

## Evolution of a wave function in a mixed phase space: chaos-assisted tunneling

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*Abstract:* In the presence of a complex classical dynamics associated with a mixed phase space, a quantum wave function can tunnel between two stable islands through a chaotic sea, an effect that has no classical counterpart. We report here new results on this topics realized on a quantum modulated pendulum involving a Bose Einstein condensate placed in a deep and strongly modulated optical lattice. In contrast with the pioneering works of M. Raizen and W. Phillips published in 2001, we investigate a mixed phase space having two classical dynamically stable islands symmetric in position space. The diffraction pattern of our BEC initially placed at different positions in phase space enables us to reconstruct the classical phase space including its bifurcations. Besides this cartography of the phase space, we observe the quantum tunneling between the two stable islands and its strong variations depending on the system parameters. The detailed analysis of the tunneling curve also reveals the two types of tunneling: regular tunneling and chaos assisted tunneling for which the intermediate states that mediates the transport towards the other islands can be identified.

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