

Observation of anomalous momentum distribution in a sample of turbulent BEC obtained by free expansion

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Recently we have obtained a turbulent cloud of trapped atomic superfluid composed of a Bose-Einstein condensate of Rb atoms held in a magnetic harmonic trap. Vortices in a BEC were generated by an oscillating field generated by a set of coils is superimposed to the trapping field creating displacement, rotation and deformation of the trap potential. Occurrence of Turbulence was evidenced by a changing in the behavior of the hydrodynamics of the sample as well as by the fast proliferation of vortices. The finite size effects on the transition between non-turbulent to turbulent regime was analyzed. At the present work, we show the first evidence of anomalous momentum distribution obtained during a free expansion of the superfluid. During the expansion $n(k)$ can be extracted if a few considerations are made. The most important consideration is related to the validity of the method. During the free expansion of a normal (absence of vortices sample), momentum of expansion results from the strong interaction presented in the sample (Thomas Fermi regime). We however show that for the turbulent cloud that is not the case, and the extra kinetic energy added due to the rotational field is the main cause of the anomalous regime obtained. We will present the technique as well as the results, discussing the possible explanations for the observations.

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