

Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Progress Toward Buffer Gas Cooling of a $1 \mu_B$ Species

CORT JOHNSON, BONNA NEWMAN, NATHAN BRAHMS, ROBERT DECARVALHO, CHIH-HAO LI, TOM GREYTAK, DAN KLEPPNER, JOHN DOYLE, MIT/Harvard Center for Ultracold Atoms — Thermalization with a non-magnetic ^3He buffer gas has been demonstrated to be an effective means of removing heat from a sample of hot magnetic atoms held in a magnetic trap[1]. To thermally isolate the atoms, it is necessary to remove the buffer gas without sweeping away the magnetically trapped atoms. The magnetic trap strength is proportional to the magnitude of the atom's moment. This is the primary reason that trapping a $1 \mu_B$ species has never been realized in a buffer gas cooling experiment. Eventually, we plan to use this technique to trap and cool atomic hydrogen and deuterium. We have built a cryogenic valved cell suspended from a dilution refrigerator along the axis of a 4T quadrupole magnetic field. The cell is maintained at a base temperature of 100mK. The buffer gas is removed by opening the valve. Any remaining buffer gas may be energetic enough to scatter the atoms out of the trapping potential, thus limiting the lifetime. Therefore, we lower the temperature of the cell to decrease the vapor pressure of any ^3He remaining on the walls. We can mimic the conditions of a $1 \mu_B$ species using atomic Mn ($5 \mu_B$) simply by lowering the trapping field strength by a factor of five. Further, we will report on efforts to trap and thermally isolate ^7Li , a true $1 \mu_B$ species.

[1]J. D. Weinstein et al., Phys. Rev. A **57**, R3173 (1998).

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Date submitted: 16 Mar 2006

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