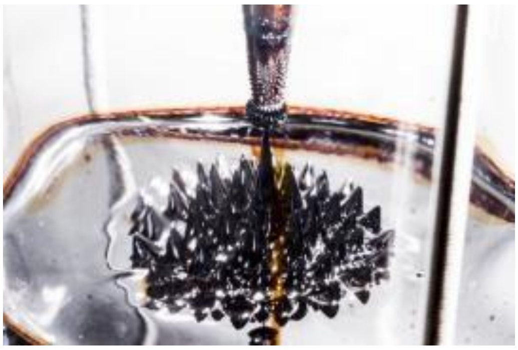
PHYSICAL AND COLLOID CHEMISTRY (FCC)



The research in the Physical and Colloid Chemistry Group involves the self-organization of colloids, nanoparticles, and macromolecules. Besides that we develop and study model systems inspired by biology. We are interested in the structure and formation dynamics of (liquid) crystals and magnetic colloids, and random packings of colloidal spheres, rods, and plates as well as particles and macromolecules with more complex shapes and interactions.

Our research can roughly be divided into five parts.

1. Development of new model systems (which includes chemical synthesis); recent examples include colloidal cubes, particles with attractive patches, deformable particles, and magnetic dipolar spheres. This part also includes particle surface functionalization with polymers or organic molecules of interest, providing interesting openings for more synthetic chemistry-oriented students
2. Study of the structure and dynamics of dispersions of colloids or nanoparticles by optical (confocal) and cryogenic electron microscopy, by scattering of X-rays, neutrons and light, or by analytical ultracentrifugation, membrane osmometry and magnetization measurements. This part comprises advanced techniques, including homemade set-ups such as the charge sensor, that will appeal to students with a more physics-oriented interest.
3. Development of theoretical models. Theory is an important part of almost all the projects in our group and is not limited to colloids. For students, who (also) would like to pursue theoretical modelling, we usually have a few purely theoretical (student) projects running. Recent examples are the properties of random packings, thermodynamics of magnetic colloids and charged interfaces, the stability of virus shells, and the statistical mechanics of genetic regulation.
4. Biology inspired model systems. We develop and study relatively simple model systems for allosteric behavior as well as in-vitro methods for transcription regulation. In parallel we develop theoretical models based on equilibrium and non-equilibrium statistical thermodynamics, see (3.).
5. A new addition to the research group is the investigation of nonequilibrium soft matter structures. An example are bicontinuous interfacially jammed emulsion gels (bijels). We study the formation dynamics of bijels by high speed (confocal) video microscopy and interfacial techniques. This research shows potentials for applications in catalysis, membrane separations and energy generation/storage.

COLLABORATIONS AND INTERNSHIPS

There are several collaborations with industry (DSM, AKZO, Shell, OCE) as well as universities abroad (Edinburgh, Lund, New York, Paris, just to name a few) in which students may participate.

REQUIREMENTS

We strongly recommend the Colloid Science course (SK-MCS) and Toy Models (BETA-MTOYM).

FOR MORE DETAILS CONTACT

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