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Classification and Description of Bosonic Symmetry Protected Topological Phases with semiclassical Nonlinear Sigma models ZHEN BI, ALEX RASMUSSEN, CENKE XU, University of California, Santa Barbara — Symmetry protected topological (SPT) phases are a new type of quantum disordered phases with certain symmetry G, which is intrinsically different from a trivial direct product state. Well-known examples include topological insulators, topological superconductors and the Haldane phase of spin-1 chain. We focus on the field theory description of Bosonic SPT phases in all physical spatial dimensions. We propose that many bosonic SPT phases with different symmetries on a d-dimensional lattice can be described and classified by the same O(d+2) Nonlinear Sigma Model (NLSM) of a semiclassical Landau order parameter field in (d+1)-dimensional space-time, with a topological Θ-term. Our classification based on topological NLSMs is completely identical to the Group Cohomology Classification of bosonic SPT phases. Besides that, NLSMs formalism also allow us to describe explicit physical properties of SPT phases, such as the bulk wave functions and boundary theories.

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