Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Dissipative Transport of Trapped Bose-Einstein Condensates through Disorder SATYAN BHONGALE, George Mason University, PAATA KAKASHVILI, NORDITA, CARLOS BOLECH, University of Cincinnati, HAN PU, Rice University — After almost half a century since the work of Anderson [Phys. Rev. **109**, 1492 (1958)], at present there is no well established theoretical framework for understanding the dynamics of interacting particles in the presence of disorder. Here, we address this problem for interacting bosons near $T = 0$, a situation that has been realized in trapped atomic experiments with an optical speckle disorder. We develop a theoretical model for understanding the hydrodynamic transport of *finite-size* Bose-Einstein condensates through disorder potentials. The goal has been to set up a simple model that will retain all the richness of the system, yet provide analytic expressions, allowing deeper insight into the physical mechanism. Comparison of our theoretical predictions with the experimental data on large-amplitude dipole oscillations of a condensate in an optical-speckle disorder shows striking agreement. We are able to quantify various dissipative regimes of slow and fast damping. Our calculations provide a clear evidence of reduction in disorder strength due to interactions. The analytic treatment presented here allows us to predict the power law governing the interaction dependance of damping. The corresponding exponents are found to depend sensitively on the dimensionality and are in excellent agreement with experimental observations.

Satyan Bhongale
George Mason University

Date submitted: 16 Nov 2010 Electronic form version 1.4