ND Grad Student Topology Seminar, Spring 2018: A Survey of Topological Quantum Field Theories

January 3, 2018

Topological quantum field theories (TQFT) were originally motivated by questions in physics in the 1980s, but have since lead to numerous fruiful avenues of mathematical inquiry (such as invariants of manifolds, constructions of higher categories, questions in stable homotopy theory, etc.).

My plan is to give a series of lectures introducing the definition of TQFT (outlining its motivation from physics), and then to illustrate a particular instance of how TQFT are related to classical algebraic topology questions: namely, how the supersymmetric 0|1-dimensional TFT over a manifold X are related to the de Rham cohomology of X.

TQFT is a vast topic, and there are many areas that we could explore in this seminar. I've listed a few topics that I think would be particularly interesting to learn more about, as a place to start looking for inspiration:

- extended TQFT and higher categories

- the Cobordism Hypothesis (survey paper by Dan Freed by this name, 2013; Constantin Teleman's *Five Lectures on TFT*

- invertible TQFT and connection to stable homotopy theory (for invertible TFT with nice pictures, Chris's *Tori Detect Invertibility of TFT*

- factorization algebras and their relationship to TFT (Stephan's notes)

- more about higher dimensional supersymmetric field theories and their relationship to topological invariants (K-theory, possibly TMF; see the Stolz-Teichner survey paper, *Supersymmetric field theories and generalized cohomology*; Arno Caine also has notes from a course Stephan taught of the same name)