

Abstract Submitted
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A theorem for the existence of Majorana fermion modes in spin-orbit-coupled semiconductors¹ SUMANTA TEWARI, Department of Physics and Astronomy, Clemson University, Clemson, SC 29634, JAY D. SAU, SANKAR DAS SARMA, Condensed Matter Theory Center and Joint Quantum Institute, Department of Physics, University of Maryland, College Park, MD 20742 — We prove a theorem for the existence of Majorana zero modes in a semiconducting thin film with a sizable spin-orbit coupling when it is adjacent to a *s*-wave superconductor. The theorem, which is analogous to the Jackiw-Rebbi index theorem for the zero modes in mass domain walls in one-dimensional Dirac theory, applies to vortices with odd flux quantum in a semiconducting film in which *s*-wave superconductivity and a Zeeman splitting are induced by proximity effect. Thus the theorem proves the existence of non-degenerate zero-energy Majorana excitations and the resultant non-Abelian topological order in the proposed semiconductor heterostructure.

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