Friedrich-Alexander-Universität
Technische Fakultät

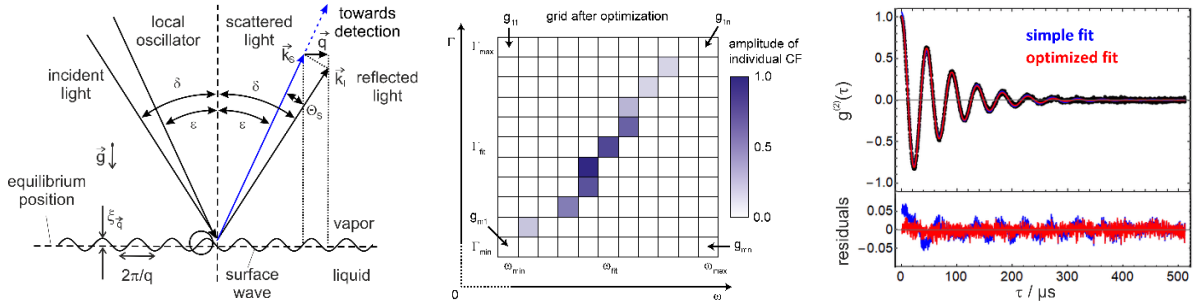
The **Institute of Advanced Optical Technologies – Thermophysical Properties (AOT-TP)** offers a

Master's Thesis

with the tentative title

Accurate determination of viscosity and surface tension by surface light scattering in presence of line broadening effects

Surface Light Scattering (SLS) is a well-established technique for the determination of viscosity and surface or interfacial tension with high accuracy in a non-invasive way. This is possible by probing thermal fluctuations at phase boundaries, whose dynamics is reflected by the temporal behavior of the scattered light intensity. Continuous developments of the SLS technique open up further application possibilities in thermophysical property research with strong reference to process engineering, including its on-line or in-line operation. Here, process-relevant fluids are often opaque and non-transparent, which is why SLS experiments need to be performed in reflection geometry employing small wave vectors of the probed surface fluctuations. In this range, however, line broadening effects originating from experimental uncertainties in the definition of the wave vector are present, which cause a systematic over- and underestimation of the determined viscosity and surface tension, respectively. To address this problem, physically solid evaluation approaches are required, yet lacking so far.



At AOT-TP, strategies are developed that aim at the determination of accurate viscosity and surface tension data from SLS experiments under small wave vectors that are subjected to line broadening effects. Amongst different conceivable strategies, one promising data evaluation method that relies on a Monte-Carlo-based optimization has already been developed. Without making prior assumptions about the underlying distribution of wave vectors, the method allows to decompose the measured SLS signal in form of a correlation function represented by the superposition of individual contributions in form of damped oscillations. The information obtained is eventually used as input for solving the hydrodynamic theory in its exact form.

The major task of the master's thesis is the further development of the SLS technique for its application towards a reliable determination of viscosity and surface tension in the presence of line broadening effects. For this, both theoretical and experimental work will be necessary. The theoretical work includes the further development of the data evaluation strategies, which in case of a successful evaluation includes the optimization of the program codes used. Complementary, experimental investigations will be carried out on selected systems. This should allow to validate the evaluation procedure and to examine whether additional adaptions to the existing setup are necessary for its reliable application in the range of small wave vectors.

For the described thesis, we are looking for a committed student with interests in the fields of optical metrology and thermophysical property research. 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

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