Observation of anomalous momentum distribution in a turbulent Bose-Einstein Condensate

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Bose condensed gaseous samples in the superfluid regime may present the simplest form of turbulence, due to their velocity field constrains, and be a gateway for the better understanding of such complex phenomenon. Trapped Bose-Einstein condensates have unparalleled control over many experimental parameters, such as dimensionality, density, trapping potential, and atomic interactions. Additionally, Bose condensed gasses can be measured by several *in situ* techniques allowing for dynamic studies.[1,2] The emergence of quantum turbulence observed in a magnetically trapped sample of ^{87}Rb BEC was investigated. Vortices and anti-vortices were nucleated using a controlled sinusoidal external magnetic field gradient that twisted the superfluid sample injecting kinetic energy. The vortices spread all over the cloud, setting up the experimental conditions for the turbulent regime to rise. The atomic cloud was then allowed to freely expand and an anomalous momentum distribution density was observed and studied. Time-of-flight absorption images were acquired and the turbulent and non-turbulent condensates were compared. Clear deviations from the Thomas-Fermi (non-turbulent momentum distribution) were observed in the expanding turbulent clouds.

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