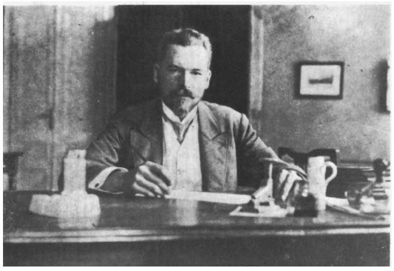

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Statisitical properties of random advection-diffusion

Thursday, 28 September 2023 11:25 (25 minutes)

We study the statistics of a one-dimensional randomly advected field with diffusion. The motivation for this setup comes from a straightforward interpretation as advection of particles in one-dimensional turbulence, but it is also related to a problem of synchronization of dynamical systems driven by common noise. A general class of lattice models describing the joint effect of random advection and diffusion for an ensemble of particles is introduced. It consists of a general microscopic random update rule and encompasses as specific cases, some models studied in the literature, like the Kang-Redner, Kipnis-Marchioro-Presutti, Takatasu-Taguchi etc. For finite lattices, we study both the coagulation of an initially spread field (interpreted as roughening), and the statistical steady-state properties. We distinguish two main size-dependent regimes, depending on the strength of the advection term and on the lattice size. Using numerical simulations and mean-field approach, we study the statistics of the field. For weak diffusion, we unveil a characteristic hierarchical structure of the field. We also connect the model and the iterated function systems concept.

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