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Quantum boomerang effect: beyond the standard Anderson model

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It was recently shown that wavepackets with skewed momentum distribution exhibit a boomerang-like dynamics in the Anderson model due to Anderson localization [1]: after an initial ballistic motion, they make a U-turn and eventually come back to their starting point.
In this work [2], we study the robustness of the quantum boomerang effect in various kinds of disordered and dynamical systems: tight-binding models with pseudo-random potentials, systems with band random Hamiltonians, and the kicked rotor. Our results show that the boomerang effect persists in models with pseudo-random potentials. It is also present in the kicked rotor, although in this case with a specific dependency on the initial state. On the other hand, we find that random hopping processes inhibit any drift motion of the wavepacket, and consequently the boomerang effect. In particular, if the random nearest-neighbor hopping amplitudes have zero average, the wavepacket remains in its initial position.

[1] T. Prat, D. Delande, N. Cherroret, Phys. Rev. A **99**, 023629 (2019).
[2] L. Tessieri, A. Akdeniz, N. Cherroret, D. Delande, P. Vignolo, arXiv:2103.06744