Characterization of an apparatus and theoretical predictions for a two species BEC turbulence experiment

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The observation of superfluid turbulence in ^{87}Rb[1] introduced the experimental tools of atomic optics into the world of quantum fluid dynamics. Prior to this experimental realization, quantum turbulence research has only been conducted in cryogenic helium which often requires large and cumbersome apparatus. Atomic optical apparatus on the other hand, fit well on a single tabletop and allow for unprecedented measurement precision and access to the experimental volume. The work reported on here is an evolution of our previous work in ^{87}Rb[1], where we study the properties of a turbulent BEC, however in this apparatus we investigate turbulence in two miscible atomic species, Na and K. For this, we have constructed and characterized a new apparatus where two separate 2D MOTs are used to deliver atoms into a joint optical dipole trap. In the optical trap the two samples elements are simultaneously cooled. In this report we present both the experimental designs, apparatus specifications and measurements, in addition to theoretical predictions and computations for proposed future experiments.

1. Henn, E. A. L. and Seman, J. A. and Roati, G. and Magalhães, K. M. F. and Bagnato, V. S. (2009). "Emergence of Turbulence in an Oscillating Bose-Einstein Condensate", 103 Physical Review letters.

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