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Interaction-Driven Dynamics of a Bose-Einstein Condensate in an Optical Lattice[1] M. K. H. OME, T. BERSANO, S. MOSSMAN, P. ENGELS, Washington State University, Q. GUAN, D. BLUME, Homer L. Dodge Department of Physics and Astronomy and Center for Quantum Research and Technology (CQRT), University of Oklahoma — Ultracold clouds of atoms placed into carefully designed optical lattice potentials form an excellent tool for probing the dynamics of interacting, quantum mechanical particles. In this work, we investigate the properties of non-linear Bloch bands of Bose-Einstein condensates that come into existence for sufficiently strong interactions between the atoms. In our experiments, we analyze the properties of non-linear Bloch bands by applying optical lattices and performing well-controlled lattice accelerations. The experiments reveal non-exponential tunneling of atoms which is conceptually connected to predicted loop structures. Our observation of non-exponential tunneling provides a clear demonstration of the power of ultracold atoms for investigating complex quantum mechanical dynamics.

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Md Kamrul Hoque Ome
Washington State Univ

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