

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, 13th June, 2014, 16:00 s.t.

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Modeling crawling cell motility

Self-propelled motion, emerging spontaneously or in response to external cues, is a hallmark of living organisms. Systems of self-propelled synthetic particles are also relevant for multiple applications, from targeted drug delivery to the design of self-healing materials. Self-propulsion relies on the force transfer to the surrounding. While self-propelled swimming in the bulk of liquids is fairly well characterized, many open questions remain in our understanding of self-propelled motion along substrates, such as in the case of crawling cells or related biomimetic objects. Here we present a phenomenological model for crawling cells based on an advected phase field model and other reaction-diffusion equations. The force transfer from the cell to the substrate is explicitly taken into account, giving rise to complex modes of cell movement such as «bipedal» motion and «stick-slip» motion. The model captures the generic structure of the traction force distribution and faithfully reproduces experimental observations, like the response of a cell on a gradient in substrate elasticity (durotaxis). Collective states of motion such as concerted rotation arises for multiple interacting cells on patterned substrates.