

Berlin Center for Studies of Complex Chemical Systems

Fritz-Haber-Institut der Max-Planck-Gesellschaft, Humboldt-Universität, Max-Delbrück-Centrum für Molekulare Medizin, Otto-von-Guericke-Universität Magdeburg, Physikalisch-Technische Bundesanstalt, Technische Universität Berlin, Universität Potsdam.

Seminar

Complex Nonlinear Processes in Chemistry and Biology

Honorary Chairman: G. Ertl.

Organizers: M. Bär, C. Beta, H. Engel, M. Falcke, M. J. B. Hauser, J. Kurths, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, and H. Stark.

Friday, 5th July, 2013, 16:00 s.t.

Address: Richard-Willstätter-Haus, Faradayweg 10, 14195 Berlin, U-Bahnhof Thielplatz (U3).

Pawel Romanczuk

Max Planck Institute for the Physics of Complex Systems

Beyond minimal alignment models: coarse-grained theories and pattern formation in self-propelled particle systems

The derivation of coarse-grained equations describing the large-scale behavior of active particles systems from microscopic models poses a long standing theoretical problem, where significant progress has been made in recent years. Here, I discuss our recent work on deriving a kinetic theory and hydrodynamic equation for self-propelled particles with selective attraction-repulsion interactions. The corresponding coarse-grained equations not only establish a direct link between the microscopic parameters and macroscopic parameters governing the large-scale dynamics of density and velocity fields, but allow us also analyze the instabilities of the disordered and ordered homogeneous states. They provide additional insights into the different phases and corresponding pattern formation phenomena observed in our model, which extend far beyond simple models of self-propelled particles, and include some fascinating generic phases of active matter, such as active nematic filaments and active smectic phases.