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JOHANNES GUTENBERG UNIVERSITÄT MAINZ

# Seminar über Quanten-, Atom- und Neutronenphysik (QUANTUM)

Jan. 15, 2020 at 10:30 a.m.
QUANTUM Seminarraum (02-427), Institut für Physik, Staudingerweg 7

Note: Sondertermin und -ort

Brian Rost and Lorenzo Del Re
Georgetown, USA

## Simulating Open Quantum Systems on Currently Available Quantum Computers

The driven dissipative many body problem is one of the longest standing unsolved problems in physics and it has experienced a renewed interest in the last decade. In fact, dissipation has been theoretically proposed as a resource for quantum computation and experimentally has been demonstrated that it can be employed to prepare maximally entangled states.
Thus, quantum computers could shed some light on the unsolved problem of driven-dissipative quantum systems but there are many choices for how one engineers the reservoir. An attractive approach is to integrate the bath degrees of freedom out via a master equation. Here we show how accurate this approach is by comparing it to an exact solution in the case of a tight-binding dissipative-driven model of fermions coupled to an external fermionic bath, and how to actually simulate it on a currently available IBM quantum computer. We also address the case of an interacting dissipative-driven finite size system, i.e. a three-site Hubbard model with on-site interaction driven by an external field and coupled to a bath. Here, we obtain many of the qualitative features already displayed in the thermodynamic limit. The biggest challenge in implementing these ideas on current quantum computers lies with the need for partial resetting of qubits. We discuss

strategies to implement on commercially available hardware and what might be possible with academic machines (such as those available at Mainz).

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