Math 993, Fall 2013

Topics in Gauge Theory

Room A-304 Wells Hall
Course webpage:
math.msu.edu/∼parker/GT

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Office hours: Tuesday 1-2
Wednesday 11-12
Thursday 11-12

This course covers mathematical gauge theory. In content and organization, it will adapt the perspective of physicists. The aim is to integrate the physics viewpoint and intuition into the mathematical theory. The terminology of physics permeates the subject, but if often not understood by mathematicians. In particular, we will discuss quantum gauge theories.

Here is a preliminary list of topics:

1. Classical fields and Maxwell's equations as a gauge theory.
2. Spinors and the Dirac equation.
3. The Seiberg-Witten equations.
4. Second quantization
5. Yang-Mills and general gauge theories
6. Path integrals
7. Examples

Prerequisites: Familiarity with manifolds and vector bundles. It will be very useful, but not strictly necessary, to have some knowledge of PDEs and Riemannian geometry.

Grades: There will be homework assignments, collected every 1-2 weeks; the course grade will be based on these. Students are encouraged to work together on these.

References (The first two are available online – click on title).

1. *Mirror Symmetry*, by K. Hori, S. Katz, A. Klemm, R. Pandharipande, R. Thomas, C. Vafa, R. Vakil and E. Zaslow. This book gives nice, but terse, explanations of physics concepts from a mathematical viewpoint.
2. *Advanced Quantum Mechanics*, by Freeman Dyson. Read the preface for the interesting history of these notes.
3. *The geometry of four-manifolds*, by S. Donaldson and P. Kronheimer.