Subgaussian Concentration and Rates of Convergence in Directed Polymers

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Abstract: We consider directed random polymers in $(d + 1)$ dimensions with i.i.d. disorder. We study the partition function $Z_{N,\omega}$ and establish exponential concentration of $\log Z_{N,\omega}$ about its mean on the subgaussian scale $(N/\log N)^{1/2}$. This is used to show that $\mathbb{E}[\log Z_{N,\omega}]$ differs from N times the free energy by an amount which is also subgaussian (i.e. $o(\sqrt{N})$), specifically $O(N^{1/2}(\log\log N)/(\log N)^{1/2})$.