Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Ultracold Cesium source for FIB below 1nm: Milling, deposition, and lithography ROSS MARTIN-WELLS, Carleton College — We discuss the applications, models, and apparatus for a high-brightness, low-emittance Focused Ion Beam(FIB) source from ultracold cesium atoms. We propose a system where the atoms are cooled in two Magneto-Optic Traps(MOT) and degenerate sideband cooled in an optical lattice, decreasing the temperature to 100-300nK. Temperatures in the nanokelvin regime mean that by adapting current ion lens techniques from an Liquid Metal Ion Source (LMIS) column, our cesium ion beam can be focused to <1 nm. The ionization process at these ultracold temperatures is studied using a Monte Carlo simulation, determining the velocity distribution of the ions. After ionization via a two-frequency excitation, the cloud is accelerated by electric fields in the same way as LMIS FIB systems. We also discuss: (1)production of a much higher current continuous wave ultracold atom source for nanofabrication and (2) the use of interferometrically stabilized optical interference masks as a system to print structures of linewidth <1nm by the deposition of atoms from a variety of ultracold sources. These tools could make major contributions in the fields of lithography and microscopy in nanofabrication, conducting milling operations as well as deposition and microscopy far below the photon-diffraction limit

Ross Martin-Wells
Carleton College

Date submitted: 15 Nov 2013 Electronic form version 1.4