

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Theory of Odd-Parity Superconductivity: from Gap Function to Topological Invariants and Surface Andreev Bound States YANG QI, Institute for Advanced Study, Tsinghua University, LIANG FU, Department of Physics, Massachusetts Institute of Technology — Three-dimensional superconductors with a nodeless pairing gap can be classified by an integer topological invariant, and gapless Andreev bound states exist on the surface when the topological invariant is nontrivial. In this letter we give a general criterion for determining the topological invariant for centrosymmetric superconductors with *odd-parity* pairing. We show that in a general system with spin-orbit coupling, the superconducting gap function can be expressed by a pseudospin d-vector, and the topological invariant can be determined from the total winding number of the pseudospin d-vector on the Fermi surfaces. We also discuss Andreev surface states, and we found gapless surface states when the topological invariant in the bulk is topologically nontrivial.

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Date submitted: 09 Nov 2011

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