Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Trapping and Detecting Polar Molecular Ions in a Closed-Cycle 4 K Ion Trap GLEB AKSELROD, Massachusetts Institute of Technology, DAVID SCHUSTER, Yale University, PAUL ANTOHI, ZILIANG LIN, Massachusetts Institute of Technology, ROB SCHOELKOPF, Yale University, ISAAC CHUANG, Massachusetts Institute of Technology, MIT QUANTA RESEARCH GROUP TEAM, YALE CIRCUIT QED TEAM TEAM — The rich internal structure of polar molecular ions make them attractive for interfacing with solid state systems in quantum information processing, yet it is this structure that makes trapping and detecting molecules difficult. We present an approach to this challenge which allows a superconducting cavity to be used as an integral part of a surface electrode ion trap, based on a closed-cycle cryostat operated at 4 K, and addressing the problem of loading molecules and detecting their presence. A mixture of Sr and SrCl ions is loaded into the trap by laser ablation. Subsequent laser cooling of the Sr ions sympathetically cools the molecular ions, producing a two-component Wigner crystal. This allows detection of the molecules using mass spectroscopy, observed indirectly through imaging of the Sr ions, or through coupling to microwave lines in the trap. Using a closed-cycle cryostat enables rapid testing and evaluation of ablation targets and trap geometries, at the cost of some trap vibration, measured to be below 160 nm in amplitude.

Gleb Akselrod
Massachusetts Institute of Technology

Date submitted: 27 Nov 2007 Electronic form version 1.4