Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Quantum Circuits for Measuring Levin-Wen Operators NICK BONESTEEL, Dept. of Physics and NHMFL, Florida State University, DAVID DIVINCENZO, Forschungszentrum Juelich & RWTH Aachen — We give explicit quantum circuits (expressed in terms of Toffoli gates, CNOTs and single qubit rotations) which can be used to perform quantum non-demolition measurements of the commuting set of vertex and plaquette operators that appear in the Levin-Wen model [1] for the case of doubled Fibonacci anyons. Such measurements can be viewed as syndrome measurements for the quantum error correcting code defined by the ground states of the Levin-Wen model — a scenario envisioned in [2]. A key component in our construction is a quantum circuit $\mathcal{F}$ that acts on 5 qubits at a time and carries out a so-called F-move, a unitary operation whose form is essentially fixed by a self-consistency condition known as the pentagon equation. In addition to our measurement circuits we also give an explicit 7 qubit circuit which can be used to verify that $\mathcal{F}$ satisfies the full pentagon equation as well as a simpler 2 qubit circuit which verifies the essential nontrivial content of this equation.
[1] M.A. Levin and X.-G. Wen, Phys. Rev. B **71** 045110 (2005).
[2] R. Koenig, G. Kuperberg, and B.W. Reichardt, Ann. Phys **325**, 2707 (2010).

Nick Bonesteel
Dept. of Physics and NHMFL, Florida State University

Date submitted: 11 Nov 2011 Electronic form version 1.4