
Fragility of the WKB approximation in the rare events problem

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Abstract

The analysis of the rates of rare events in fluctuating classical and quantum systems is often based on the WKB-type approximation. In this approximation, the calculation of the exponent of the rate is reduced to minimizing an effective action functional. The form of the functional is determined by the nature of the fluctuations. We show that the logarithms of the tail of the probability distribution and of the escape rate calculated this way can display a sharp change with the parameters of the system. We call this fragility. For the distribution over quasienergy of a modulated dissipative quantum oscillator, we show that the change occurs in the range that nonanalytically depends on the small parameter of the WKB approximation. We provide other examples of a nonanalytic behavior. To expand the context of the talk, we will also present experimental data from other groups on the observation of the scaling of the escape rates and the optimal escape paths in systems far from thermal equilibrium.

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