



# 清华大学高等研究院

Institute for Advanced Study, Tsinghua University

## 学术报告

**Title:** Higher Categories and Topological Quantum Field Theories

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**Time:** 3:30pm, Monday, Nov 28, 2016

**Venue:** Conference Hall 322, Science Building, Tsinghua University

### Abstract

We construct a Turaev-Viro type invariant of smooth closed oriented 4-manifolds out of a  $G$ -crossed braided spherical fusion category ( $G$ -BSFC) for  $G$  a finite group. The construction can be extended to obtain a (3+1)-dimensional topological quantum field theory (TQFT). The TQFT generalizes several known ones in literature such as the Crane-Yetter/Walker-Wang TQFT from a ribbon fusion category and Yetter's TQFT from homotopy 2-types. If the  $G$ -BSFC is concentrated only at the sector indexed by the trivial group element, a co-homology class in  $H^4(G, U(1))$  can be introduced to produce a different invariant, which reduces to the twisted Dijkgraaf-Witten theory in a special case. Although not proven, it is believed that our invariants of 4-manifolds are strictly different from other known invariants. It remains to see if the invariants are sensitive to smooth structures. It is expected that the most general input to the construction of (3+1)-TQFTs is a spherical fusion 2-category. We show that a  $G$ -BSFC corresponds to a monoidal 2-category with certain extra structures, but these structures do not satisfy all the axioms of a spherical fusion 2-category given by M. Mackaay. Thus the question of what axioms properly define a spherical fusion 2-category is open.