CPP 77: Special Session in Honor of the 75th Birthday of Siegfried Hess: Non-equilibrium dynamics of anisotropic fluids (Joint session DY, CPP)

Time: Friday 9:30–11:30   Location: BH-N 243

Invited Talk   CPP 77.1   Fri 9:30   BH-N 243
The "shear-gradient concentration coupling instability": non-uniform flow of sheared hard-sphere glasses. — •Jan K.G. Dhont — Forschungszentrum Juelich, Germany

There are several types of shear-induced instabilities in soft-matter systems, like vorticity- and gradient-banding. The microscopic origin of these two instabilities is by now well understood. There is, however, an instability that can be referred to as *the Shear-gradient Concentration Coupling instability* (the SCC-instability) that has been largely ignored since its phenomenological description a few decades ago. This instability is due to a postulated shear-gradient induced mass flux together with a strong coupling of the stress to concentration. The origin of the shear-induced mass flux resulting from direct interactions is so far not understood, and explicit expressions for the corresponding transport coefficient have therefore not been derived. In this presentation, the origin of this mass flux is discussed, an explicit expression for the transport coefficient is presented, and numerical results are discussed for the stationary non-uniform flow profiles and concentration profiles of an initially SCC-unstable system, which will be compared to experiments on hard-sphere glasses.

Invited Talk   CPP 77.2   Fri 10:00   BH-N 243
Active anisotropic fluids — •Sriram Ramaswamy — TIFR Centre for Interdisciplinary Sciences, Tata Institute of Fundamental Research, Hyderabad 500 075 India

The study of nonequilibrium phenomena in anisotropic fluids has taken interesting new directions recently thanks to the growing interest in the collective self-propulsion. My talk will summarise new developments from our group's work on fluids of self-driven orientable particles, in vibrated granular monolayers and active colloids.

Invited Talk   CPP 77.3   Fri 10:30   BH-N 243
Flow properties of anisotropic fluids — •Sebastian Heidenreich[1], Sabine H. L. Klapp[2], and Markus Bär[1] — [1]Physikalisch Technische Bundesanstalt, Berlin, Germany — [2]Technische Universität Berlin, Berlin, Germany

From liquid crystal polymers to suspensions of bacteria anisotropic fluids are ubiquitous in nature and technology. The flow exhibits intriguing phenomena like flow alignment, shear banding, tumbling, shear thickening/thinning, large-scale correlation and mesoscale turbulence. The emergence of such fascinating aspects is often related to the anisotropy and to the out-of equilibrium character of the considered system. In the first part of our resentation we review selected flow phenomena of passive fluids with anisotropy. We discuss the role of the order parameter like the alignment tensor for the description of the flow properties. In particular, we introduce the relaxation equation for the alignment tensor coupled to the hydrodynamic flow and discuss the orientational dynamics in the shear flow. In the second part of the talk we focus on active fluids like dense bacterial suspensions and we introduce the governing hydrodynamic equations for self-sustained individuals that are swimming in a Newtonian fluid. We discuss the relationship to the passive counterpart and finally present recent work on mesoscale bacterial turbulence.

Invited Talk   CPP 77.4   Fri 11:00   BH-N 243
Concluding Remarks — •Siegfried Hess — Institut für Theoretische Physik, Technische Universität Berlin, Germany

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