

Séminaire de Probabilités et Statistique

Mardi 14 Mars 2023 à 14h00

Laboratoire Dieudonné

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Localization of a one-dimensional simple random walk among powerlaw renewal obstacles.

We consider a one-dimensional simple random walk killed by quenched soft obstacles. The position of the obstacles is drawn according to a renewal process with a power-law increment distribution. In a previous work, we computed the large-time asymptotics of the quenched survival probability. In the present work we continue our study by describing the behaviour of the random walk conditioned to survive. We prove that with large probability, the walk quickly reaches a unique time-dependent optimal gap that is free from obstacle and gets localized there. We actually establish a dichotomy. If the renewal tail exponent is smaller than one then the walk hits the optimal gap and spends all of its remaining time inside, up to finitely many visits to the bottom of the gap. If the renewal tail exponent is larger than one then the random walk spends most of its time inside of the optimal gap but also performs short outward excursions, for which we provide matching upper and lower bounds on their length and cardinality. Our key tools include a Markov renewal interpretation of the survival probability as well as various comparison arguments for obstacle environments. Our results may also be rephrased in terms of localization properties for a directed polymer among multiple repulsive interfaces.