Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

A cryogenic ion trap for $^9Be^{+1}$ KENTON R. BROWN, CHRISTIAN OSPELKAUS, YVES COLOMBE, DIETRICH LEIBFRIED, DAVID WINELAND, National Institute of Standards and Technology — Ion traps with cryogenic electrodes present several advantages over their room temperature counterparts, including longer ion lifetimes, lower motional heating rates, and the possibility of coupling ions to other systems that function only at cryogenic temperatures. We have recently built a surface electrode ion trap for $^9Be^+$ ions (ion-to-surface distance = 40 μm) that incorporates electrodes cooled to 4.2 K, a bakeable copper vacuum enclosure surrounding the electrodes, and an achromatic, completely reflective, in-vacuum imaging objective. Preliminary results indicate an ion lifetime limited only by the stability of our cooling laser, effective shielding from magnetic field fluctuations, high radial trapping frequencies ($>$ 30 MHz), and a heating rate of 75 quanta/sec for the 2.3 MHz axial mode. We will present these results and discuss our plans for experiments taking advantage of the low heating rate realized in this apparatus.

[1]Work supported by DARPA, NSA, ONR, IARPA, Sandia and The NIST Quantum Information Program.

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Date submitted: 22 Jan 2010 Electronic form version 1.4