Lower-Tail Large Deviations of the KPZ Equation

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Consider the solution of the KPZ equation with the narrow wedge initial condition. We prove the one-point, lower-tail Large Deviation Principle (LDP) of the solution, with time $t \to \infty$ being the scaling parameter, and with an explicit rate function. This result confirms existing physics predictions. We utilize a formula from Borodin and Gorin (2016) to convert the LDP of the KPZ equation to calculating an exponential moment of the Airy point process, and analyze the latter via stochastic Airy operator and Riccati transform.