How a finite potential barrier decreases the mean first-passage time

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What is an energy landscape which leads to the minimum of the mean first passage time between two points x_1 and x_2, whose energies are E_1 and E_2 ($E_1 > E_2$)? Naively, one might suggest that the solution is a linear potential drop between the two points. However, in our analysis we show that for an energy landscape consisting of two linear parts, a potential barrier with height $E_b > E_1$ leads to a decrease of the mean first passage time. The same effect is found for subdiffusive conditions.

Our a priori surprising findings are obtained analytically and supported by numerical analysis. Several approaches were used, namely, direct numerical solution of Fokker-Planck equation in Brownian case, numerical inverse Laplace transform of first passage time density obtained by solution of equation in Laplace space for Brownian and subbdiffusive motions, and Monte Carlo simulation approach for the both types of diffusion. Part of the results has been published in J. Stat. Mech. (2012) L03001.