Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

An Index Theorem for the Majorana Zero Modes in Chiral P-Wave Superconductors[1] SUMANTA TEWARI, SANKAR DAS SARMA, Condensed Matter Theory Center, Department of Physics, University of Maryland, College Park, MD 20742, DUNG-HAI LEE, Department of Physics, University of California at Berkeley, Berkeley, CA 94720 — We show that the Majorana fermion zero modes in the cores of odd winding number vortices of a 2D $p_x + ip_y$-paired superconductor is due to an index theorem. This theorem is analogous to that proven by Jackiw and Rebbi for the existence of localized Dirac fermion zero modes on the mass domain walls of a 1D Dirac theory. The important difference is that, in our case, the theorem is proven for a two component fermion field theory where the first and second components are related by parity reversal and hermitian conjugation. The vortices with Majorana zero modes can be used, in principle, to build a topological quantum computer.

[1]DOE Grant No. DE-AC03-76SF00098, and ARO-DTO, ARO-LPS, and NSF.

Sumanta Tewari
Condensed Matter Theory Center, Department of Physics
University of Maryland, College Park, MD 20742

Date submitted: 10 Nov 2006 Electronic form version 1.4