FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG
TECHNISCHE FAKULTÄT

AOT-TP

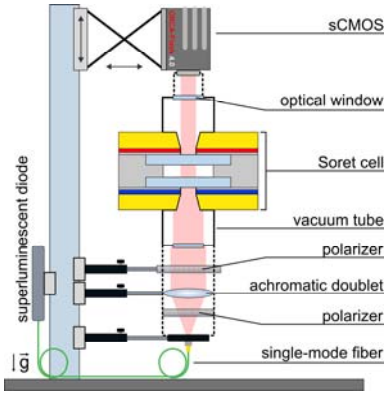
The **Institute of Advanced Optical Technologies – Thermophysical Properties (AOT-TP)** offers a

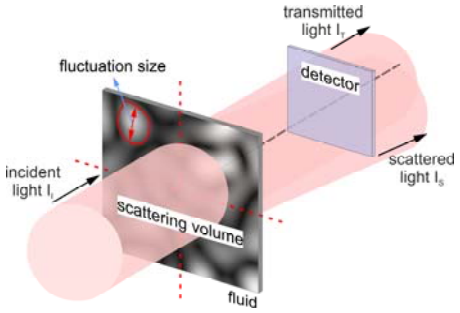
Master thesis / Student position

with the tentative title / topic

Determination of Diffusion Coefficients in Binary Fluid Mixtures by the Shadowgraph Method

In process engineering, knowledge of transport properties such as the thermal diffusivity and thermal conductivity, viscosity, and mass diffusion coefficient is essential for the optimized design of processes. For the investigation of the mentioned transport properties and, furthermore, the Soret coefficient of fluid systems, the shadowgraph method is currently under development at AOT-TP. In this method, a temperature gradient is applied to a multicomponent fluid mixture, inducing a concentration gradient due to the Soret effect by thermodiffusion. In principle, the Fick diffusion coefficient, thermal diffusivity, kinematic viscosity, and Soret coefficient of binary mixtures can be determined simultaneously by the shadowgraph method, which analyzes the spatial and temporal behavior of light scattered at the non-equilibrium fluctuations resulting from the concentration gradient. In a typical shadowgraph experiment, series of pictures of the investigated fluid layer are recorded with a high-speed camera. By subtracting the recorded pictures, the spatial and temporal behavior of the scattered light and, thus, of the fluctuations becomes visible and can therefore be analyzed.





The student working on this thesis/position is going to contribute to the development of the shadowgraph method towards a routine measurement technique for the determination of Fick diffusion coefficient and thermal diffusivity in binary fluid mixtures. For this, several binary hydrocarbon mixtures are to be investigated with systematic variations of the applied temperature gradient, which is realized by varying its orientation and the fluid layer thickness. From the performed measurements, information about the measurement uncertainties that can be achieved for fluid mixtures with various properties when applying the different configurations as well as the limitations of the method should be gained. The findings from this work will serve for the development of a strategy for the application of the shadowgraph method in routine measurements for the accurate determination of diffusion coefficients in arbitrary binary fluid mixtures.

For the offered master thesis/student position, we are looking for a committed student with interests in the fields of optical metrology and thermophysical property research. We offer a multidisciplinary and international working environment with excellent potential for scientific and personal development. Basic knowledge of MATLAB can be helpful but is not required.

Start of the thesis: as soon as possible

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