Quantum Simulation of Markovian Open Quantum Systems

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A simulation of quantum systems is one of the most exciting use cases for quantum computers. The simulation of closed quantum systems, or Hamiltonian simulation, has been explored in recent years. Novel methods have been developed, improving the widely used and well-known Suzuki Lie Trotter product formulas. However, in many practical situations, one must consider unavoidable interaction with the thermal environment. The success of quantum computers in simulating physical systems has led to the development of quantum algorithms to simulate open quantum systems in the fault-tolerant setting. However, these algorithms are limited to the Suzuki Lie Trotter product formulas of the first and second order. In this talk, I will give an overview of the quantum simulation of open quantum systems and focus on our recent work of reducing the gate complexity in the simulation of an open quantum system by using two methods that rely on randomisation.