CPP 48: Colloids and Complex Liquids III

Time: Friday 10:15–11:30 Location: H39

Topical Talk CPP 48.1 Fri 10:15 H39

Structural arrangement and picosecond dynamics of phospholipids in colloidal systems — •Tobias Unruh, Sebastian Busch, and Martin Schmiele — Technische Universität München, Forschungsneutronenquelle Heinz Maier-Leibnitz and Physik Department E13, 85747 Garching

Phospholipids (PL) are extensively studied for decades mainly because they form the dominant constituent of biological membrans. Furthermore, PL are widely used for stabilization of dispersions, solubilization of hardly soluble substances, and as liposomes and vesicles in food and pharmaceutical industry. However, only little is known so far about the molecular arrangement and dynamics of the stabilizing PL layers in native, technological relevant nanodispersions.

In this talk it will be demonstrated that it is possible to gain detailed structural information about the PL stabilizer layer in nanodispersions by combining X-ray and neutron small angle scattering studies with ab initio calculations of the complex scattering patterns. The mobility of PL molecules in the liquid crystalline phase but also in the stabilizer layer of nanodispersions was studied by quasi elastic neutron scattering. Using this method it could be observed that on a picosecond time scale PL molecules perform rather a directed flow-like (collective) motion than a random walk-like diffusive motion. This observation is essential for the understanding of transport processes in biological membranes over distances in the lower nanometer range and is found to be in excellent agreement to recent molecular dynamics simulations.

CPP 48.2 Fri 10:45 H39

On the diffusion of circular domains on a spherical vesicle — •Saeedeh Aliaskarisohi and Thomas.M Fischer — Institut fuer Experimentalphysik, Universitaet Bayreuth, 95440 Bayreuth, Germany

Tracking the motion of lipid domains on a vesicle is a rheological technique allowing the measurement of surface shear viscosities of vesicular lipid phases. The ratio of surface to bulk viscosity defines a viscous length scale. Hydrodynamic interactions split the motion of the domains into different modes of diffusion. The measurability of surface shear viscosities from any mode of diffusion is limited to viscous length scales between the radius of the domains and the radius of the vesicle. Switching between the various modes of diffusion is a trade between sensitivity gained and resolution lost by the hydrodynamic interactions leaving the measurability unchanged. Measurability drops with the number of domains making single-domain rheology the best technique to measure surface shear viscosities. Ultimately confinement of the domains to small vesicles renders measurements of surface rheological properties with domain tracking rheology impossible. Experiments on domains in vesicles of a mixture of dioleoyl phosphatidylcholine (DOPC),dipalmytoylphosphatidylcholin(DPPC),and cholesterol(Chol) exhibit diffusion that is entirely controlled by dissipation into the water. The diffusion is suppresed compared to the diffusion of isolated domains in a flat membrane due to confinement to the curved vesicle and by hydrodynamic interactions between the domains. Effects of surface shear viscosity can be neglected.

CPP 48.3 Fri 11:00 H39

Flow dynamics in anisotropic quasi two-dimensional liquids — •Kirsten Harth, Alexey Eremin, and Ralf Stannarius — Otto-von-Guericke-Universität Magdeburg, Institut für Experimentalphysik

Thin free-standing films of tilted thermotropic smectic phases represent the simplest quasi two-dimensional anisotropic liquids. These mesophases possess a layered structure where mesogens can flow liquid-like within the layer plane. Coupling between orientation and flow fields within the film are unique to such systems.

We investigate the relaxation of specially prepared initial non-equilibrium states in three particularly simple geometries. Experimental observations are made with a polarising microscope. For a theoretical analysis, the dynamic equations - the anisotropic incompressible Navier-Stokes equation and the torque balance equation - are solved using standard finite element methods. We observe two essentially different types of stick-slip motion around central vortices (defects of the director field with topological strengths ± 1). It is demonstrated that macroscopic flow patterns are generated by the inhomogeneous director relaxation, and vice versa.

We show that a neglection flow coupling in the description of relaxation processes leads to large quantitative and even qualitative errors. Comparison of experiments and simulations yields information on viscosity coefficients and elastic constants of the mesophase.

CPP 48.4 Fri 11:15 H39

Coarsening and Structure analysis of thermotropic liquid crystal foams — •Torsten Trittel, Thomas John, and Ralf Stannarius — Otto-von-Guericke-Universität Magdeburg

Foams made from surfactant solutions (aqueous foams) are well investigated and understood, but so far, there has been no report of properties of thermotropic liquid crystal (LC) foams, which can be made from pure smectic material. This type of foams has distinct microscopic properties, compared to soap foams. Owing to their inner structure, they are much more stable than aqueous foams. In our experiments, we investigate two-dimensional foams, made from smectic A LC-material, by means of digital image analysis. We focus on the temporal evolution (ageing) and describe quantitatively the asymptotic behaviour. Fundamental scaling laws are derived for the mean cellarea, number of cells, distribution of n-polygons, Aboav-Weaire-law, etc.