Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Detection of topological excitations in atom circuits via phase reference[1] C. LANIER, N. MURRAY, M. EDWARDS, Georgia Southern University, C.W. CLARK, Joint Quantum Institute — Atom circuits (such as ring Bose–Einstein condensates [BECs]) can now be implemented in ultracold–atom systems confined in a horizontal plane with a red–detuned light sheet plus an essentially arbitrary two–dimensional potential in the plane. Atom–circuit operation may be effected by subsequent interaction with the system (such as stirring a ring BEC with a blue–detuned laser). These interactions will create topological excitations such as solitons and ring– and line–vortices which may be critical to circuit operation. It is therefore interesting to study methods by which such topological excitations can be detected and to identify the various signatures whereby the different excitations can be distinguished. We have investigated methods for doing this in multiply connected BECs in which part of the condensate participates in the atom circuit while another part is left alone so that its phase profile is undisturbed. By releasing the confinement the presence of these topological excitations may be detected via the resulting interference pattern. Using the time–depdendent Gross–Pitaevskii equation, we demonstrate ways in which this may be done for BECs confined in ring–ring and disk–plus–ring traps. We show how to detect vortices, solitons, and phonons.

[1]Supported in part by NSF grant #1068761 and ARO Atomtronics MURI

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Date submitted: 14 Nov 2013 Electronic form version 1.4