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Topological Phases on Non-orientable Surfaces: Twisting by Parity Symmetry PAK ON CHAN, ICMT at University of Illinois Urbana-Champaign, CHI YAN TEO, Physics at the University Of Virginia, SHINSEI RYU, ICMT at University of Illinois Urbana-Champaign — We discuss (2+1)D topological phases on non-orientable spatial surfaces, such as Möbius strip, real projective plane and Klein bottle, etc., which are obtained by twisting the parent topological phases by their underlying pairty symmetries through introducing parity defects. We construct the ground states on arbitrary non-orientable closed manifolds and calculate the ground state degeneracy. Such degeneracy is shown to be robust against continuous deformation of the underlying manifold. We also study the action of the mapping class group on the multiplet of ground states on the Klein bottle. The physical properties of the topological states on non-orientable surfaces are deeply related to the parity symmetric anyons which do not have a notion of orientation in their statistics. For example, the number of ground states on the projective plane equals the root of the number of distinguishable parity symmetric anyons, while the ground state degeneracy on the Klein bottle equals the total number of parity symmetric anyons; In deforming the Klein bottle, the Dehn twist encodes the topological spins whereas the Y-homeomorphism tells the particle-hole relation of the parity symmetric anyons.

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