

Abstract Submitted
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Observation of Quantized Flow of a BEC in a Toroidal Trap¹

CHANGHYUN RYU, KEVIN HENDERSON, MALCOLM BOSHIER, Los Alamos National Laboratory — Quantized circulation, one of the most important consequences of Bose-Einstein condensation, is fundamental to the understanding of superfluid phenomena. In a toroidal trap, Bose- condensed atoms should flow with a well defined winding number, which makes it an ideal system to demonstrate the quantized nature of circulation. We used a scanning laser beam to create a toroidal trap [1]. To rotate the atoms, a small potential barrier within the toroidal trap was rotated at a certain frequency and then the barrier was lowered to create a quantized flow state. The winding number of the flow was determined by the diameter of the central hole seen in a time of flight image of the condensate. The measurement showed diameters increasing stepwise with the stirring frequency. We observed flows with winding number up to 5. This is a clear demonstration of the quantization of the flow of atoms in a toroidal trap. Further study of critical velocity and metastability of flow of atoms will be very important in understanding the nature of superfluidity of atoms in a toroidal trap, especially in a 1D limit.

[1] K. Henderson, C. Ryu, C. MacCormick, and M. G. Boshier, *New Journal of Physics* 11, 043030 (2009).

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