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题目: Mixing time for the asymmetric simple exclusion process in a random environment

摘要: We consider the simple exclusion process in the integer segment $\llbracket 1, N \rrbracket$ with $k \leq N/2$ particles and spatially inhomogenous jumping rates. A particle at site $x \in \llbracket 1, N \rrbracket$ jumps to site $x - 1$ (if $x \geq 2$) at rate $1 - \omega_x$ and to site $x + 1$ (if $x \leq N - 1$) at rate ω_x if the target site is not occupied. The sequence $\omega = (\omega_x)_{x \in \mathbb{Z}}$ is chosen by IID sampling from a probability law whose support is bounded away from zero and one (in other words the random environment satisfies the uniform ellipticity condition). We further assume $\mathbb{E}[\log \rho_1] < 0$ where $\rho_1 := (1 - \omega_1)/\omega_1$, which implies that our particles have a tendency to move to the right. We prove that the mixing time of the exclusion process in this setup grows like a power of N . More precisely, for the exclusion process with $N^{\beta+o(1)}$ particles where $\beta \in [0, 1]$, we have in the large N asymptotic

$$N^{\max(1, \frac{1}{\lambda}, \beta + \frac{1}{2\lambda}) + o(1)} \leq t_{\text{mix}}^{N,k} \leq N^{C+o(1)}$$

where $\lambda > 0$ is such that $\mathbb{E}[\rho_1^\lambda] = 1$ ($\lambda = \infty$ if the equation has no positive root) and C is a constant which depends on the distribution of ω . We conjecture that our lower bound is sharp up to sub-polynomial correction. Joint work with Hubert Lacoin (IMPA, Rio de Janeiro).