Math 80440 Spring 2014

Topics in Topology

Stephan Stolz

The topic of this course is **Functorial Field Theories and Factorization Algebras**. Functorial field theories (pioneered by Atiyah, Konsevich and Segal in the 1980's) as well as factorization algebras (a notion introduced by Beilinson and Drinfeld in the early 2000's) are intended as tentative mathematical definitions of "quantum field theories". A main goal of this course is an introduction to these notions and a discussion of examples of these structures. This is proceeded by describing classical field theories and a heuristic discussion of "quantization" that motivates these notions.

The course will draw from the following sources:

- Owen Gwilliam's 2012 thesis, entitled *Factorization algebras and free field theories*, which is available at http://math.berkeley.edu/~gwilliam/thesis.pdf.
- The draft of the book entitled *Factorization algebras in quantum field theory* by Costello and Gwilliam, available at http://www.math.northwestern.edu/~costello/factorization.pdf.
- The survey paper *Supersymmetric field theories and generalized cohomology* by Teichner and myself in Volume 83 of Proc. Symp. Pure Math. available at http://arxiv.org/pdf/1108.0189.pdf.
- Unpublished work of Dwyer, Teichner and myself that relates factorization algebras and functorial field theories.

I will attempt to provide texed notes of my lectures on the course website http://www3.nd.edu/~stolz/Math80440(S2014)/.

The only prerequisite for the course is standard first year graduate material (in particular, manifolds, vector bundles, differential forms, chain complexes, homology and categories) and a willingness to learn new stuff. Necessary background material will be covered as needed.