MODULAR TENSOR CATEGORIES AND QUANTUM INVARIANTS
MATH 7290
FALL 2019

Course Information

- **Classroom:**
  Allen Hall 134
- **Time:**
  MWF 10:30 - 11:20 AM
- **Instructors:**
  Siu-Hung Ng and Yilong Wang
- **Offices:**
  252 Lockett Hall (Ng)
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- **Office Hours:**
  Th 9:30 - 11:20 AM in 252 Lockett Hall, or by appointment.
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Course Description

This course gives an introduction to modular tensor categories and their application to the Reshetikhin-Turaev (RT) 3-dimensional topological quantum field theories (TQFTs). We will start with the theory of fusion and modular tensor categories. The indispensable tool of graphical calculus for the study of these categories demonstrates a relation between ribbon graphs and the algebraic structures of ribbon or modular tensor categories. Quantum invariants of framed links and 3-manifolds are defined by this relation. We will then give an axiomatic definition of TQFTs with the emphasis on the 3-dimensional RT-TQFTs associated to modular tensor categories and the mapping class group representations.

References

- Turaev, Vladimir G. *Quantum invariants of knots and 3-manifolds (Third edition)*. De Gruyter Studies in Mathematics, 18. De Gruyter, Berlin, 2016. (Main reference for TQFTs)

- Bakalov, Bojko; Kirillov, Alexander, Jr. *Lectures on tensor categories and modular functors*. University Lecture Series, 21. American Mathematical Society, Providence, RI, 2001. (Main reference for modular tensor categories)

- Kassel, Christian. *Quantum groups*. Graduate Texts in Mathematics, 155. Springer-Verlag, New York, 1995. (Classical textbook.)

- Etingof, Pavel; Gelaki, Shlomo; Nikshych, Dmitri; Ostrik, Victor. *Tensor categories*. Mathematical Surveys and Monographs, 205. American Mathematical Society, Providence, RI, 2015. (Technical reference for the general theory of fusion categories.)