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Non-Markovian dynamics in the refined weak-coupling limit

I will explain a refined weak-coupling limit that preserves complete positivity, reproduces the exact dynamics at short times and approaches the standard Born-Markov-Secular generator – Davies generator – for long times. Interestingly, this method describes a rich non-Markovian phenomenology for the spin-boson model. This implies a dynamical difference between entanglement and coherence: the latter undergoes revivals, whereas the former not, despite the induced dynamics being fully incoherent. In addition, the evolution presents “quasieternal” non-Markovianity, becoming non-CP-divisible at any time period where the system qualitatively evolves. Furthermore, the method allows for an exact derivation of a master equation that accounts for a kind of reversible energy exchange between system and environment. Specifically, this is obtained in the form of a time-dependent Lamb shift term.