

Tensor Network simulation of multi-emitter Waveguide QED

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Waveguide Quantum Electrodynamics (Waveguide QED) is a promising and versatile platform for studying fundamental light-matter interactions and quantum technology implementations. Notably, interesting effects emerge when two or more quantum emitters are coupled to the waveguide, including collective phenomena, e.g., superradiance and formation of bound states in the continuum (BICs).

An effective approach to address the behaviour of such systems is via Tensor Network quantum-inspired simulation techniques, enabling to efficiently simulate the real-time dynamics of many-body quantum systems, i.e., a waveguide QED platform.

In particular, I will present a method based on Matrix Product States (MPS) to model a waveguide QED architecture featuring multiple emitter pairs and simulate its dynamics in the non-Markovian regime. Then, I will discuss the obtained results, focusing on the emergence of BICs and other collective effects in the long-time limit.

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