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Entanglement manipulation via quantum walks in linear chain registers DMITRY SOLENOV, Saint Louis University, St. Louis, MO 63103, THOMAS CAVIN, Missouri University of Science and Technology, Rolla, MO 65409, WASHMA ANWAR, Saint Louis University, St. Louis, MO 63103 — It has been theoretically argued that continuous time quantum walks are effective in performing entangling gates in systems of two and three qubits coupled via higher energy auxiliary states. We investigate how quantum walks can perform entangling quantum gates in a scalable linear chain register. We focus on systems that have two sufficiently coherent auxiliary states available for pulse control, such as self-assembled quantum dots, diamond defect states, and transmon superconducting qubits. We show that states and Rabi frequencies in linear chain registers of such architectures can be mapped onto multidimensional hypercube graphs with the degree of asymmetry dictated by the structure of physical interactions between qubits. We analytically and numerically demonstrate that quantum walks traversing these graphs can accumulate sufficient phase and return back to boolean domain, thus manipulating entanglement.

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