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Max-Delbrück-Centrum für Molekulare Medizin, Otto-von-Guericke-Universität
Magdeburg, Physikalisch-Technische Bundesanstalt, Technische Universität Berlin,
Universität Potsdam

Berlin Center for Studies of Complex Chemical Systems

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, October 24. 2014, 16:00 s.t.

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Scroll Ring Dynamics in Spatial Confinement

Non-planar excitation waves are exhibited by a variety of dissipative non-equilibrium systems including chemical waves, catalytic oxidation of carbon monoxide, social waves in bee colonies, and electrical activity in the heart muscle. We investigate a certain class of three-dimensional axisymmetric waves, known as scroll rings. Using the Belousov-Zhabotinsky reaction, it is possible to probe the dynamics of these rings in a chemical medium with adjustable height. The close proximity of the boundaries leads to dramatic changes in the dynamics. Intrinsic contraction of scroll rings can be damped and even reverted into an expansion of the organizing vortex ring, despite its positive filament tension. Furthermore, this results in a substantial increase in the lifetime of such a pattern, during which its frequency dominates the medium. We explain these observations with a kinematic model incorporating boundary effects that qualitatively exhibits all of the experimentally observed phenomena and is in quantitative agreement with numerical simulations.