Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Formation of a Matter-Wave Breather in a ^{7}Li BEC[1] P. BAGGE, J. H. V. NGUYEN, D. LUO, R. G. HULET, Department of Physics and Astronomy and Rice Center for Quantum Materials, Rice University, Houston, TX 77005 — A breather is a nonlinear wave phenomenon that occurs in systems well described by a nonlinear wave equation such as the one-dimensional nonlinear Schrödinger equation (1D NLSE). It derives its name from its characteristic profile, which is localized in space and oscillates in time. As a solution to the 1D NLSE, the simplest form of a breather is a bound state of two solitons with zero relative velocity. Despite observations of breathers in various physical systems, a matter-wave analog has yet to be created. Theory suggests that matter-wave breathers may show quantum many-body effects, even for atom numbers in the thousands[2]. We explore the creation of a matter-wave breather by starting with a fundamental bright soliton formed from a ^{7}Li Bose-Einstein condensate with attractive interactions and confined to a highly elongated, cylindrically symmetric harmonic trap. We use a Feshbach resonance to quench the atomic interaction by a factor of four to induce the formation of a breather with a 3:1 amplitude ratio. We will explore the dissociation of the breather by reflection/transmission at a barrier and its spontaneous dissociation due to quantum effects.

[1]Work supported by the NSF, ONR, an ARO MURI grant, and the Welch Foundation.
[2]V. A. Yurovsky, B. A. Malomed, R. G. Hulet, and M. Olshanii, Phys. Rev. Lett. 119, 220401 (2017).

Patrick Bagge
Rice University

Date submitted: 24 Jan 2018 Electronic form version 1.4