Chaotic diffusion in randomly perturbed dynamical systems

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The impact of spatial disorder [1] and time-dependent noise [2] on diffusion in chaotic dynamical systems is studied. As an example, we consider deterministic random walks in a one-dimensional periodic array of scatterers modeled by a parameter-dependent coupled chaotic map. In computer simulations we find a crossover from deterministic to stochastic diffusion under variation of the perturbation strength related to different asymptotic laws for the diffusion coefficient. Typical signatures of this scenario are multiple suppression and enhancement of normal diffusion. These results are explained by simple theoretical approximations showing that the oscillations emerge as a direct consequence of the unperturbed deterministic diffusion coefficient, which is known to be a fractal function of control parameters [3].

[1] R.Klages, Phys. Rev. E 65, 055203(R) (2002)

[2] R.Klages, Europhys. Lett. 57, 796 (2002)

[3] R.Klages, *Microscopic Chaos, Fractals and Transport in Nonequilibrium Statistical Mechanics*, Advanced Series in Nonlinear Dynamics Vol.24 (World Scientific, Singapore, 2007), Part 1.