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, 5 November 2010, 16:00 s.t.

Dr. Igal Berenstein

Biological Physics Group, Institute of Physics and Astronomy, University of Potsdam

Control of spatiotemporal chaos by flow in a reaction-diffusion-advection system

Abstract

We report spatiotemporal chaos in the Oregonator model of the Belousov-Zhabotinsky (BZ) reaction. Uniform oscillations and traveling waves are unstable and spatiotemporal chaos spontaneously develops in a regime, where the underlying local dynamics show stable limit cycle oscillations (diffusion-induced turbulence). We show that spatiotemporal chaos can be suppressed by a unidirectional flow in the system. With increasing flow velocity, we observe a transition scenario from spatiotemporal chaos via a regime of travelling waves to a stationary steady state. At large flow velocities we recover the known regime of flow distributed oscillations (stationary structure). We also investigated systems with a gradient in one of the parameters. We show that in such systems, localized domains of spatiotemporal chaos can be found if the gradient is sufficiently small, i.e., if the size of the chaotic domain is large compared to the diffusive length scale. Finally, we show that spatiotemporal chaos can be suppressed by allowing diffusive exchange of the activator between the reaction-diffusion system and a non-reacting layer. The type of pattern that is formed is independent of a flow in the non-reactive layer.

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

Information: Markus Radszuweit, Tel. (030) 314-27681, email: markus.radszuweit@ptb.de or radszuweit@itp.physik.tu-berlin.de