Yepez, Jeffrey; **Boghosian, Bruce**
An efficient and accurate quantum lattice-gas model for the many-body Schrödinger wave equation. (English) Zbl 0998.81124
Comput. Phys. Commun. 146, No. 3, 280-294 (2002).

Summary: We presented a quantum lattice-gas model for simulating the time-dependent evolution of a many-body quantum mechanical system of particles governed by the non-relativistic Schrödinger wave equation with an external scalar potential. A variety of computational demonstrations are given where the numerical predictions are compared with exact analytical solutions. In all cases, the model results accurately agree with the analytical predictions and we show that the model's error is second order in the temporal discretization and fourth order in the spatial discretization. The difficult problem of simulating a system of fermionic particles is also treated and a general computational formulation of this problem is given. For pedagogical purposes, the two-particle case is presented and the numerical dispersion of the simulated wave packets is compared with the analytical solutions.

MSC:

81V70	Many-body theory; quantum Hall effect
81Q05	Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other equations of quantum mechanics
81-04	Software, source code, etc. for problems pertaining to quantum theory
81P68	Quantum computation

Cited in **12** Documents

Keywords:

Schrödinger wave equation; quantum computing; quantum lattice gas; quantum mechanics; computational physics

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