

Open Quantum Systems with Kadanoff-Baym- and Lindblad equations

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Open Quantum Systems are widely used to describe the density matrix of one particle or a chain of interacting particles, which are surrounded by a thermal heat bath. Usually this heat bath is assumed to be coupled as proposed in the Caldeira-Leggett model, in a Markovian approximation with weak coupling and Ohmic environment. Nevertheless, the question of thermalization and a variety of assumptions that are made in this ansatz are not fully understood yet. However, Lindblad dynamics are frequently discussed in heavy ion physics (Quarkonia) and recently become of interest in quantum computer applications (Schwinger model).

We want to pave the way for another application of Lindblad dynamics, the description of non-relativistic bound states, as for example the deuteron, by using the already well understood techniques on a quantum mechanical level, and adapting them to a one dimensional non-relativistic bound state framework. Furthermore, we discuss limitations and subtleties of the application of Lindblad dynamics in heavy ion physics. Here we will argue, using Keldysh-Schwinger techniques, that collisions in the language of second quantization can only be modelled if further terms are added to the Lindbladian. However, this contradicts the ansatz of Caldeira and Leggett concerning the (weak) linear coupling and requires to rethink, what the actual frameworks are.

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