Abstract Submitted
for the APR17 Meeting of
The American Physical Society

Mechanism of stimulated Hawking radiation in a laboratory Bose-Einstein condensate TED JACOBSON, YI-HSIEH WANG, University of Maryland, MARK EDWARDS, Georgia Southern University, CHARLES W. CLARK, Joint Quantum Institute — Analog black/white hole pairs have been achieved in recent experiments by J. Steinhauer, using an elongated Bose-Einstein condensate [1]. He reported observations of self-amplifying Hawking radiation, via a lasing mechanism operating between the the black and white hole horizons. Through the simulations using the 1D Gross-Pitaevskii equation, we find that the experimental observations should be attributed not to the black hole laser effect, but rather to a growing zero-frequency bow wave, generated at the white-hole horizon. The relative motion of the black and white hole horizons produces a Doppler shift of the bow wave at the black hole, where it stimulates the emission of monochromatic Hawking radiation. This mechanism is confirmed using temporal and spatial windowed Fourier spectra of the condensate. We also find that shot-to-shot atom number variations, of the type normally realized in ultracold-atom experiments, and quantum fluctuations of condensates, as computed in the Bogoliubov-De Gennes approximation, give density-density correlations consistent with those reported in the experiments. In particular, atom number variations can produce a spurious correlation signal.

[1]J. Steinhauer, *Nature Physics* **11**, 864 (2014)

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Date submitted: 30 Sep 2016 Electronic form version 1.4