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Rare fluctuations in nonequilibrium systems: onset of singularities in the path distribution OLEG KOGAN, Michigan State Uniersity, University of Pennsylvania, University of Chicago, MARK DYKMAN, Michigan State University — Fluctuations in systems away from thermal equilibrium have features that have no analog in equilibrium systems. One of such features concerns large rare excursions far from the stable state in the space of dynamical variables. For equilibrium systems, the most probable fluctuational trajectory to a given state is related to the fluctuation-free trajectory back to the stable state by time reversal. This is no longer true for nonequilibrium systems, where the pattern of the most probable trajectories generally displays singularities. Here we study how the singularities emerge as the system is driven away from equilibrium, and whether there is a threshold for their onset. Using a resonantly modulated nonlinear oscillator as a model, we show that the singularities can emerge without a threshold if it takes an infinite time for the system to go to infinity along the optimal path in thermal equilibrium. We find the scaling of the location of the singularities as a function of the control parameter. If the system reaches infinity in finite time, there is a threshold for the onset of singularities, which we study for the model.

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