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Tomography with cMPS: Extension and applications to quantum transport experiments

In recent years, a close connection between the description of open quantum systems, the input-output formalism of quantum optics, and continuous matrix product states in quantum field theory has been established. So far, however, this connection has not been extended to the quantum transport context. In this work, we substantially develop further and apply a machinery of continuous matrix product states (cMPS) to perform tomography of transport experiments. We first present an extension of the tomographic possibilities of cMPS by showing that reconstruction schemes do not need to be based on low-order correlation functions only, but also on low-order counting probabilities. We show that fermionic quantum transport settings can be formulated within the cMPS framework. This allows us to present a reconstruction scheme based on the measurement of low-order correlation functions that provides access to quantities that are not directly measurable with present technology. Emblematic examples are high-order correlations functions and waiting times distributions (WTD). The latter are of particular interest since they offer insights into short-time scale physics. We demonstrate the functioning of the method with actual data, opening up the way to accessing WTD within the quantum regime.