CPP 2 SYMPOSIUM: Dynamics of multi-component fluids II

Zeit: Freitag 11:15–12:30 Raum: TU C243

Hauptvortrag

CPP 2.1 Fr 11:15 TU C243

Non-equilibrium Dynamics of Giant Vesicles — •Hans-Günther Döbereiner — Departments of Biology and Physics, Columbia University, New York, NY 10027

I will review our work on the dynamics of giant lipid vesicles and polymersomes out of chemical and/or mechanical equilibrium. Phospholipid vesicles under prolonged attack of the enzyme phospolipase C exhibit lateral phase separation coupled to a pronounced morphological transition of the membrane [1]. Further, I will discuss the morphological relaxations observed in temperature [2,3] and pH [4] jump experiments, respectively.

[1] K. A. Riske and H.-G. Döbereiner, Biophys. J. **85**, 2352-2362 (2003).

[2] C. K. Haluska, W. T. Góźdź, H.-G. Döbereiner, S. Förster, and Gerhard Gompper, Phys. Rev. Lett. **89**, 238302 (2002).

[3] A. A. Reinecke and H.-G. Döbereiner, Langmuir **19**, 605 (2003).

[4] H.-G. Döbereiner, P.G. Petrov and K.A. Riske, J. Phys.: Condens. Matter **15**, S303 (2003).

CPP 2.2 Fr 11:45 TU C243

Dynamics of elastic micro-capsules in shear flow — •Reimar Finken and Udo Seifert — II. Intstitut für Theoretische Physik, Universität Stuttgart, 70550 Stuttgart

The dynamics of elastic capsules with finite bending rigidity subjected to linear shear flow is examined. We present a systematic expansion of the motion of a quasispherical capsule for small deformation and explore the phase diagram of possible motions (tank-treading and tumbling). To first order in the displacements the equations of motion can be reduced to the solution of a tridiagonal system of linear equations. The second order expansion admits a systematic exploration of the tank-treading and tumbling behaviour. The expansion in normal modes is accompanied by numeric simulations of the fluidics.

Shear flow induces regions with compressive and expansive stresses on the membrane. Since elastic membranes cannot resist high compressive stress, they react to compression in one direction by wrinkling, as has been observed experimentally (Walter et al., Colloids and Surfaces A 183-185, 123 (2001)). We present a theory predicting the amplitude and wavelengths of these wrinkles as a function of the elasticity coefficients. This will enable experimentalists to extract elasticitity data from shear flow experiments.

CPP 2.3 Fr 12:00 TU C243

Hierarchical Self-Assembly of CdSe Nanoparticles: Capsules, Membranes and Sensing Devices — •Alexander Böker[1], Yao Lin[2], Heiko Zettl[1], Kevin Sill[2], David Cookson[3], A.D. Dinsmore[4], Todd Emrick[2], and Thomas P. Russell[2] — [1]Lehrstuhl für Physikalische Chemie II, Universität Bayreuth, 95440 Bayreuth, Germany — [2]Department of Polymer Science and Engineering, University of Massachusetts, Amherst, MA 01003, USA — [3]Australian Synchrotron Research Program, Bld. 434, APS, Argonne IL 60439, USA — [4]Department of Physics, University of Massachusetts, Amherst, MA 01003, USA

We report on the self assembly of ligand stabilized CdSe nanoparticles at oil-water or polymer-polymer interfaces as templates for the generation of encapsulation and delivery as well as sensing devices. Furthermore, we studied the dynamics of the nanoparticle self-assembly and the structures formed at a fluid interface, using a pendant drop tensiometer, confocal fluorescence microscopy, TEM, FE-SEM and in-situ GISAXS. In general, we find a monolayer of particles exhibiting liquid-like behavior and ordering at the interfaces. Crosslinking of the nanoparticle assembly using surface functionalities affords robust membranes that maintain their integrity even when they are removed from the interface, while the properties unique to the nanoparticles are preserved.

CPP 2.4 Fr 12:15 TU C243

Pattern formation during membrane adhesion — •Thomas R. Weikl — Max Planck Institute of Colloids and Interfaces, Theory Division, 14424 Potsdam

Functional domains in biological membranes are often highly dynamic. An intriguing example are the domain patterns formed during T cell adhesion. The patterns are composed of domains which either contain short TCR/MHCp receptor-ligand complexes or the longer LFA-1/ICAM-1 complexes. During T cell adhesion, the domains evolve in a characteristic pattern inversion: The final T-cell pattern has a bull-eye shape with a central TCR/MHCp domain, whereas the intermediate pattern is inverted with the TCR/MHCp complexes at the periphery of the bull eye. We study the pattern formation dynamics in a statistical-mechanical model for the adhesion of multicomponent membranes. In this model, the domain formation is driven by the length difference between the TCR/MHCp and the LFA-1/ICAM-1 complexes. We obtain several dynamic regimes with distinct domain patterns at intermediate times, and propose a novel self-assembly mechanism for the formation of the intermediate inverted T-cell pattern. This mechanism is based (i) on the initial nucleation of numerous TCR/MHCp microdomains, and (ii) on the diffusion of free receptors and ligands into the cell contact zone. The formation of the final T-cell pattern requires active cytoskeletal transport processes in our model, in agreement with experimental findings.