Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

A realistic topological quantum computation platform using hole-doped semiconductor nanowires and s-wave superconductors MING GONG, LI MAO, Department of Physics and Astronomy, Washington State University, Pullman, Washington, 99164 USA, SUMANTA TEWARI, Department of Physics and Astronomy, Clemson University, Clemson, South Carolina, 29634, USA, CHUANWEI ZHANG, Department of Physics and Astronomy, Washington State University, Pullman, Washington, 99164 USA, ZHANG TEAM, TEWARI TEAM — We show that two majorana fermions exist at the two ends of a hole-doped semiconductor nanowire that is in proximity contact with an s-wave superconductor. The required experimental parameters (carrier density, g-factor, spin-orbit coupling effect, magnetic field, etc.) for the observation of the Majorana fermions are within the experimentally reachable regime of InSb and InAs nanowires and the mini gap that provides the topological protection for the Majorana zero energy states is of the order of the s-wave superconducting gap. The Majorana zero energy states can be observed through the zero bias peak in the STM signal. The Josephson effects between two nanowire are studied. The proposed model provides a realistic experimental platform for observing non-Abelian statistics and performing topological quantum computation. This work is supported by DARP-MTO (FA955-10-1-0497), and DARPA-YFA (N66001-10-1-4025).

Ming Gong
Dept of Physics and Astronomy, Washington State University,
Pullman, Washington, 99164 USA

Date submitted: 27 Nov 2010 Electronic form version 1.4