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The Role of Interactions in Disorder Induced Damping of Dipole Oscillations of a Bose-Einstein Condensate[1] SCOTT POLLACK, D. DRIES, T.A. CORCOVILOS, R.G. HULET, Rice Quantum Institute and Department of Physics and Astronomy, Rice University, Houston, TX 77005 — We investigate the damping of dipole oscillations of a ^{7}Li Bose-Einstein condensate (BEC) in a disordered optical potential. In our highly tunable system we vary the disorder strength V_D, the initial velocity of the BEC, and the chemical potential μ by adjusting the s-wave scattering length a via a Feshbach resonance. We observe the breaking of superfluid flow, for values of V_D as small as $0.1\,\mu$, and cessation of motion for $V_D \sim \mu$. Counter-intuitively, at supersonic velocities the flow becomes asymptotically dissipationless regardless of the disorder strength. We test the validity of the scaling V_D/μ over several decades of a, including values of a as small as $0.01\,a_0$, where magnetic dipole effects dominate. We also report on observations of dissipative flow of nearly non-interacting ideal quantum gases and bright matter-wave solitons.

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