Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Measurement Scheme with 171Yb+ Chains in a Microfabricated Ion Trap DANIEL GAULTNEY, RACHEL NOEK, GEERT VRIJSEN, EMILY MOUNT, STEPHEN CRAIN, SOYOUNG BAEK, JUNGSANG KIM, Electrical and Computer Engineering Department and Fitzpatrick Institute for Photonics, Duke University — Trapped ions are promising candidates for implementing a scalable quantum computing system. We consider a quantum information processor implemented in an ion chain, where a multi-qubit gate between ions is executed using the transverse modes of ion motion. Quantum error correction requires that the states of data qubits be maintained during the initialization and readout of ancilla qubits. Such procedures require the ability to collect light from individual fluorescing ions without resonantly exciting other ions in the system. We describe an ion measurement protocol that uses shuttling to separate the ions being detected from the rest of the chain in order to decrease the resonant crosstalk between measured and unmeasured qubits. We will discuss experimental progress towards the implementation of this scheme in a microfabricated surface trap where scattered photons are collected using a high numerical aperture lens, and characterize the impact of resonant scattering from the measured qubits on the remaining qubits in the ion chain. A similar isolation scheme is required for the generation of heralded entanglement between two ion chains.

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Date submitted: 15 Nov 2013 Electronic form version 1.4