PhD Projects
"Advanced X-ray and Neutron Scattering in Molecular and Nanomaterials"

The research group of Prof. Dr. Frank Schreiber at the University of Tübingen deals with the physics of molecular and biological materials using X-ray and neutron scattering. The main research areas are materials for photovoltaics (such as organic semiconductors and organic-inorganic halide perovskites), proteins in solutions and at the interfaces, and complex nano-structured materials. For further information, please visit our group web page at www.soft-matter.uni-tuebingen.de.

Currently, we can offer several options for interesting PhD projects in these research areas.

The projects:
Candidates interested in one of the following topics are particularly encouraged to apply:

- **Fabrication of perovskite films for photovoltaic applications**. Lead-halide perovskites are prospective materials for photovoltaics because of their efficiency, tolerance to defects and scalability of production. In this project, we study the formation of the perovskite thin films using our own spin-coater. The candidate will use time-resolved X-ray scattering in grazing incidence (GISAXS/GIWAXS), Atomic Force Microscopy (AFM), photoluminescence spectroscopy (PL) and other characterization techniques in our laboratory and synchrotron sources to reveal the details of formation of perovskite structure from the precursors and optimize the fabrication process. We also seek to combine the electrical, structural, and optical measurements to study the performance of perovskite-based solar cells *in operando*.

- **X-ray nano-diffraction studies of complex materials and nanodevices**. The candidate will perform X-ray scattering experiments with nanofocused beams to study the structure of self-assembled superlattices of nanoparticles. Such superlattices are the key element for many prospective applications, including light-emitting diodes (LEDs) and electro-optical modulators.

- **Dynamics of protein crystallization in bulk and at interfaces**. In this project, we seek to understand the structure and dynamics of protein molecules in concentrated solutions and understand the formation and growth of protein crystals. The candidate will use optical microscopy, quartz crystal microbalance with dissipation (QCM-D), Small-Angle X-ray Scattering (SAXS), X-ray Photon Correlation Spectroscopy (XPCS) and Dynamic Light Scattering (DLS) techniques to study the dynamics of proteins in solutions and of their crystallization in bulk and at interfaces.

- **Neural networks and machine learning strategies for the analysis of scattering data**. Large amount of scattering data obtained in our group requires development of the advanced analysis techniques. In this project, the candidate will design and use machine learning (ML) tools to classify and analyze X-ray and neutron scattering data. This project also includes implementation of FAIR concepts (Findability, Accessibility, Interoperability and Reusability) into the experimental data bases and analysis pipeline.

The place:
The University of Tübingen is one of the eleven Germany's Universities of Excellence. It provides top-level research and teaching aimed at finding solutions to future challenges in a globalized society. The University has around 28,000 students and more than 500 years of academic tradition. It is continuously placed among Germany's best in national and international rankings.

Your qualifications:
As a candidate, you should have good communication skills, an interest in detail and motivation to familiarize yourself with new subject areas. Both working independently and working in a team, e.g. during the measurement campaigns, is particularly important. Knowledge of programming languages such as Python is an advantage. Practical lab skills and enjoying experimental work is also a plus. Knowledge of German is not necessary, but will be considered as an advantage.

How to apply:
Your application should be accompanied by a cover letter describing motivation, skills and any special achievements. Furthermore, a CV and a transcript of records should be added. The positions can be filled immediately. Please send your application as one PDF-file or any related inquiries to softmatter@ifap.uni-tuebingen.de