

Abstract Submitted  
for the MAR10 Meeting of  
The American Physical Society

**Novel Ion Trap for Efficient Fluorescence Collection from Trapped Ion Qubits** GANG SHU, NATHAN KURZ, MATTHEW R. DIETRICH, BORIS B. BLINOV, University of Washington — Efficient ion fluorescence collection is critical for fast reliable qubit state detection and higher photon collection rates from single trapped ions or atoms would lead to more efficient single-photon sources and ion-photon entanglement. By integrating a high N.A. spherical mirror into a linear Paul trap, we recently achieved 10% photon collection efficiency from a single  $Ba^+$  qubit. Based on the current successful trap, we designed and built a novel trap in which the reflective optical surface serves as the RF electrode. The new trap geometry is very open and almost 30% of the photons emitted by the ion will be intercepted. Additionally, the axial symmetry of the trap provides means for self-alignment of the ion trapping position and the optical axis of the spherical mirror. Its smaller size will proportionally reduce the spherical aberration so that we can achieve diffraction-limited ion image, and attempt to couple ion fluorescence into a single mode optical fiber for remote ion entanglement. Compared to refractive optics systems, our solution has the advantage of simplicity, low cost, flexibility and scale-up potential.

Gang Shu  
University of Washington

Date submitted: 08 Dec 2009

Electronic form version 1.4