Rare transitions in noisy heteroclinic networks

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We study white noise perturbations of planar dynamical systems with heteroclinic networks in the limit of vanishing noise. We show that the probabilities of transitions between various cells that the network tessellates the plane into decay as powers of the noise magnitude, and we describe the underlying mechanism. A metastability picture emerges, with a hierarchy of time scales and clusters of accessibility, similar to the classical Freidlin-Wentzell picture but with shorter transition times. We discuss applications of our results to homogenization problems and to the invariant distribution asymptotics. At the core of our results are local limit theorems for exit distributions obtained via methods of Malliavin calculus. Joint work with Hong-Bin Chen and Zsolt Pajor-Gyulai.