Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Interactions of Bright Matter-Wave Solitons with a Barrier Potential[1] PAUL DYKE, JASON NGUYEN, DAVID TAM, RANDALL HULET, Rice University — We study the interaction of a bright matter-wave soliton with a tunnel-barrier. In our experiments, bright matter-wave solitons are formed from Bose-Einstein condensates in a gas of ultracold ^{7}Li atoms. We use the broad Feshbach resonance of ^{7}Li in the $|1,1\rangle$ state and tune the scattering length through zero to small negative values to form a single bright matter-wave soliton close to the critical number for collapse. We excite the collective dipole mode of a soliton confined to a quasi-1D potential which is formed from a single focused laser beam, with a ratio of radial to axial harmonic frequencies of 60. The soliton interacts with a thin potential barrier formed by a near-resonant, blue detuned, cylindrically focused laser beam that perpendicularly bisects the trapping beam at its focus. Through adjustment of the barrier potential height, the soliton can either be split in two, transmitted or reflected. When the barrier produces splitting, the fragments will undergo a second interaction at the barrier thus realizing the ingredients of a Mach-Zender type interferometer in an attempt to observe coherent recombination.

[1]Work supported by the NSF, ONR, and the Welch Foundation

Paul Dyke
Rice University

Date submitted: 24 Jan 2013 Electronic form version 1.4