Abstract Submitted
for the DAMOP08 Meeting of
The American Physical Society

Constructing Diodes and Transistors for Ultracold Atoms RONALD PEPINO, JOHN COOPER, DANA ANDERSON, MURRAY HOLLAND, JILA — The ultracold atom-optical analogy to electronic systems is presented, along with the master equation formalism that is applied to this novel physical context of system-reservoir interactions. The proposed formalism lends itself quite readily to not only the study of atomtronic systems, but also transport properties of ultracold atoms in optical lattices. We demonstrate how these systems can be configured so that they emulate the behavior of the electronic diode, field effect transistor (FET), and bipolar junction transistor (BJT). The behavior of simple logic gates: namely, the AND and OR gates are follow as direct consequences of the atomtronic BJTs.

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Date submitted: 01 Feb 2008 Electronic form version 1.4