

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Stirring a ring Bose-Einstein condensate: vortices and overall circulation¹ NOEL MURRAY, MARK EDWARDS, Georgia Southern University, CHARLES W. CLARK, Joint Quantum Institute — We have studied the process whereby stirring a superfluid Bose–Einstein condensate confined in a ring-shaped potential leads to an overall circulation. We solved the time-dependent Gross–Pitaevskii equation under conditions chosen to match those of an experiment recently conducted at NIST. Briefly, 500,000 Na atoms were confined at the ring-shaped intersection of a red-detuned horizontal light sheet and a vertically propagating Laguerre–Gauss beam. Stirring was carried via a blue-detuned gaussian beam. We found that, at first, the stirring spawned a number of vortex–antivortex pairs and then stopped. These vortices displayed a complicated dynamical behavior which slowly reduced the number of vortices pairwise via annihilation and singly via diffusion into surface modes of the condensate. At the end of this dynamics, the set of vortices was replaced by an overall circulation of atoms around the ring. We present examples of this behavior, give a simple model of vortex motion and vortex-vortex interaction, and show how the production and annihilation of vortices gets turned into an overall circulation of the ring Bose–Einstein condensate.

¹Support in part by NSF grant #1068761.

Mark Edwards
Georgia Southern University

Date submitted: 13 Nov 2012

Electronic form version 1.4