Effect of Disorder on a Bose-Einstein Condensate with Tunable Interactions\textsuperscript{1} D. DRIES, YONG P. CHEN\textsuperscript{2}, J. HITCHCOCK, M. JUNKER, T. A. CORCOVILOS, C. WELFORD, R. G. HULET, Rice University Physics and Astronomy and Rice Quantum Institute — We have investigated the effect of a disordered optical potential on the transport and phase coherence of a Bose-Einstein condensate (BEC) of $^7$Li. We observe damping of BEC dipole oscillations even when the disorder strength, $V_D$, is small, while for large $V_D$, transport is completely inhibited. Time-of-flight images show that the BEC gradually loses phase coherence for $V_D \geq \mu/2$, with coherence completely lost when $V_D = \mu$, where $\mu$ is the chemical potential of the BEC. We interpret this loss of coherence as resulting from fragmentation of the BEC as seen from \textit{in-situ} measurements of the density distribution.

While these experiments were performed with a BEC healing length, $\xi$, that is small in comparison to the disorder length scale, we are currently attempting to observe the Anderson localization predicted to occur for large $\xi$. Using a magnetically-tuned Feshbach resonance, the $s$-wave scattering length, $a_s$, is reduced to near zero where $\xi$ becomes very large. Results of applying the disorder potential to this nearly non-interacting condensate, with $a_s$ much less than the Bohr radius, will be reported.

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