Abstract Submitted
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Renormalization Group for Quantum Walks[1] STEFAN FALKNER, STEFAN BOETTCHER[2], Department of Physics, Emory University, Atlanta, GA 30322; USA, RENATO PORTUGAL[3], Laboratorio Nacional de Computacao Cienfica, Petropolis, RJ 25651-075; Brazil — A renormalization group (RG) treatment of quantum walks holds significant promise for insights into quantum transport phenomena and search algorithms for quantum computing. The generality of this approach has a good chance to elucidate salient characteristics of quantum walks on higher-dimensional lattices which at this point are unobtainable with other methods and are even difficult to study numerically. Key questions concern the scaling properties of (unitary) quantum evolution depending on the lattice type. Is there a single exponent describing the mean-square displacement of quantum walks, similar to the scenario observed in ordinary random walks, or is there a spectrum of modes, each with their own exponent? Does quantum interference ensure that these exponents are always smaller than for the respective classical random walks? To what extend do translational invariance and other lattice properties matter? Generally, what is the nature of universality in quantum walks? Our preliminary results on effectively one-dimensional lattices demonstrates how RG can be used to study quantum random walks and their asymptotic behavior.

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