

Abstract Submitted
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Phase Separated Bose-Einstein Condensate for High Sensitivity Force Measurement¹ SATYAN BHONGALE, Rice University, EDDY TIMMERMANS, Los Alamos National Laboratory — A trapped, phase separated, two component Bose-Einstein condensate (BEC) can be configured to give a single BEC bubble that floats freely in the surrounding BEC. We point out that this system gives a unique template to carry out mesoscopic quantum studies and to detect weak forces. We demonstrate the detection capabilities by proposing and studying a “Quantum Level” for fundamental quantum fluctuation studies and for mapping the potential energy landscape near a surface with exquisite accuracy. We show that for typical (modest) values of currently available experimental parameters, the proposed device is sensitive to the variations in gravitational acceleration to 1 part in 10 billion. While such sensitivity is in the range of other available devices, for example torsion balance, the BEC device allows for measuring the gravitational acceleration on length scales of the order of a few microns.

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