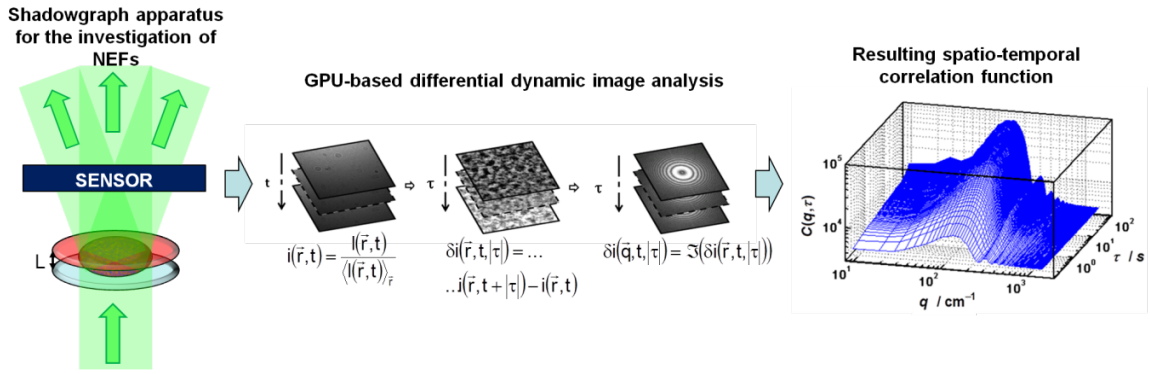
The **Institute of Advanced Optical Technologies – Thermophysical Properties (AOT-TP)** offers a

Master thesis

with the tentative title

Development of an Optimized GPU-Based Image Analysis Software for the Analysis of Non-Equilibrium Fluctuations

An accurate knowledge of the heat, mass, and momentum transport coefficients over a wide range of systems and thermodynamic states is of interest in many natural and industrial processes. These transport coefficients can be determined in an absolute way by analyzing the dynamics of spontaneous fluctuations from fluids and fluid mixtures using light scattering techniques. In an ongoing research project funded by DFG, we are interested in the analysis of long-ranged non-equilibrium fluctuations (NEFs) for the simultaneous determination of multiple transport properties of thermally stressed binary mixtures using shadowgraphy. In fact, the dynamics of NEFs for a binary mixture thermally stressed are governed by the thermal diffusivity, the mass diffusivity, the kinematic viscosity, the Soret effect as well as some boundary effects. One of the most critical aspects for the determination of all these transport properties by shadowgraphy is data processing. Within a single experimental run, a large stack of images representing about 100 GB is acquired. Due to memory consumption, the image analysis, including normalization, pre-treatment, computation of the Fourier domain correlations between images, etc., need to be performed using the advantage of parallel processing. For example, it could be demonstrated that using graphical processing unit (GPU) facilities, the treatment of 30 GB of NEFs data could be reduced from 36 hours to 1 hour.



The major task of the master work is to contribute to the development of an image analysis software implemented in CUDA to run efficiently on GPUs with the aim to reduce the computational time of our actual software developed in Matlab. The candidate should develop original ideas in order to optimize the number of operations and data transfers between CPU and GPU in the treatment of NEFs data. Estimates based on our experience confirm that by suitable modifications of the existing algorithms, it should be possible to reduce the analysis to few minutes.

For the described thesis, we are looking for a committed student with interests in parallel computing, image analysis, C++/CUDA as well as Matlab. We offer a diverse, multidisciplinary, and international working environment with excellent potential for scientific and personal development.

Start of the thesis: as soon as possible

Contact: Dr. Cédric Giraudet
Email: cedric.cg.giraudet@fau.de
Phone: 09131-85-23022