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

Course Title: **Advanced Topics in Quantum Mathematics: Gromov—Witten theory**

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. 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: The goal of these lectures is to study the algebraic construction of categorical enumerative invariants from a cyclic A-infinity category and a splitting of the Hodge filtration due to Caldararu—Costello—Tu, and its relation to topological conformal and Deligne—Mumford field theories.

The precise content of the course can be amended at the beginning of the semester based on the common interests of the students.

Evaluation method:

The evaluation will be based on a 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 lecturer(s)   Guillaume Laplante-Anfossi

Literature

Kevin J. Costello, Topological conformal field theories and Calabi—Yau categories, Adv. Math. 210 (2007), no. 1, 165–214. (https://arxiv.org/abs/math/0412149)

Andrei Caldararu, Kevin J. Costello, Junwu Tu, Categorical Enumerative Invariants, I: String vertices, https://arxiv.org/abs/2009.06673, 2020

Andrei Caldararu, Junwu Tu, Effective Categorical Enumerative Invariants, https://arxiv.org/abs/2404.01499, 2024

Amanda Hirschi and Kai Hugtenburg, An open-closed Deligne—Mumford field theory associated to a Lagrangian submanifold, https://arxiv.org/abs/2501.04687, 2025