MAT755: LECTURE QUANTUM INVARIANTS OF LINKS

What?

Quantum invariants are more than just topological invariants needed to tell objects apart. They build bridges between topology, algebra, number theory and quantum physics helping to transfer ideas, and stimulating mutual development. They also have a deep and interesting connection to representation theory, in particular, to representations of quantum groups.

In this course we will introduce these objects from different perspectives: skein and representation theoretic. We will start with the Jones polynomial, study its properties, and then move to the categorification of this polynomial discovered by Khovanov. (This is the topic of the block course.) In the second part (i.e. this lecture) of the class we will explain its connections to representation theory following the ideas of e.g. Reshetikhin–Turaev, and then explain how the categorification also arises from very natural constructions in categorical representation theory.

Note that there is a block course given by Anna Beliakova. The lecture follows several texts, e.g. [BS11], [EGNO], [HV19] or [TV17].

Who?

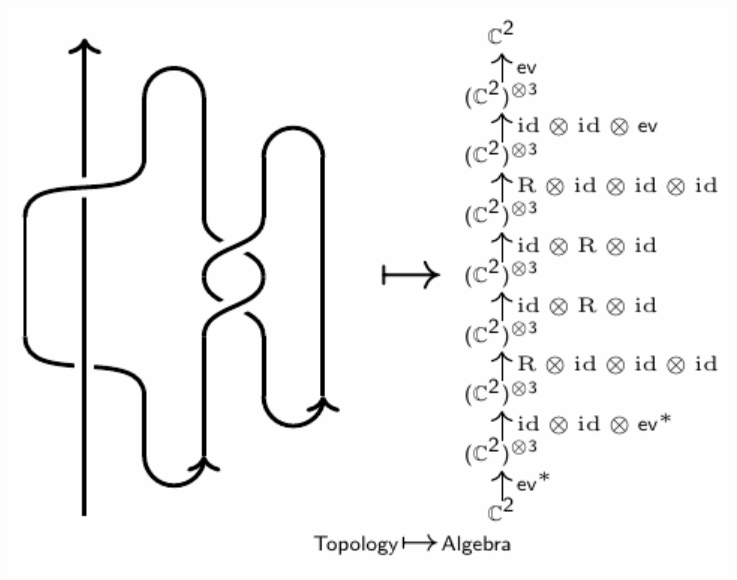
MSC or PhD students in Mathematics interested in a mixture of (linear) algebra, topology and category theory, but everyone is welcome.

Where and when?

- ▶ Time and date.
  - Every Monday from 10:15–12:00.
  - Room Y27H25, University Zurich, Institute of Mathematics.
  - First lecture: Monday 02.Mar.2020. Last lecture: Monday 18.May.2020.
- ▶ Website http://www.dtubbenhauer.com/lecture-qinv-2020.html

Preliminary Schedule.

- ▷ Categories—definitions, examples and graphical calculus. (02.Mar.2020)
- ▷ Monoidal categories I—definitions, examples and graphical calculus. (09.Mar.2020)
- ▷ Monoidal categories II—more graphical calculus. (16.Mar.2020)
- ▷ Pivotal categories—definitions, examples and graphical calculus. (23.Mar.2020)
- ▷ Braided categories—definitions, examples and graphical calculus. (30.Mar.2020)
- ▷ Additive, linear and abelian categories I—definitions and examples. (06.Apr.2020)
- ▷ Additive, linear and abelian categories II—enrich the concepts from before. (27.Apr.2020)
- ▷ Fusion and modular categories I—definitions and graphical calculus. (04.May.2020)
- ▷ Fusion and modular categories II—mainly examples. (11.May.2020)
- ▷ Quantum invariants—finally. (18.May.2020)



References

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[HV19] C. Heunen, J. Vicary. Categories for Quantum Theory: An Introduction. Oxford Graduate Texts in Mathematics, **28**. Oxford University Press, Oxford, 2019. xii+336 pp. Comes close: http://www.cs.ox.ac.uk/people/jamie.vicary/IntroductionToCategoricalQuantumMechanics.pdf

[TV17] V. Turaev, A. Virelizier. Monoidal categories and topological field theory. Progress in Mathematics, **322**. Birkhäuser/Springer, Cham, 2017.

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