

SUPERSLOW BIASED DIFFUSION IN A RANDOM POTENTIAL

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Superslow diffusion, i.e., diffusion of objects (particles) whose mean-square displacement or variance grows slower than any power of time, has been predicted in a number of systems. The so-called Sinai diffusion [1] represents the first and best known example of this type of diffusion. Other examples come from resistor networks, continuous-time random walks (CTRWs), charged polymers, iterated maps, two-dimensional lattices, etc. The common feature of all these examples is that the laws of superslow diffusion, or in other words the long-time behavior of the variance $\sigma^2(t)$, are given by a power function of the logarithm of time:

$$\sigma^2(t) \propto \ln^\nu t \quad (1)$$

($t \rightarrow \infty$, $\nu > 0$). An important question in this respect is if there exist laws of superslow diffusion that differ from (1). The answer is positive: It has been recently shown within the decoupled CTRW [2,3] that if the exceedance probability, i.e., the probability that the waiting time exceeds t , varies slowly at infinity then the corresponding laws of superslow diffusion form a broad class of slowly varying functions. Thus, the search for physical systems exhibiting superslow diffusion that does not follow the diffusion law (1) is a problem of current interest.

In this talk, we report on the solution of the above problem for particles moving under a constant force in a piecewise linear random potential. It is shown that, in addition to other types of anomalous biased diffusion considered in Ref. [4], in this case the superslow biased diffusion can also exist. We formulate conditions for this type of diffusion, establish the connection between the distribution of times that a particle spends moving with a constant velocity and the distribution of slopes of the potential, and derive the laws of superslow biased diffusion. Finally, the dependence of the variance growth on the slope distribution is analyzed in detail.

1. Ya.G. Sinai, *Theory Probab. Appl.* **27**, 256 (1982).
2. S.I. Denisov, H. Kantz, *Europhys. Lett.* **92**, 30001 (2010).
3. S.I. Denisov, H. Kantz, arXiv: 1102.2590.
4. S.I. Denisov, E.S. Denisova, H. Kantz, *Eur. Phys. J. B* **76**, 1 (2010).