Introduction to Seiberg-Witten theory

Tuesday 14:50–16:25, Thursday 19:30–21:05
Room 1418

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grading:
I will give some exercises which will be the basis for your grade. I will post problems and announcements on the above web page.

This course will give an introduction to the Seiberg-Witten invariants and their applications to the geometry and topology of smooth four manifolds. Since the mid 90's Seiberg-Witten theory has revolutionized the study of the topology and differential geometry of smooth four manifolds. The new invariants, introduced by Ed Witten in '94, are easier to work with and more versatile than the $SU(2)$ Yang-Mills theory due to Simon Donaldson, and are now essential knowledge for anyone working in four dimensional topology, differential geometry, or symplectic 4-manifolds.

The first part of the course will introduce the equations, the moduli space, and the invariants. Along the way we will cover the necessary and useful background in analysis and 4-manifold topology. With this in hand we will consider applications to the smooth topology of complex surfaces, and time permitting we will cover more advanced topics. The latter will likely include Taubes' result on the non-vanishing of the Seiberg-Witten invariant of a symplectic 4-manifold, and gluing results.

The course will require a working knowledge of differential geometry, and also some knowledge of complex manifolds will be assumed. But no knowledge of gauge theory is required.

The main reference will be

- Liviu Nicolaescu. Notes on Seiberg-Witten theory. Graduate Studies in Mathematics, 28. *American Mathematical Society*, 2000, 484 pp.

Some other good introductory texts:

- John W. Morgan. The Seiberg-Witten equations and applications to the topology of smooth four manifolds. Mathematical Notes, 44. *Princeton University Press*, 1996, 128 pp.
- Dietmar Salamon. Spin geometry and Seiberg-Witten invariants. *book based on lectures by author at University Warwick*, 1996, 390 pp.

A good source on 4-manifold topology is

- Robert Gompf and András Stipsicz 4-manifolds and Kirby Calculus. Graduate Studies in Mathematics, 20. *American Mathematical Society*, 1999, 558 pp.