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Self-trapping in Cold Atoms from Negative Effective Mass¹ KHALID HOSSAIN, M. KHAMEHCHI, M. MOSSMAN, Washington State University, YONGPING ZHANG, Shanghai University, TH. BUSCH, OIST Graduate University, Okinawa, MICHAEL FORBES, Washington State University, University of Washington, P. ENGELS, Washington State University — Self-trapping phenomena have been observed in optical lattices but the expalanation is complicated because of the underlying lattice geometry. In this talk, we will describe a simple theory based on negative-mass hydrodynamics in a spin-orbit coupled (SOC) Bose-Einstien condensate (BEC) of ⁸⁷Rb, and argue that self-trapping can be explained solely in terms of negative effective mass without any complications of lattice geometry. We have engineered the underlying dispersion relation with a negative curavature region exhibiting exquisite control over atomic interactions, which leads to a number of interesting effects, such as breaking of Galilean covariance, modulational instability and a slow down demonstrating negative acceleration.

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