

Abstract Submitted
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Interferometric measurement of the sign and magnitude of a persistent, quantized current in a BEC AVINASH KUMAR, STEPHEN ECKEL, FRED JENDRZEJEWSKI, GRETCHEN CAMPBELL, NIST/JQI/ University of Maryland, College Park — We introduce a new method to simultaneously determine the sign and magnitude of a persistent, quantized current state of a ring-shaped BEC by interfering it with a phase reference. We implement this scheme by trapping neutral ^{23}Na atoms in an all optical “target trap shaped” potential, which consists of a disc surrounded by a toroidal trap. Previous experiments done in our group and elsewhere have measured the persistent current state of a ring-shaped BEC by observing a hole appear in the BEC after time of flight expansion [*Phys. Rev. Lett.*, **106**, 130401 (2011); *Phys. Rev. A.*, **86**, 013629 (2012)]. However, this method is unable to determine the direction of rotation. To overcome this limitation, we have added a disc-shaped trap inside the toroidal trap. The BEC trapped in the disc acts as an independent phase reference, which when released interferes with the BEC in the toroidal trap. The resulting atomic density distribution in time of flight has a spiral shape. The number of spiral arms gives the magnitude of winding number, while their chirality allows us to determine the direction of the persistent current.

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