Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Quantum walks in momentum space[1] MICHAEL S. UNDERWOOD, DAVID L. FEDER, University of Calgary — It has recently been shown that universal quantum computation can be achieved via quantum walks, both continuous [1] and discrete [2]. In analogy to the standard circuit model for quantum algorithms, these quantum walk-based proposals require a 'rail' for each computational basis state, meaning that the number of these rails must grow exponentially with the number of qubits. The quantum walker travels from left to right along the rails, and gates are enacted via additions to the rails or connections among them. While these methods employ large numbers of spatial states for even simple gates on small numbers of qubits, they only require a small number of momentum eigenstates. With this in mind, we explore the promise of performing quantum walks in momentum space to drastically reduce the number of required resources.

[1] Childs. Phys. Rev. Lett. **102** 180501 (2009)
[2] Lovett et al. arXiv:0910.1024v2 [quant-ph] (2009)

[1]This work supported by NSERC and iCORE.

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Date submitted: 20 Nov 2009 Electronic form version 1.4