

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 This course is an introduction to advanced topics in symplectic and contact geometry. The primary aim is to serve as an introduction to Fukaya categories and their deep connections with other areas of mathematics through the vehicles of Legendrian contact homology and homological mirror symmetry. The focus will be on concrete examples and applications which implement modern viewpoints and methods of calculation.

In addition to the mathematical content, the pedagogical aim of the course is to provide ample opportunity for students to read and learn from influential works of the past decades. During discussions, students are encouraged to ask questions and pursue their own interests within the parameters of the course. One final aim is that students receive training on their presentation skills by giving regular lectures in view of their peers.

Synopsis Floer theory and Fukaya categories are essential tools in modern symplectic and contact geometry, and their development has motivated many fundamental advancements in the past decades. This course explores their ubiquity by highlighting techniques from geometric representation theory, low-dimensional topology, quantum field theory, as well as many other fields of mathematics.

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 twice a week.

Responsible lecture(s) William Olsen, Adrian Petr

Literature Paul Seidel, Fukaya Categories and Picard–Lefschetz Theory. 2008.

Denis Auroux, A beginner’s introduction to Fukaya categories. math.SG/1301.7056.

Bourgeois—Ekholm—Eliashberg, Effect of Legendrian surgery

Ekholm--Lekili, Duality between Lagrangian and Legendrian invariants