

# IMPLEMENTATION SCHEME FOR MULTIDIMENSIONAL QUANTUM WALKS IN CLASSICAL OPTICAL SETUP

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Classical Optics can be used to efficiently process quantum information with a high degree of control, for example, in quantum walks through the space of light modes directed by the polarization of light. In order to explore the potential of quantum information processing with classical light we here suggest a method to realize high-dimensional quantum walks with classical optics – an important step towards robustly implementing certain quantum algorithms. In this scheme different degrees of freedom of light, such as frequency, orbital angular momentum and the spatial displacement represent different directions of the walk which are chosen by means of a coin realized by the polarization on different paths. The coin can in principle serve to steer any walk in a space of arbitrary dimension. As a result of the dynamics the walker's states cannot be separated with respect to the different degrees of freedom and hence become entangled classically. This is the first scheme where multi-degree classical entanglement is discussed.

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