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Non-Markovian Quantum Exceptional Points

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Exceptional points (EPs) are singularities in the spectra of non-Hermitian operators where eigenvalues and eigenvectors coalesce. Open quantum systems have recently been explored as EP testbeds due to their non-Hermitian nature. However, most studies focus on the Markovian limit, leaving a gap in understanding EPs in the non-Markovian regime. In this talk, I will present our recently proposed general framework for characterizing quantum EPs beyond the Markovian approximation. The framework incorporates non-Markovian effects by introducing auxiliary degrees of freedom, which effectively embed memory into an enlarged dynamical space. This approach enables the emergence of additional and higher-order EPs that are inaccessible within the conventional Markovian description. We demonstrate the power and versatility of the framework through applications to the spin-boson model and linear bosonic systems.

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