Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Autonomous Reversible Fluxon Logic Gates WALTRAUT WUSTMANN, KEVIN D. OSBORN, Laboratory for Physical Sciences, College Park, MD, OSBORN TEAM — The low-dissipative motion of fluxons in long Josephson junctions (LJJ) may be exploited in future computational settings such as reversible digital computing and flux qubit readout. The former aims to minimize energy cost per logical operation and in the latter a fluxon delay dependent on the state of the flux qubit is detected. We study the scattering of fluxons between LJJs which are connected by a special interface containing only a few ordinary JJs. The structure exhibits intriguing phenomena, where the fluxon is forward-scattered as either fluxon or antifluxon, depending on the interface parameters. These processes are moreover reversible, involving almost no energy loss. We identify the phenomena with the Identity and NOT gate, respectively, by noting that the fluxon and antifluxon can represent the two bit states. Unlike existing reversible digital logic which rely on adiabatic external drives, these reversible gates are autonomous. The gate dynamics are quantitatively captured by a collective coordinate approach using only two variables, where each one represents a LJJ field using a fluxon and mirror antifluxon. We then show that a reversible 2-bit gate can be made which is related to the dynamics of the 1-bit gates.

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Date submitted: 11 Nov 2016 Electronic form version 1.4