Oral Qualification Exam Syllabus for Aakash Parikh

Qualification Exam Time: 3:00 PM on Friday, September 17th

Proposed Committee:
Kristen Hendricks (chair), Gregory Moore, Hongbin Sun, Feng Luo

Major Topic: Algebraic Topology

1. **Knot Theory**
   Via Lickorish "An Introduction to Knot Theory" Chapters 1-12. Seifert surfaces, Jones polynomial, alternating links (geometry of and Jones polynomial), Alexander polynomial (including covering space theory definition and matrix/diagram definition), Conway polynomial, slice Knots, cyclic branched covers and Goertz matrix, Arf invariant and Jones polynomial, knot fundamental group, 3 manifolds/surgery.

2. **Characteristic Classes**
   Via Milnor and Stasheff "Characteristic Classes" Chapters 1-16 (and supplemented by Hatcher Vector Bundles and K-theory) Bundle basics, Stiefel Whitney classes (axiomatic definition and existence), Grassman manifolds and universal bundles giving rise to characteristic classes, cohomology ring of Grassman manifolds, Euler class, Thom Iso, Example of characteristic classes on tangent and normal bundle, obstructions, complex vector bundles, Chern classes, Pontrjagin classes, Chern and Pontrjagin numbers.

Minor Topic: 2d Conformal Field Theory

Via diFrancesco CFT, Ginsparg's online notes, Fuchs' notes and papers. Basics of conformal symmetry in two dimensions, fields and correlation functions, radial quantization and the operator formalism, conformal families and Verma modules, Examples of CFTS, extended symmetry algebras, modular invariance, conformal blocks, simple Lie algebras, affine Lie algebras, WZW models, GKO coset models, gauged WZW models. Maybe 2dTQFT/Frobenius algebras.