Non-Markovian Quantum Exceptional Points

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**Abstract**

Exceptional points (EPs) are singularities in the spectra of non-Hermitian operators, where eigenvalues and eigenvectors coalesce. Recently, open quantum systems have been increasingly explored as testbeds for quantum EPs due to their natural non-Hermitian nature. However, existing works mostly focus on the Markovian limit, leaving a gap in understanding EPs in the non-Markovian regime. In this work, I will present our new results, where we address this gap by proposing a theoretical framework based on two numerically exact descriptions of non-Markovian dynamics: the pseudomode mapping and the hierarchical equations of motion. We unveil pure non-Markovian EPs that are unobservable in the Markovian limit. Remarkably, the EP aligns with the Markovian-to-non-Markovian transition. Moreover, we show that structured environments can elevate EP order, thereby enhancing the system’s sensitivity.