

Abstract

Dichotomic Random Processes and Scaling Properties of One-Dimensional Anderson Model with Diagonal Disorder

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In this paper we study scaling and statistical properties of finite size Lyapunov exponent (LE) in a model of one-dimensional Anderson localization described by a tight-binding Hamiltonian with a correlated diagonal disorder. We consider a model, in which a dichotomic process describes the distribution of site energies. In a simplest case a dichotomic process corresponds to a random variable, which can only take two different values, while the length of segments with same energy are distributed according to a Poisson law. Such a system is characterized by two parameters, the rms fluctuation and the radius of correlation. Numerical Monte-Carlo simulations shows that the spectrum of the system can be divided in three regions with qualitatively different behavior LE. For the values of energy corresponding to extended states, which would exist in homogeneous systems with both values of site energies, the behavior is universal, and demonstrates single parameter scaling (SPS). In the spectral regions where extended states would have existed for the homogeneous system with one of the site energies, SPS fails, and behavior is non-universal. In the third region, where extended states would not have arisen in none of the possible homogeneous systems, behavior becomes universal again. We showed that for large enough correlation radius there exist a simple analytical description, which gives good agreement with numerical calculations for both regions with non-SPS behavior.

[¶]Presenter