

Abstract Submitted
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Negative-mass hydrodynamics in a spin-orbit coupled Bose-Einstein condensate¹ KHALID HOSSAIN, M. A. KHAMEHCHI, M. E. MOSSMAN, Washington State University, YONGPING ZHANG, Shanghai University, TH. BUSCH, OIST Graduate University, MICHAEL FORBES, Washington State University, University of Washington, PETER ENGELS, Washington State University — Negative effective mass is peculiar; whereas objects usually accelerate away from a push, negative-mass objects will accelerate *towards* the push. This strange behaviour can be realized in spin-orbit coupled (SOC) BECs where the dispersion relationship can be engineered to exhibit negative curvature. In this talk we will describe an experiment, where trapped ⁸⁷Rb atoms expand in the presence of a spin-orbit coupling, demonstrating an interesting array of dynamical phenomena, including the breaking of Galilean covariance, dynamical instabilities, and a slowing down consistent with negative acceleration. We show that these features can be described with a simple theory of negative-mass hydrodynamics, and argue that this also explains a related phenomena of self-trapping seen in optical lattices.

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