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On the physical realizability of quantum stochastic walks BRUNO TAKETANI, LUKE GOVIA, PETER SCHUHMACHER, FRANK WILHELM, Saarland University — Quantum walks are a promising framework that can be used to both understand and implement quantum information processing tasks. The recently developed quantum stochastic walk combines the concepts of a quantum walk and a classical random walk through open system evolution of a quantum system, and have been shown to have applications in as far reaching fields as artificial intelligence. However, nature puts significant constraints on the kind of open system evolutions that can be realized in a physical experiment. In this work, we discuss the restrictions on the allowed open system evolution, and the physical assumptions underpinning them. We then introduce a way to circumvent some of these restrictions, and simulate a more general quantum stochastic walk on a quantum computer, using a technique we call quantum trajectories on a quantum computer. We finally describe a circuit QED approach to implement discrete time quantum stochastic walks.

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