Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Quantum Computation under Micromotion in a Planar Ion Crystal[1] SHENG-TAO WANG, Department of Physics, University of Michigan, Ann Arbor, Michigan 48109, USA, CHAO SHEN, Department of Applied Physics, Yale University, New Haven, Connecticut 06511, USA, LUMING DUAN, Department of Physics, University of Michigan, Ann Arbor, Michigan 48109, USA — We propose a scheme to realize scalable quantum computation in a planar ion crystal confined by a Paul trap. We show that the inevitable in-plane micromotion affects the gate design via three separate effects: renormalization of the equilibrium positions, coupling to the transverse motional modes, and amplitude modulation in the addressing beam. We demonstrate that all of these effects can be taken into account and high-fidelity gates are possible in the presence of micromotion. This proposal opens the prospect to realize large-scale fault-tolerant quantum computation within a single Paul trap.

[1]We would like to thank T. Choi and Z.-X. Gong for useful discussions. This work was supported by the NBRPC (973 Program) No. 2011CBA00300 (No. 2011CBA00302), the IARPA MUSIQC program, the ARO, and the AFOSR MURI program.

Sheng-Tao Wang
Department of Physics, University of Michigan, Ann Arbor,
Michigan 48109, USA

Date submitted: 26 Jan 2015 Electronic form version 1.4