Effects of noise and forcing in chaotic scattering

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In this talk we present a study of chaotic scattering phenomena in presence of noise [1,2] and periodic forcing [3], which are very typical in different physical situations such as the effect of companion galaxies, chaotic advection in open flows, among others. The presence of weak noise can induce longer transients in the survival probability of the particles in the scattering region as compared with the noiseless case. Besides, the study of the decay law versus the noise intensity reveals the presence of both, a local maximum and a local minimum which are related with the basin structure in phase space. On the other hand, we also investigate the effects of the forcing amplitude and the external frequency in both, the survival probability of the particles in the scattering region and the exit basins associated to phase space. We found an exponential decay law for the survival probability of the particles in the scattering region. A resonant-like behavior is uncovered where the critical values of the frequency and allow to escape the particles faster than for other different values [3]. On the other hand, the computation of the basins in phase space reveals the existence of Wada basins [4] depending of the frequency values. We provide numerical evidence of these facts, by using the Hénon–Heiles system as prototype model, and some rough theory that is in good agreement with the previous numerical results. This is joint work with M. A. F. Sanjuán, F. Blesa, R. Barrio and J. D. Bernal.

[1] J. M. Seoane, L. Huang, M. A. F. Sanjuán, and Y. C. Lai. Effect of noise on chaotic scattering. Phys. Rev. E 79, 047202 (2009).

[2] J. D. Bernal, J. M. Seoane, and M. A. F. Sanjuán. Weakly noisy chaotic scattering. Phys. Rev. E 88, 032914 (2013).

[3] F. Blesa, J. M. Seoane, R. Barrio, and M. A. F. Sanjuán. Effect of periodic forcing in chaotic scattering. Phys. Rev. E 89, 042909 (2014).

[4] J. M. Seoane and M. A. F. Sanjuán. New developments in classical chaotic scattering. Rep. Prog. Phys. 76, 016001 (2013).