

Abstract Submitted  
for the 4CF10 Meeting of  
The American Physical Society

**Design of Ion Optics for Focusing a Single Si-31 Ion from a Magneto-optical Trap with nm Precision for Si Quantum Computing<sup>1</sup>**  
JINMING ZHANG, WILLIAM FAIRBANK, Colorado State University — A scalable silicon-based quantum computer, proposed 12 years ago by B. Kane [1], requires placement of P-31 atoms 20nm apart and 10nm below the surface of a pure Si-28 substrate. A laser-cooled single-atom-on-demand source of Si-31 ions has been proposed to accomplish this [2]. As a part of this scheme, a Si-31 ion produced by resonant ionization of a single trapped Si-31 atom in a magneto-optical trap(MOT) must be transported and deposited into a Si-28 pure substrate at low energy (100eV) with high precision (1nm). After deposition, the Si-31 ion decays to 31-P. Designs for a focused ion beam system have been studied using a ray tracing program. By a tradeoff between angular spread and spot size, a focal spot approaching the desired 1 nm size has been found.

[1] B. E. Kane, Nature **393**, 133-137 (1998).

[2] W. M. Fairbank, Jr. and S. A. Lee, to be published.

<sup>1</sup>Supported by the W. M. Keck Foundation.

Jinming Zhang  
Colorado State University

Date submitted: 14 Sep 2010

Electronic form version 1.4