Seminar des Graduiertenkollegs 1276

UNIVERSITÄT DES SAARLANDES

Strukturbildung und Transport in komplexen Systemen

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Dynamics of active particle in external flow field

Dynamics of active particles has attracted much attention in the field of nonequilibrium physics. A lot of examples of active particles are found in artificial colloidal swimmers with fixed stable shapes, but there are also cases in which the particles are deformable and do change shape during their motion. Such deformability is of basic importance for active droplets but is also relevant for living swimmers such as protozoa and other microorganisms. Therefore a basic theoretical description for active soft particles is needed. In a quiescent solvent, dynamical equations of motion were recently put forward which couple the particle position and deformability. However, in most practical situations, various external fields are present to influence the particle motion. They are, for instance, induced by a chemo-attractant, phototaxis, and gravity. An important particular case is a solvent flow field such as a Couette flow with a constant shear gradient or a Poiseuille flow through tubes. There are several studies of rigid self-propelled particles in various shear geometries. However, despite its practical relevance, the motion of a deformable self-propelled particle in a solvent flow has not been considered theoretically. In this seminar, we would like to present our recent studies of dynamics of an active soft particle in external flow field. Based on symmetry considerations, we propose coupled nonlinear dynamical equations for the particle position, velocity, deformation, and rotation [1]. We considered the motion of an active soft particle in two types of flow field as examples. One is a linear shear flow as a simplest case [1] and the other is a swirl [2]. In the latter case, we investigate capturing and scattering dynamics, inspired by the classical Kepler and Rutherford problem.

References:

[1] M. Tarama, A.M. Menzel, B. ten Hagen, R. Wittkowski, T. Ohta, and H. Löwen, J. Chem. Phys. 139, 104906 (2013).
[2] M. Tarama, A.M. Menzel, and H. Löwen, arXiv:1401.3606.

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Der Gast wird betreut von Karsten Kruse (Tel. 2763)

Alle Interessenten sind herzlich eingeladen

Die Sprecher des Graduiertenkollegs
Manfred Lücke und Ludger Santen