Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Anyon and Loop Braiding Statistics in Field Theories with a Topological Θ-term ZHEN BI, University of California, Santa Barbara, YI-ZHUANG YOU, The Kavli Institute for Theoretical Physics, UC Santa Barbara, CENKE XU, University of California, Santa Barbara — For gapped quantum many-body systems, the topological properties of the state are usually encoded by the exotic statistics between its excitations. In 2d, braiding statistics of quasi-particle excitations can be anyonic and uniquely determine the topological phase. This method is successfully applied in 2d to distinguish different Symmetry Protected Topological Phases. Recently, a generalized idea about braiding statistics of loop excitations in 3d gapped system was proposed. We demonstrate that the anyon statistics and three-loop statistics of various 2d and 3d topological phases can be derived using semiclassical Nonlinear Sigma Model field theories with a Topological Θ-term. In our formalism, the braiding statistics has a natural geometric meaning: The braiding process of anyons or loops leads to a nontrivial field configuration in the space-time, which will contribute a braiding phase factor due to the Θ-term. We also provide several physical pictures to understand the cyclic relation of the loop statistics.

Zhen Bi
University of California, Santa Barbara

Date submitted: 05 Nov 2014 Electronic form version 1.4