

# Discrete-time quantum walks on one-dimensional lattices

Xin-Ping Xu

(Submitted on 9 Mar 2010)

In this paper, we study discrete-time quantum walks on one-dimensional lattices. We find that the coherent dynamics depends on the initial states and coin parameters. For infinite size of lattice, we derive an explicit expression for the return probability, which shows scaling behavior  $P(0,t) \sim t^{-1}$  and does not depend on the initial states of the walk. In the long-time limit, the probability distribution shows various patterns, depending on the initial states, coin parameters and the lattice size. The average mixing time  $M_{\epsilon}$  closes to the limiting probability in linear  $N$  (size of the lattice) for large values of thresholds  $\epsilon$ . Finally, we introduce another kind of quantum walk on infinite or even-numbered size of lattices, and show that the walk is equivalent to the traditional quantum walk with symmetrical initial state and coin parameter.

Comments: 17 pages research note

Subjects: **Cellular Automata and Lattice Gases (nlin.CG)**; Statistical Mechanics (cond-mat.stat-mech); Quantum Physics (quant-ph)

Cite as: **arXiv:1003.1822v1 [nlin.CG]**

## Submission history

From: Xin-Ping Xu [[view email](#)]

[v1] Tue, 9 Mar 2010 07:44:51 GMT (525kb)

*[Which authors of this paper are endorsers?](#)*

Link back to: [arXiv](#), [form interface](#), [contact](#).

## Download:

- [PDF](#)
- [PostScript](#)

Current browse context:

nlin.CG

[< prev](#) | [next >](#)

[new](#) | [recent](#) | [1003](#)

Change to browse by:

[cond-mat](#)

[cond-mat.stat-mech](#)

[nlin](#)

[quant-ph](#)

## References & Citations

- [CiteBase](#)

## Bookmark (what is this?)

[CiteULike logo](#)

[Connotea logo](#)

[BibSonomy logo](#)

[Mendeley logo](#)

[Facebook logo](#)

[del.icio.us logo](#)

[Digg logo](#)

[Reddit logo](#)