Physik der Molekularen und Biologischen Materie
Arbeitsgruppe Prof. Dr. Frank Schreiber
Institut für Angewandte Physik

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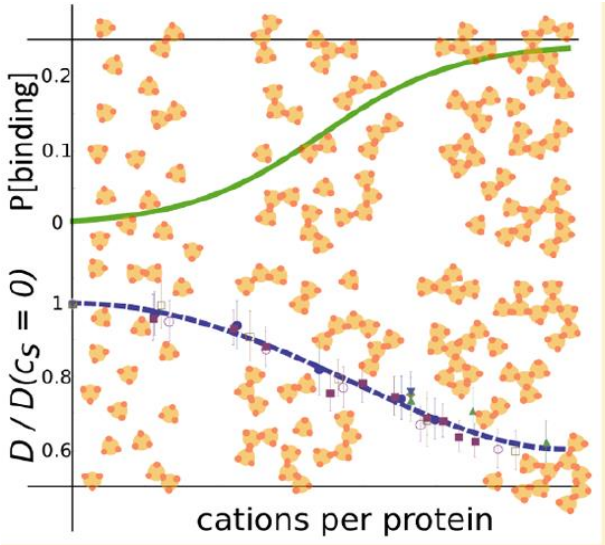
Master and Bachelor Project: Modeling and analysis of neutron scattering experiments for protein diffusion and cluster formation

Project description:

The study of dynamic properties of protein clusters is of high importance because they serve as precursors for protein condensation related phenomena, such as the aggregation, crystallization and fibril formation. In our research group we use multivalent ions to tune the effective interactions in protein solution and their phase behavior. In particular, the bridging effect of multivalent metal cations can generate a series of competing interactions which is essential for the formation of protein nano-clusters with lifetimes ranging from nanoseconds to seconds.
You will analyse datasets for different protein and salt concentration which have been collected a high-resolution technique called "neutron spin echo". From it you will extract parameters of the diffusion of the system, giving information about the lifetime, the size and the stability of the clusters. The results will be compared to previous complementary experimental studies[1, 2] and simulations [3]. You will contribute in connecting these studies to have a general understanding of the process of cluster formation.

In the project you will acquire knowledge in:

- Data analysis using Matlab or Python
- Dynamical processes in protein solutions
- Neutron spectroscopy



Remarks: This project can be done as a part of independent studies or a bachelor or a master thesis. It can be done fully online at home at the computer with supervision by email and skype.

Starting time: immediately

Candidates interested in soft-matter physics and data analysis with basics knowledge of MATLAB or Python are encouraged to apply for this project.

Contact: anita.girelli@uni-tuebingen.de or frank.schreiber@uni-tuebingen.de

References and further information:

www.soft-matter.uni-tuebingen.de (see under publications and open positions)

1. Soraruf, D., et al., *Protein cluster formation in aqueous solution in the presence of multivalent metal ions - a light scattering study.* Soft Matter, 2014. **10**(6): p. 894-902.
2. Grimaldo, M., et al., *Salt-Induced Universal Slowing Down of the Short-Time Self-Diffusion of a Globular Protein in Aqueous Solution.* The Journal of Physical Chemistry Letters, 2015. **6**(13): p. 2577-2582.
3. Bleibel, J., et al., *Two time scales for self and collective diffusion near the critical point in a simple patchy model for proteins with floating bonds.* Soft Matter, 2018. **14**: p. 8006-8016.