A Measurement of the s-Wave Scattering Length in a $^7$Li Bose-Einstein Condensate

D. DRIES, M. JUNKER, J. HITCHCOCK, C. WELFORD, Y.P. CHEN, R.G. HULET, Department of Physics and Astronomy and Rice Quantum Institute, Rice University — The s-wave scattering length, $a_s$, parameterizes the effective interatomic interactions in a Bose-Einstein condensate (BEC). The sign and magnitude of $a_s$ have important consequences for the observable properties of the condensate and, consequently, $a_s$ needs to be accurately known in order to correctly interpret many experimental results. In our experiment, we create an optically trapped $^7$Li BEC in the $F = 1, m_F = 1$ hyperfine state. Using a Feshbach resonance, we are able to change the value of $a_s$ by nearly two orders of magnitude over the magnetic field range of 507-730 G. We extract $a_s$ from absorption images of the condensate by fitting to the Thomas-Fermi radius. Furthermore, the condensate suddenly disappears at fields above $730 \pm 1$ G, placing a lower bound on the location of the Feshbach resonance.

$^1$Supported by the NSF, ONR, and the Welch and Keck Foundations.