Berlin Center for Studies of Complex Chemical Systems e. V.

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, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, H. Stark**

Friday, 27th Mai 2011, 16:00 s.t.

Dr. Pawel Romanczuk

Max Planck Institute for the Physics of Complex Systems

Active Brownian particles - from individual to collective dynamics

Abstract

We consider first non-interacting self-propelled Brownian particles under the influence of active fluctuations. In contrast to passive fluctuations, associated with a stochastic environment (e.g. ordinary Brownian motion), active fluctuations are assumed to be a pure far from equilibrium phenomenon associated with the activity of the self-propelled particle. Here we consider active fluctuations, as independent stochastic processes in the direction of motion and velocity. We discuss the impact of active fluctuations in generic models of self- propelled particles in one and two spatial dimensions, discuss their stationary velocity and speed distributions as well as diffusion coefficients. We show that, for example, in two dimensions active fluctuations lead to an increased probability of low speeds and, as a consequence, to sharply peaked Cartesian velocity probability densities at the origin. Furthermore, we consider interacting (active) Brownian agents. Hereby we focus on the onset of collective motion due to escape and pursuit interactions, which are motivated by the recently suggested connection between collective motion and cannibalism in certain insects species. We show emergence of large scale collective motion for both interaction types and discuss their different impact on global dynamics. Finally, we discuss some applications of the escape+pursuit framework to modeling collective motion of desert locusts.

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