

Lapitski, Denis; Dellar, Paul J.

Convergence of a three-dimensional quantum lattice Boltzmann scheme towards solutions of the Dirac equation. (English) Zbl 1223.82002

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Summary: We investigate the convergence properties of a three-dimensional quantum lattice Boltzmann scheme for the Dirac equation. These schemes were constructed as discretizations of the Dirac equation based on operator splitting to separate the streaming along the three coordinate axes, but their output has previously only been compared against solutions of the Schrödinger equation. The Schrödinger equation arises as the non-relativistic limit of the Dirac equation, describing solutions that vary slowly compared with the Compton frequency. We demonstrate first-order convergence towards solutions of the Dirac equation obtained by an independent numerical method based on fast Fourier transforms and matrix exponentiation.

MSC:

82-08 Computational methods (statistical mechanics) (MSC2010)

82B80 Numerical methods in equilibrium statistical mechanics (MSC2010)

Cited in **3** Documents

Keywords:

quantum lattice Boltzmann; Dirac equation; Schrödinger equation

Software:

[FFTW](#)

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