

**Target group:** PhD students and postdocs in mathematics & mathematical physics

**Course Title:** Advanced topics in geometry and topology

**Extend:** 3 hours per week / 15 weeks / 5 ECTS

**Aims** The primary aim of this course is to introduce students to some advanced topics that serve as a connecting bridge between fundamental concepts in quantum physics and beautiful structures in algebraic geometry and topology. These subjects go beyond what is typically covered in PhD level courses and will be tailored to specific thesis problems of current PhD students, while still being valuable for all PhD students and postdocs working in relevant fields. Specific topics will be determined commonly by instructor and students together at the beginning of semester (text will be given upon topics are decided). Meanwhile, this course is also targeted at guiding students on the practice of giving a math lecture. Students will gain experience on handling time constraints during a talk and how to field questions from the audience.

**Synopsis** Sheaves theory plays a central role in mathematics, and was widely applied in pure and applied mathematics. Sheaves on topological spaces, in particular manifold, are particular useful in topology and geometry. In this course, we will explain sheaves on manifold, in particular its microlocal aspects based on the theory of infinity category. We will try to cover basic notion of infinity category and higher topos theory, with emphasize in examples and applications.

The precise content of the course will be determined by the instructors based on thesis topics and current interest of the students. Students are expected to provide a one-hour presentation on their chosen topic. After the presentation, we will continue with a thirty minute group discussion. Students will discuss the topics under supervision of the instructor.

#### Evaluation method

The evaluation will be based on the two-hour presentation by each student in class (using the hours allocated for the course) on one of the topics covered in the course. The lecturer and an internal censor will be present during the talk to evaluate the presentation and ask the student questions. The evaluation will be pass/fail.

**Teaching method:** In person lectures.

**Responsible lecture(s)** Bingyu Zhang

**Literature** Misaki Kashiwara and Pierre Schapira, Sheaves on manifold.

Achim Krause, Thomas Nikolaus, Phil Putzstuck, Sheaves on Manifolds.

Moritz Groth, A short course on  $\infty$ -categories.

Jacob Lurie, Higher topos theory.

Jacob Lurie, Higher algebra.