

Quantum Physics

Faster transport with a directed quantum walk

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We give the first example of faster transport with a quantum walk on an inherently directed graph, on the directed line with a variable number of self-loops at each vertex. These self-loops can be thought of as adding a number of small dimensions. This is a discrete time quantum walk using the Fourier transform coin, where the walk proceeds a distance $\Theta(1)$ in constant time compared to $\Theta(1/n)$ classically, independent of the number of these small dimensions. The analysis proceeds by reducing this walk to a walk with a two dimensional coin.

Comments: 3 pages, 2 figures. To be published in Phys. Rev. A. v2: Minor wording changes. For Mathematica simulation source, see [this http URL](#)

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