Abstract Submitted
for the DAMOP07 Meeting of
The American Physical Society

Density profiles of trapped ultracold fermion-boson mixtures and mediated interaction effects D.H. SANTAMORE, EDDY TIMMERMANS, T-4, Theoretical Division, Los Alamos National Laboratry — Quantum degenerate gas mixtures of fermionic and bosonic atoms are trapped fairly routinely. A Bose-Einstein condensate (BEC) is often used as a coolant to decrease the temperature of fermions (sympathetic cooling). On the other hand, the introduction of distinguishable atoms into the degenerate fermion gas generally induces fermion hole heating. We show that the fermion (boson)-mediated boson-boson (fermion-fermion) interactions can significantly alter both the fermion and boson density profiles, which conversely can be used to detect mediated interactions. We also present a low order linked-cluster calculation of the equation of state of a dilute homogeneous mixture of a normal single component fermion gas, mixed with a BEC. We also derive an improved Thomas-Fermi description of the trapped density profiles. Our results suggest that (a) boson-mediated fermion-fermion interactions can be repulsive, (b) the polaron shift can largely determine the fermion density profile, and (c) shrinking of the BEC-size can be the precursor of the fermion-boson phase separation transition as well as the mean-field collapse.

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Date submitted: 02 Feb 2007 Electronic form version 1.4