Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Near ground state Raman sideband cooling of an ion in a hybrid radiofrequency-optical lattice trap[1] ALEXEI BYLINSKII, LEON KARPA, DORIAN GANGLOFF, Massachusetts Institute of Technology, MARKO CETINA, Institute of Quantum Optics and Quantum Information, Innsbruck, Austria, VLADAN VULETIC, Massachusetts Institute of Technology — We achieve near ground state cooling of an ion in a hybrid trap formed by a two-dimensional radio-frequency Paul trap and an optical lattice produced by a cavity in the axial dimension. We drive far-detuned lattice-assisted Raman transitions on the red vibrational sideband between the Zeeman sublevels of the $^2S_{1/2}$ ground level of $^{174}Yb^+$. The cooling cycle is completed by a close-detuned spontaneous Raman transition. Efficient Cooling in all three dimensions is achieved this way. Furthermore, spatially dependent AC Stark shifts induced by the lattice allow us to measure axial temperature via ion fluorescence, and we estimate the population of the lattice vibrational ground state to be above 50%. This work is an important step towards quantum information and quantum simulations with ions in hybrid traps and optical lattices.

[1]Army Research Office, National Science Foundation, National Science and Engineering Research Council of Canada, Alexander von Humboldt Foundation

Alexei Bylinskii
Massachusetts Institute of Technology

Date submitted: 25 Jan 2013 Electronic form version 1.4