

Abstract Submitted  
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**Formation of bright matter-wave breathers**<sup>1</sup> D. LUO, J. H. V. NGUYEN, P. BAGGE, R. G. HULET, Department of Physics and Astronomy and Rice Center for Quantum Materials, Rice University, Houston, TX 77005 — Solitons are 1D nonlinear waves that propagate without changing their shape. In recent years, solitons in quasi-1D matter-wave systems have been investigated extensively. The nonlinearity in these systems can also give rise to a bound state of two solitons, known as a breather. It is also non-dispersive, but its density profile is periodic in time, oscillating at the frequency given by the chemical potential difference between the two solitons. We report the creation of a breather by first forming a bright matter-wave soliton from a Bose-Einstein condensate of <sup>7</sup>Li atoms in a quasi-1D trap. Then we quench the scattering length by a factor of 4 to create a 1:3-norm ratio breather. We measure the breather frequency as a function of the trap aspect ratio. We plan to explore the breather interaction with a potential barrier, which has been predicted to have a quantized tunneling ratio<sup>2</sup>. In addition, we plan to study the predicted spontaneous dissociation of breathers due to quantum many-body effects<sup>3</sup>.

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<sup>2</sup>V. Dunjko and M. Olschani, arXiv:1501.00075 (2015)

<sup>3</sup>V. A. Yurovsky et al. Phys. Rev. Lett. 119, 220401 (2017)

De Luo  
Rice University

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