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Anomalies in (2+1)D fermionic topological phases and (3+1)D state sums for fermionic SPTs

I will describe a way to compute anomalies in general (2+1)D fermionic topological phases. First, a mathematical characterization of symmetry fractionalization for (2+1)D fermionic topological phases is presented, and then this data will be used to define a (3+1)D state sum for a topologically invariant path integral that depends on a generalized spin structure and G bundle on a 4-manifold. This path integral is a cobordism invariant and describes a (3+1)D fermion symmetry-protected topological state (SPT). The special case of time-reversal symmetry with $T^2 = -1^F$ gives a $\mathbb{Z}_{16}$ invariant of the 4D Pin$^+$ smooth bordism group, and gives an example of a state sum that can distinguish exotic smooth structure.