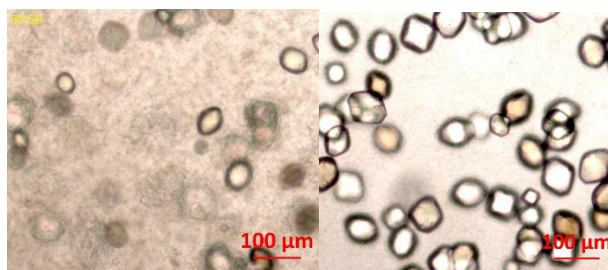
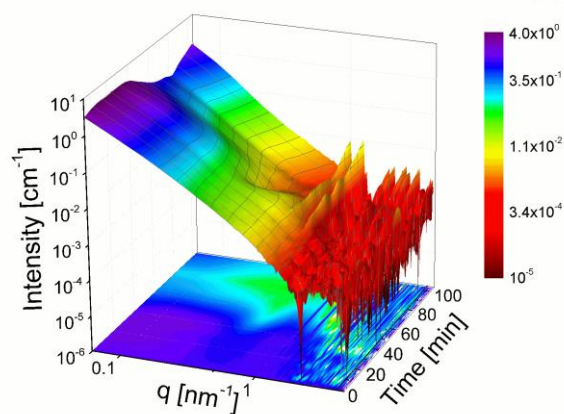
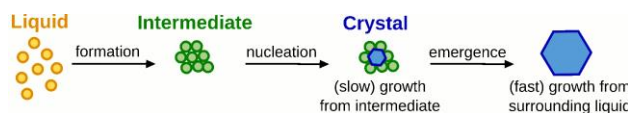




## PhD Opening in Protein Biophysics

### Real-Time Study of Protein Crystallization

According to the classical nucleation theory, nucleation starts as solute molecules reversibly aggregate in supersaturated solutions and form nuclei with the exact density and structure of the crystals in the final stage. While classical nucleation theory provides a successful description in many systems, studies on the crystallization of proteins and colloids as well as on bio-mineralization have shown features beyond the classical view. According to the recently proposed two-step nucleation mechanism, the two order parameters (density and structure) develop sequentially instead of simultaneously, i.e. a metastable intermediate phase (MIP) forms first from the supersaturated solution, and nucleation occurs afterwards inside the MIP. Despite the existing theoretical concepts, clear experimental evidence and suitable methods to distinguish the early stage of nucleation are rather rare - in particular, when aiming for an ensemble average of the rare-event nucleation process for a real system. Here we aim to understand the nucleation mechanisms behind crystallization and the exact pathway followed by crystal growth. In particular, we use multivalent metal ions to control the phase behavior in protein solutions. The main techniques used for this project will be real-time small angle x-ray scattering (both synchrotron and lab-source SAXS) and optical microscopy. Complementary techniques including dynamic and static light scattering are available in the lab.



Non-classical nucleation and crystal growth in protein crystallization followed by real-time optical microscopy and SAXS [1].

**Starting time:** Applications will be considered until the position is filled.

**Working place:** University of Tübingen

**Application:** Candidates with a master degree in physics, physical chemistry, or material science with a strong interest in scattering experiments are encouraged to send us their applications, CVs, and preferably contact details of one reference.

**Contact:** [Softmatter.tuebingen@gmail.com](mailto:Softmatter.tuebingen@gmail.com)

**References and further information:**

[www.soft-matter.uni-tuebingen.de](http://www.soft-matter.uni-tuebingen.de) (see under publications and open positions)

1. A. Sauter et al., J. Am. Chem. Soc. **137** (2015) 1485.
2. F. Zhang et al., J. Appl. Cryst. **44** (2011) 755.
3. F. Zhang et al., Phys. Rev. Lett. **101** (2008) 148101.