

Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Induced Chiral f-wave Superconducting Pairing and Majorana Fermions in a Hole-doped Semiconductor¹ CHUANWEI ZHANG, LI MAO, Department of Physics and Astronomy, Washington State University, Pullman, Washington, 99164 USA, JUNREN SHI, International Center for Quantum Materials, Peking University, Beijing 100871, China, QIAN NIU, Department of Physics, The University of Texas, Austin, Texas 78712 USA — We show that a chiral f + if-wave superconducting pairing may be induced in the lowest heavy hole band of a hole-doped semiconductor thin film through proximity contact with an s-wave superconductor. The chirality of the pairing originates from the 3π Berry phase accumulated for a heavy hole moving along a close path on the Fermi surface. There exist three chiral gapless Majorana edge states, in consistence with the chiral f + if-wave pairing. We show the existence of zero energy Majorana fermions in vortices in the semiconductor-superconductor heterostructure by solving the Bogoliubov-de Gennes equations numerically as well as analytically in the strong confinement limit. The proposed semiconductor/superconductor heterostructure can be used as a platform for observing non-Abelian statistics and performing TQC.

¹This work is supported by DARPA-YFA, DARPA-MTO, ARO, 973 program, NSFC, DoE, and the Welch Foundation.

Chuanwei Zhang
Department of Physics and Astronomy, Washington State University,
Pullman, Washington, 99164 USA

Date submitted: 09 Nov 2010

Electronic form version 1.4