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Large deviations for random walk in a random environment

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Random walk in a random environment is a discrete time Markov chain on \mathbb{Z}^d with random transition probabilities $\pi(x, x + y)$. The collection $\omega = (\pi(x, x + y))_{x,y}$ is the called the environment. If $(X_n)_n$ denotes the path of the "particle", $(T_{X_n}\omega)_n$ is a Markov chain on the space of environments Ω . Here, T denotes the spatial shift on Ω and the chain is called the "environment Markov chain". This approach, known as taking the point of view of the particle, is standard in the study of random media.

In this talk, I will ask the following vague question: "Conditioned on the particle having asymptotic velocity equal to a given atypical vector, how does the environment Markov chain behave?". My answer to various rigorous formulations of this question will involve equality of quenched and averaged rates in some cases, Doob transforms, level-2 large deviation principles, and minimizers of certain variational formulae.