Scroll Ring Dynamics under Spatial Confinement

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Non-planar excitation waves are exhibited by a variety of dissipative non-equilibrium systems, including chemical waves, fuel combustion, catalytic oxidation of CO, social waves in bee colonies and electrical activity in the heart muscle. We investigate a certain class of axisymmetric waves, called scroll rings. Using the ferroin-catalyzed Belousov-Zhabotinsky reaction, it is possible to study these rings in a chemical medium of adjustable height. The close proximity of the boundaries leads to dramatic changes of the dynamics, as the intrinsic contraction can be damped and even be reverted into an expansion of the organizing vortex ring. Furthermore this results in a substantial increase of the life time of such a pattern, during which its frequency dominates the medium. Observations from chemical experiments are in good agreement with numerical simulations based on parameters derived from the employed chemical concentrations and can be predicted qualitatively with a simple phenomenological model.