
Statistics of coherent waves inside media with Lévy disorder

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Abstract

Structures with heavy-tailed distributions of disorder occur widely in nature. The evolution of such systems, as in foraging for food or the occurrence of earthquakes is generally analyzed in terms of an incoherent series of events. But the study of wave propagation or lasing in such systems requires the consideration of coherent scattering. We consider the distribution of wave energy inside 1D random media in which the spacing between scatterers follows a Lévy α -stable distribution characterized by a power-law decay with exponent α . We show that the averages of the intensity and logarithmic intensity are given in terms of the average of the logarithm of transmission and the depth into the sample raised to the power α . Mapping the depth into the sample to the number of scattering elements yields intensity statistics that are identical to those found for Anderson localization in standard random media.

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