Non-Markovian Population Dynamics from Correlated Environment

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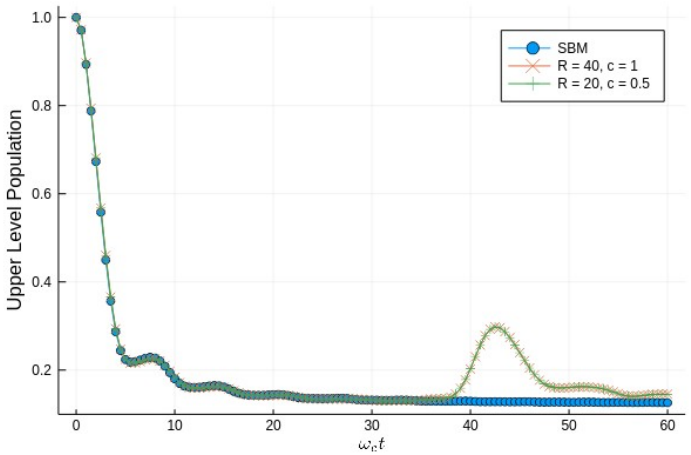
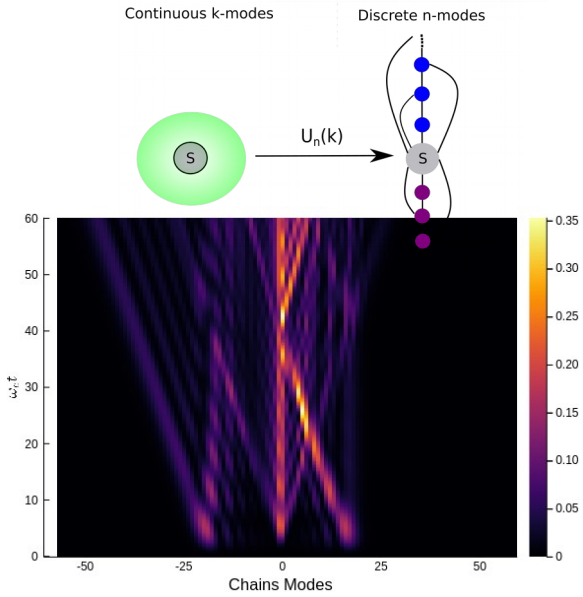
Abstract

Real life quantum systems are never truly isolated from the rest of the Universe and thus are formally open systems interacting with an environment. Markovian environments are memory-less of their interactions with the system and usually responsible for the decay to ground states and decoherence. In such cases, Redfield theory can describe system dynamics accurately whereas Non-Markovian dynamics have proven to be quite challenging because of the curse of dimensionality. We present here a simple system exhibiting a rich Non-Markovian dynamics.

Results





Project Description

We show a simple model of a system composed of several sites spatially separated by a distance R, interacting with a bosonic bath where the interaction is linear and depends on the spatial arrangement of the system. The Non-Markovian behaviour is clearly shown through revivals of decayed eigenstate population, associated to information travelling from one part of the system to another one through the environment.
We study this model with a numerically exact tensor network-based variational time-evolution method (TDVPMPS and TEDOPA).
The specific interaction between system and bath described here generates long-range system/bath correlations that depend on the spatial structure of the system.

Conclusions

- Generic method to simulate OQS
- Non-Markovian dynamics
- Access to system and environment dynamics
- Clear relation between environment dynamics and spatial structure of the system
- Connections to biological systems

Links https://tfmlax.github.io/talks.html