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Matrix Product Operator Simulations of Dissipative Quantum Many Body Systems

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The ability to simulate quantum many body systems in and out
of equilibrium and subject to dissipative dynamics is of substantial current interest. Important applications are the description of heating processes in ultracold atomic gases in optical lattices, the modeling of transport through correlated nanostructures, and several proposals have been put forward which exploit dissipative dynamics in order to stabilize exotic quantum phases.

In this contribution we present first results obtained with our implementation of a Matrix Product Operator (MPO) approach to simulate the relevant Lindblad equation. Our implementation exploits systematically symmetries and conservation laws and is therefore able to simulate larger systems and more accurately than previous implementations. We illustrate its strength by performing simulations for local and global heating processes in one dimensional optical lattices, which reveal in interesting interplay between quantum and dissipative dynamics.

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