Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Probing the Equation of State of Strongly Correlated Bose and Fermi Gases NIR NAVON, SYLVAIN NASCIMBENE, KENNETH GUNTER, BENNO REM, SWANN PIATECKI, WERNER KRAUTH, FREDERIC CHEVY, CHRISTOPHE SALOMON, Ecole Normale Superieure, Laboratoire Kastler-Brossel
— We have developed and used a general method to probe with high precision the thermodynamics of homogeneous systems using trapped atomic gases. We have applied this technique to the two spin-component Fermi gas with short-range interactions. Using fermionic ^{6}Li, one can explore a wide parameter space by changing the interaction strength, the spin-population imbalance or the temperature of the gas. This system exhibits remarkably rich physics, such as normal/superfluid phase transitions (that can be of thermal or quantum character) or Fermi liquid-type behaviour of the normal phase. We have extended this method to bosons using ^{7}Li close to a Feshbach resonance. We have measured the EoS of the Bose gas as a function of interactions at very low temperature. For the first time in atomic Bose gases, we measured quantitatively the Lee-Huang-Yang beyond mean-field correction to the ground state energy. We compared the experimental in-situ density profiles with Monte-Carlo predictions for thermometry purpose. We have extended this study using out-of-equilibrium measurements of the Bose gas in the strongly interacting regime, which gives a first hint on properties of the hypothetical unitary Bose gas.

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Date submitted: 24 Feb 2011 Electronic form version 1.4