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Mesoscopic and metastable quantum systems

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We shortly review the transient dynamics of mesoscopic systems, such as Josephson junctions, in noisy environments. The role of noise induced solitons and breathers on the mean switching time from the superconducting metastable state to the resistive state, in the presence of an external noise source modeled by α-stable Lévy distributions, will be outlined.
Thereafter, the dissipative dynamics of a particle moving in a strongly asymmetric double well potential, interacting with a thermal bath will be considered. Common wisdom is that quantum fluctuations enhance the escape rate from metastable states in the presence of dissipation. We show that dissipation can enhance the stability of a quantum metastable system. We find that the escape time from the metastable region has a nonmonotonic behavior, with a maximum, versus the system-bath coupling, and with a minimum versus the temperature, thus producing a stabilizing effect. Therefore, as the temperature increases, an enhancement of the escape time is observed, increasing the stability of the metastable state. These results shed new light on the role of the environmental fluctuations in stabilizing quantum metastable systems.
We will show then, how the combined effects of strong Ohmic dissipation and monochromatic driving affect the stability of a quantum system with a metastable state. We find that, by increasing the coupling with the environment, the escape time makes a transition from a regime in which it is substantially controlled by the driving, displaying resonant peaks and dips, to a regime of frequency-independent escape time with a peak followed by a steep fall off. The quantum noise enhanced stability phenomenon is observed in the system investigated. Resonant activation, the presence of a minimum in the mean escape time, occurs when the time scale of the modulations is the same as the characteristic time scale of the system's dynamics. The simple quantum system considered displays as well the general features that at slow modulations the mean escape time is dominated by the slowest configuration assumed by he system, while at fast modulations the escape dynamics is determined by the average configuration.

[1] D. Valenti, C. Guarcello, and B. Spagnolo, Phys. Rev. B **89**, 214510 (2014).

[2] C. Guarcello, D. Valenti, and B. Spagnolo, Phys. Rev. B **92**, 174519 (2015).

[3] C. Guarcello, D. Valenti, B. Spagnolo, V. Pierro and G. Filatrella, Nanotechnology, **28**, 134001 (2017).

[4] D. Valenti, L. Magazzù, P. Caldara, and B. Spagnolo, "Stabilization of quantum metastable states by dissipation", Physical Review B **91**, 235412 (7) (2015).

[5] Luca Magazzù, Angelo Carollo, Bernardo Spagnolo, Davide Valenti, "Quantum dissipative dynamics of a bistable system in the sub-Ohmic to super-Ohmic regime", Journal of Statistical Mechanics: Theory and Experiment 054016 (2016).

[6] B. Spagnolo, C. Guarcello, L. Magazzù, A. Carollo, D. Persano Adorno, D. Valenti, "Nonlinear Relaxation Phenomena in Metastable Condensed Matter Systems", Entropy, 19 (1), 20 (2017).

[7] L. Magazzù, P. Hänggi, B. Spagnolo, and D. Valenti, "Quantum Resonant Activation", Physical Review E 95 (13), 042104 (2017).

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