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Lévy flights: transitions and meta-stability

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We consider a dynamical system $dX_t^\varepsilon = -U'(X_t^\varepsilon)dt + \varepsilon dL_t$ which can be seen as a deterministic system $dX_t^0 = -U'(X_t^0)dt$ perturbed by symmetric stable Lévy noise (Lévy flights) L of small intensity.

Using probabilistic argument, we determine the exit law of X^ε from intervals containing a unique asymptotically stable attractor of X^0. In the case of the double-well potential U, we study the asymptotics of the transitions times and metastable behaviour of the jump diffusion.

Due to the heavy-tail nature of the process L, our results differ strongly from the well known case of Gaussian perturbations (Freidlin–Wentzell theory).

Our research is motivated by works by P. Ditlevsen who observed stable noises in Greenland ice-core data.