ANOMALOUS SCALING OF PERTURBATIONS IN SPATIALLY EXTENDED CHAOTIC SYSTEMS WITH QUENCHED DISORDER

Ivan G. Szendro[1,2], Juan M. López[1], Miguel A. Rodríguez[1]

(1) Instituto de Física de Cantabria (IFCA), CSIC-UC, E-39005 Santander
(2) Departamento de Física Moderna, Universidad de Cantabria, Avda. Los Castros, E-39005 Santander

Recently there has been some interest in the growth of perturbations in spatially extended chaotic systems (SECS) and the correspondence to surface roughening phenomena [1]. It has been shown that in many cases the interfaces defined as the logarithms of the absolute values of the perturbations, which are equivalent to the first Lyapunov-vector, belong to universality classes known from surface roughening as for example the Kardar-Parisi-Zhang (KPZ) class. All the models studied up to now have in common that they describe spatially homogeneous systems. An important consequence of the equivalence of all spatial points is, that Lyapunov-vectors are not going to converge but keep fluctuating in time.
We have studied the effect, which the introduction of quenched disorder has upon this kind of systems. This is of some practical interest as in many SECS found in nature (e.g. weather) the homogeneity condition may not be fulfilled. We concentrated on the study of diffusively coupled modified tent-maps, which in the homogeneous case show KPZ behavior. Quenched disorder is introduced either in the diffusion or by tuning the Lyapunov-exponents of the maps at different lattice sites to different values. As expected the Lyapunov-vectors will now converge for $t \to \infty$. We have found the emergence of triangular structures, which grow in time until in the long time limit the structure of the interface is dominated by a single triangle with some fluctuations. Analyzing power spectra, we find that interfaces grow showing anomalous scaling of the generic class postulated in [2]. A Langevin-type equation with quenched noise, reproducing the described dynamics, is presented.

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[2] J.J. Ramasco et al. Phys. Rev. Lett. **84**, 2199 (2000).