Abstract Submitted
for the DAMOP07 Meeting of
The American Physical Society

Measurement of the temperature dependence of the Casimir-Polder force ROBERT WILD, University of Colorado, JOHN OBRECHT, MAURO ANTEZZA, LEV PITAEVSKII, SANDRO STRINGARI, ERIC CORNELL — The Casimir-Polder force characterizes the surface-atom force originating from fluctuations of the electromagnetic field. Theoretical work by the Trento team has focused on the temperature dependence of this force. When the temperature of the surface differs from the temperature of free space, the force is predicted to decay more slowly at large distances and to exhibit a stronger temperature dependence. By positioning a Rb-87 Bose-Einstein condensate a few microns from a dielectric surface, the JILA team has observed changes in the collective oscillation frequency that result from the spatial variations in the force. To characterize the surface, we have developed a new technique to measure the magnitude and direction of small electric field gradients with trapped neutral atoms. These gradients are measured by resonantly driving a dipole oscillation in the BEC. The oscillation growth rate provides information about the magnitude and the sign of the surface field gradient. Measurements agree with the theoretical predictions, marking the first conclusive demonstration of the temperature dependence of the Casimir-Polder force.

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Date submitted: 08 Mar 2007 Electronic form version 1.4