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Dependence of mean switching times on relative noise intensity in fast-slow dynamical systems STEPHEN TEITSWORTH, PAUL DANNENBERG, JOHN NEU, Duke University — Recently, we used a geometric minimum action method to analytically and numerically study the dependence of most probable escape paths (MPEPs) on relative noise intensities in a generic two-dimensional fast-slow dynamical system [1]. In this talk, we apply and extend this approach to study MPEPs and associated mean switching times in a quadratic integrate-and-fire model of single neuron dynamics as a function of relative noise intensity in the two dynamical variables. Here, one variable is associated with the membrane potential while the second is associated with membrane ionic permeability. Noise-induced switching times correspond to the rate at which spontaneous action potentials occur. The fast-slow nature of this system allows us to derive analytical expressions for both the MPEPs and mean switching times as functions of the relative noise intensity. Derived expressions are found to be in good agreement with both computational minimization of the geometric action as well as direct simulation of the underlying stochastic differential equations. [1] P. H. Dannenberg, J. C. Neu, and S. W. Teitsworth, Phys. Rev. Lett. 113, 020601 (2014).

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