

**Math 666: Seminar in Geometry**  
- Introduction to Noncommutative Geometry  
**Spring 2016**

**Lecturer:** Zhizhang Xie

**Lectures:** TR 2:20-3:35pm, BLOC 160

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**Office Hours:** Monday 1:30 - 3:30pm or by appointment

**Prerequisites:** first semester graduate course in functional analysis. Familiarity with basic differential geometry and algebraic topology would help, but not required.

**Course Outline:**

This course is the second in the series of three courses for introduction to noncommutative geometry. Although designed as a follow-up of Dr. Ron Douglas' seminar course Math 663 in Fall 2015, I will try to make the course as self-contained as possible. Possible topics to be covered:

- (1) K-theory: topological K-theory of topological spaces, K-theory of  $C^*$ -algebras;
- (2) index theory: manifolds, differential operators, Atiyah-Singer index theorem, Fredholm index, higher index theory;
- (3) applications to geometry and topology.

**References:**

- Rufus Willett and Guoliang Yu, an introductory textbook on noncommutative geometry (unfinished book draft)
- Nigel Higson and John Roe, *Analytic K-homology*, Oxford University Press
- Piotr Nowak and Guoliang Yu, *Large Scale Geometry*, European Mathematical Society
- John Roe, *Elliptic operators, topology and asymptotic methods*, Longman
- Atiyah, *K-theory*, W. A. Benjamin, Inc.