Nonlinear properties of quantum trajectories of many-body systems

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Quantum trajectory (QT) methods have proven useful for the numerical simulations of the dissipative dynamics of a system, described by the Lindblad master equation for its density matrix [1] – [5]. The wide scope of problems solvable by QTs includes the dynamics of many-body quantum systems [6]. Efforts were aimed to expand the QT methods by adapting the trajectory noise [2], optimizing the conditional algorithmic information, related to the von Neumann entropy [7], generalizing the jump operator [8], and so on.

In the present work we consider the chains of M qubits as 1D many-body systems and focus on the properties of trajectories of such systems. We utilize photon-number [5] and homodyne [3] measurements to construct the trajectories. We are specifically interested in the entanglement properties of the associated trajectories, which play a crucial role in advanced methods of many-body state propagation [9]. We illustrate our approach on the paradigmatic example of the time evolution of a GHZ state of a many-body system under a Markovian dephasing channel.

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