Abstract for GR-TR Conference on Statistical Mechanics and Dynamical Systems

Topic: Noise and Stochastic Processes Preference: Oral

Diffusive mixing versus reactive mixing in non-linear dynamical systems

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Non-linear, interacting particle systems are studied using both the Mean-Filed approach and Kinetic Monte Carlo simulations on lattice substrates.

First, the behavior of lattice compatible, non-linear dynamical systems will be explored, which at the mean-field level present conservative, **center-type** dynamics. It will be shown that the reduction of these systems on low dimensional lattice supports causes clustering and drives the systems away from their mean-field behavior. In particular, the conservative systems organize in a number of local oscillators of finite sizes. These spatially extended, local oscillators have random phases, are nonsynchronous and as a result global oscillations are suppressed.

If in addition, *reactive long range mixing* is introduced, the spatially extended system regains its mean-field behavior, i.e. the conservative global oscillations, when the reactivity range becomes comparable to the system size.

If instead of reactive mixing *diffusive long range mixing* is introduced, the behavior changes drastically. For small diffusion rates p the system retains its original form, i.e. clusters into local asynchronous oscillators. After the diffusion rate p crosses a critical point p_c all local oscillators synchronize into a stable, dissipative attractor of **limit-cycle** type. Thus, oscillations in these spatially extended systems emerge as the **Hopf-like** bifurcation in dynamical systems.

This conclusion is important in physics, chemistry and population dynamics because it points out that a long range diffusive mechanism can stabilize oscillatory systems. In particular, in systems described by conservative, center-type mean field equations which are sensitive to stochastic noise, the long range diffusion mechanism can drive them to global, stable oscillations.

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[3] A. Efimov, A. Shabunin and A. Provata, *submitted*.