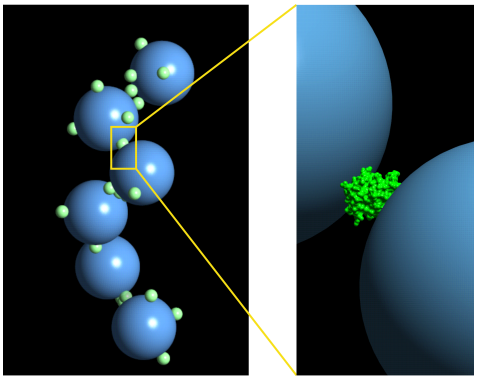
Project B1: Protein assembly on silica nanoparticles

Project leader: **Findenegg (TUB)**
Co-supervisor: **von Klitzing (TUB)**
US-Partners: **Velev (NCSU)**

Outline. In the first phase of Project B 1.2, Bhuvnesh Bharti is studying the adsorption of surfactants and globular proteins onto silica nanoparticles, in order to assess the effect of surface curvature on the self assembly of these molecules. For lysozyme it was found that the adsorbed protein molecules tend to link silica particles and in this way cause pronounced bridging flocculation. The Ph.D. project of B. Bharti is now focusing on this protein-induced aggregation of the silica particles.[1,2] For the second phase of Project B 1.2 it is planned to look for ways how to suppress particle aggregation, e.g. by surface modification of the articles, and then to study in detail the influence of particle size and protein-specific effects on the protein - particle interaction. Major topics of this Ph.D. project will be:



– Protein adsorption onto silica particles with chemically modified surface:
  In order to suppress flocculation in the protein–silica systems, particles with chemically modified surface will be prepared and the stability of the dispersion in the presence of selected proteins will be checked.

– Protein-specific effects
  Effects of the nonuniform charge distribution on the protein (leading to a more or less pronounced dipole moment) and of the rigidity of the protein structure (hard and soft proteins) on the interaction with the silica nanoparticles will be studied.

– Effect of particle size on the surface assembly of proteins
  Surface curvature of the silica particls can be controlled by the particle size. The effect of surface curvature on the protein – particle interaction and the encymatic activity will be studied for hard and soft proteins.

In cooperation with Prof. v. Klitzing we plan to study the effect of protein adsorption on the interaction between silica surfaces having much weaker surface curvature, using colloidal-probe AFM.

Complementary work in US partner group. In cooperation with Prof. O. Velev (NCSU) we plan to extend the study of chain formation of oppositely charged colloids induced by AC electric fields[3] to the domain of nanosized particles (silica nanoparticles and proteins).

[1] B. Bharti, J. Meissner, G.H. Findenegg, Langmuir 27 (16) 9823-9833 (2011)
[2] B. Bharti, G.H. Findenegg, O.D. Velev, (2012)
[3] B. Bharti, O.D. Velev, G.H. Findenegg, (2012)