

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, 11th October, 2013, 16:00 s.t.

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Phase reduction approach to synchronization of rhythmic spatiotemporal patterns in spatially extended systems

Spatially extended systems can exhibit a variety of rhythmic spatiotemporal patterns, such as localized oscillating spots, spiral waves, and target patterns in reaction-diffusion systems. These spatiotemporal patterns can be considered stable limit-cycle solutions to partial differential equations. In order to analyze synchronization dynamics of such rhythmic spatiotemporal patterns, we develop a phase reduction method for spatially extended systems, which provides simple one-dimensional description of the rhythmic spatiotemporal patterns. The phase sensitivity function, which quantifies linear phase response of the rhythmic spatiotemporal pattern to weak spatial perturbations, is obtained as a solution to the adjoint partial differential equation of the system. As an example, coupled layers of reaction-diffusion systems exhibiting oscillatory dynamics are analyzed using the developed method and interesting synchronization phenomena, such as multimodal phase locking, are found. Phase reduction approach to synchronization of Hele-Shaw convection cells will also be briefly presented. This work was done in collaboration with Tatsuo Yanagita and Yoji Kawamura.

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