

Abstract

We outline a program to construct modular tensor categories from three dimensional manifolds, that was first proposed in (JHEP 2020, 115(2020)) using M theory. The classical Chern-Simons invariant and the adjoint Reidemeister torsion provide the T-matrix and quantum dimensions of simple objects. The modular S-matrix is produced by local operators based on a guess-and-trial process. We made a number of improvements based on extensive computations of two infinite families of three manifolds, namely, the Seifert fibered spaces and the torus bundles over the circle. From the two families, we obtained premodular categories that are related to the Temperley-Lieb-Jones categories and metaplectic modular categories. The program reveals a deep connection between two parallel universes of 3-manifolds: the classical Thurston world of geometric topology and the quantum Jones world of topological quantum field theories.