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## Non-Markovianity and entanglement in collision models with initial intra-environment correlations

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Collision models (CMs) describe quantum systems interacting sequentially with elements of an environment, termed ancillas. These simple models are valuable for analyzing non-Markovian quantum dynamics by controlling environmental memory through feedback mechanisms. Their simplicity and versatility have led to applications in quantum optics, quantum information, and quantum thermodynamics.

In this work, we investigate how ancilla-ancilla entanglement relates to memory effects in the system dynamics. We first discuss how the non-Markovian system can be mapped to a larger, Markovian system (Markovian embedding). We then apply this framework to an all-qubit CM and compare the non-Markovianity of the system alone when the ancillas are correlated in two ways: after or before the collision with the system. In the former case the dynamics is always Markovian, but in the latter case non-Markovianity is produced - however, maximal initial entanglement between the incoming ancillas suppresses that non-Markovianity.

### Keyword-1

Open Quantum Systems

### Keyword-2

Collision Models

### Keyword-3

Non-Markovian Dynamics

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