Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Cooling Bose-Fermi mixtures to quantum degeneracy on a chip[1]

L. J. LEBLANC, S. AUBIN, S. MYRSKOG, M. H. T. EXTAVOUR, D. MCKAY, A. STUMMER, J. H. THYWISSEN, University of Toronto — We have demonstrated for the first time the cooling of both bosons and fermions to quantum degeneracy in a microelectromagnetic chip trap. The tight confinement of this magnetic trap allows for evaporative cooling of ^{87}Rb towards Bose-Einstein condensation with efficiencies of up to four orders of magnitude increase in phase space density for each order of magnitude decrease in atom number. Such efficiencies are among the highest reported in a magnetic trap [1]. We compare our evaporation data to a model based on [2]. We have also trapped fermionic ^{40}K simultaneously with the bosons. By evaporatively cooling the bosons, the fermions are sympathetically cooled to quantum degeneracy through rethermalizing collisions with the bosons. We find that the thermalization between species is weak for temperatures around 300μK and attribute this to a reduction in the cross-species collisional scattering cross-section. We have measured this reduction in cross-section as a function of temperature over the course of the sympathetic cooling. [1] A log-slope efficiency of 4.5 was reported in K.L. Moore, *et al.* arXiv:cond-mat/0504010. [2] O.J. Luiten, M.W. Reynolds, and J.T.M. Walraven, *Phys. Rev. A* **53**, 381 (1996).

[1]supported by NSERC, CFI, OIT, Research Corporation, and PRO.

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Date submitted: 07 Feb 2006 Electronic form version 1.4