Noise-induced transition between different meta-stable states is one of prominent examples of rare events. These interesting behaviors in the dynamical systems perturbed by noise can only be observed with very low probability or over a very long time interval. However, these rare transitions are responsible for many most important physical, chemical or biological processes. Understanding these transitions is a key challenge both for mathematics and for computations. These transitions are also responsible for some puzzling instabilities in many physical models, which can not be well explained by linear theory or weakly nonlinear theory. In this talk we summarize the progress of this area and the works done by me and my collaborators.