Stochastic modeling of diffusion in dynamical systems: two examples

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Consider equations of motion that generate dispersion of an ensemble of particles. For a given dynamical system an interesting problem is not only what type of diffusion it generates but also whether the resulting diffusive dynamics matches to a known stochastic process. I will discuss two examples of dynamical systems generating different types of diffusive transport: The first model is a soft Lorentz gas where a point particles moves through repulsive Fermi potentials situated on a triangular periodic lattice [1]. It is fully deterministic by displaying an intricate switching between normal and superdiffusion under variation of control parameters. The second model randomly mixes in time chaotic dynamics generating normal diffusive spreading with non-chaotic motion where all particles localize. Varying a control parameter the mixed system exhibits a transition characterised by subdiffusion [2]. For both models the diffusive dynamics are to some extent reproduced by simple stochastic approximations; however, there are also deviations.

[1] R.Klages, S.S.Gallegos, J.Solanpää, M.Sarvilahti, E.Räsänen, preprint arXiv:1811.06976 (2018)

[2] Y.Sato, R.Klages, preprint arXiv:1810.02674 (2018)