Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Anyonic Braiding in Optical Lattices[1] CHUANWEI ZHANG, VITO SCAROLA, SUMANTA TEWARI, SANKAR DAS SARMA, CMTC, Department of Physics, University of Maryland, College Park, MD 20742 — Topological quantum computation proposes to use braiding of collective excitations implanted in topologically protected coherent quantum states of many particles, as opposed to a single particle, to aid in or even perform quantum computation. Here we explicitly work out a realistic experimental scheme to create, braid and detect topological excitations in the Kitaev model built on a tunable robust system, a cold atom optical lattice. A key feature of topological excitations is their braiding statistics, how they behave when one excitation is taken around another. An observation of the non-trivial braiding statistics described in this Report would directly establish the existence of anyons, quantum particles which are neither fermions nor bosons. Demonstrating anyonic braiding statistics is tantamount to observing a new form of matter, topological matter. Once created, excitations in quantum topological matter, as opposed to delicate single particle quantum states, can provide a robust way to encode and manipulate quantum information.

[1]This work is supported by ARO-DTO, ARO-LPS, and NSF

Chuanwei Zhang
CMTC, Department of Physics, University of Maryland,
College Park, MD 20742

Date submitted: 22 Nov 2006 Electronic form version 1.4