MPIM Workshop

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Geometric quantization and topological recursion

November 24-28th, 2014

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Monday 24

– 8h30 Welcome
– 9h-9h50 Andersen I
– Coffee break
– 10h10-11h Andersen I
– 16h MPIM Tea
– 16h30-18h00 Conant (Topology seminar)

Tuesday 25

– 9h-9h50 Eynard I
– Coffee break
– 10h10-11h Eynard I
– 16h MPIM Tea

Wednesday 26

– 9h-9h50 Andersen II
– Coffee break
– 10h10-11h Andersen II
– 16h MPIM Tea
– 16h30-18h00 Borot (Extra talk)
– 18h30 Banquet

Thursday 27

– 9h-9h50 Eynard II
– Coffee break
– 10h10-11h Eynard II
– 15h-16h Orantin (Oberseminar)
– 16h MPIM Tea

Friday 28

– 9h-9h50 Andersen III
– Coffee break
– 10h10-11h Eynard III
– 15h MPIM Tea

Mini-courses (5h)

Monday, Wednesday, Friday

Jorgen Ellegaard Andersen

The Hitchin connection and the Witten-Reshetikhin-Turaev TQFT

We will review the relevant moduli spaces of flat connections which forms the corner stone in the construction of quantum Chern-Simons theory from a gauge theory point of view. We will further review the construction of the Hitchin connection in the bundles over Teichmüller space, which are obtained by applying geometric quantization to these moduli spaces. Following this, we will discuss the asymptotics of the Hitchin connection near certain points on the Thurston boundary of Teichmüller space. This will allow us to define both, the unitary structure preserved by the Hitchin connection, the handlebody boundary state vector and curve operators. We will then discuss their relations to Töplitz operators and obtain asymptotics results about these TQFT. If time allows, we will also discuss quantum Chern-Simons theory with complex gauge group.

Tuesday, Thursday, Friday

Bertrand Eynard

Topological recursion and moduli spaces

The lecture will start with an introduction to the topological recursion. Then, we shall explain the proof of the theorem relating topological recursion to integrals over moduli spaces of curves. The last part will focus on the notion of quantum curves. Some explicit examples will be treated, in particular the finite reductions of KdV.

Topology seminar (Monday 4.30-6pm)

Jim Conant

Graphical obstructions to the surjectivity of the higher order Johnson homomorphism

The Johnson filtration of the mapping class group gives rise to an associated graded Lie algebra. The higher order Johnson homomorphism embeds this Lie algebra in the larger but better understood Lie algebra of symplectic derivations. It has long been known that this is not surjective, and various families of obstructions to surjectivity have been constructed by several authors. We give a graph homology construction that unifies and expands all of the previously known obstructions (with one exception, the so-called Galois obstruction.)

Extra talk (Wednesday 4.30-6pm)

Gaëtan Borot

Review : relations between Chern-Simons theory and topological recursion

Up to now, Chern-Simons theory has been related to topological recursion in two different regimes. Firstly, considering $\mathrm{SU}(N+1)$ theory when $N \to \infty$ in Seifert fibered spaces, the large N expansion of the colored (in any fixed representation R) HOMFLY invariant of fiber knots, can be extracted from a topological recursion. Secondly, it is conjectured that the topological recursion can compute the semiclassical expansion (in $q = e^{\hbar} \to 1$) of a solution to the q-difference equation satisfies by the colored Jones polynomials $J_n(q)$ of a knot $K \subseteq \mathbb{S}_3$ – this was checked in particular for the 8-knot. We shall put this last aspect in perspective with the mini-courses, and informally summarize the relations we expect between geometric quantization of character varieties and topological recursion.

Oberseminar (Thursday 3-4pm)

Nicolas Orantin

Givental quantization procedure and computation of Gromov-Witten invariants by topological recursion

Following an inductive procedure developed in the setup of random matrices, it is possible to solve many problems of enumerative geometry with a unique formula called topological recursion. In particular, this procedure allows to compute higher genus Gromov-Witten invariants of some manifolds in terms of a mirror partner. In this talk, I will present this procedure and show that, in some particular cases, it is equivalent to a quantization formalism developed by Givental for expressing the potential of a semi-simple cohomological field theory in terms of KdV tau functions. This correspondence explains the universality of this procedure for computing Gromov-Witten invariants.

List of participants

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