SWISS KNOTS 2015 - ABSTRACTS

Monday afternoon

Josh Greene *Definite surfaces and alternating links*

I will describe a characterization of alternating links in terms intrinsic to the link complement and use it to give new proofs of some of Tait's conjectures.

Brendan Owens *Some bounds on unlinking number*

I will discuss various methods for obtaining bounds on unlinking numbers, and their usefulness and limitations. This is based on joint work with Matthias Nagel.

Cameron Gordon *Left-orderability, taut foliations, and cyclic branched covers*

It is conceivable that for a prime 3-manifold M the following are equivalent:

(1) $\pi_1(M)$ is left-orderable,
(2) M admits a co-orientable taut foliation, and
(3) M is not a Heegaard Floer L-space.

We will discuss these properties in the case of cyclic branched covers of knots in S^3. This is joint work with Tye Lidman.

Tuesday morning

Zsuzanna Dancso *Lattices of integer cuts and flows: Categorification and combinatorics*

The lattices of integer cuts and flows associated to a graph have rich applications in combinatorics, computer science and even knot theory (by Josh Greene). This talk is a summary of joint work - partly in progress - with Tony Licata on categorified and quantized versions of these lattices. Via a combinatorial construction we introduce Koszul algebras associated to a graph, for which categorical lifts of the lattices appear as module categories. The algebras have a natural grading, resulting in quantized cut and flow lattices which behave very differently from their classical counterparts. We'll discuss possible applications and open questions.

Christian Blanchet *Non semisimple TQFTs from nilpotent representations of quantum $sl(2)$.*

A new family of quantum invariants based on nilpotent represenions of quantum $sl(2)$ at a root of unity have been constructed by Costantino-Geer-Patureau. We show that the new quantum invariants have graded TQFT extensions. We will consider the specific case of root of unity of order 4 where CGP invariants recover Reidemeister torsion with canonical normalisation. In the general case we will describe the arising representations of mapping class groups. Joint work with François Costantino, Nathan Geer and Bertrand Patureau.

Louis-Hadrien Robert *The colored $\mathfrak{sl}_3$-homology*

I will start with a result on $\mathfrak{sl}_3$-representations: I give an explicit resolution of every simple $\mathfrak{sl}_3$-module in terms of tensor powers of the fundamental representation and its dual. Then I will recall the $\mathfrak{sl}_3$-link homology due to Khovanov.

I will tell how to use these two tools to construct an homology theory which decategorify on the colored $\mathfrak{sl}_3$-invariant for framed links. While the construction is pretty natural, there is a major technical difficulty because the $\mathfrak{sl}_3$-homology is not known to be functorial for foam cobordisms. To conclude, I will sketch a way to generalize these results to $\mathfrak{sl}_n$ (this last part is joint with Matt Hogancamp).

Tuesday afternoon

Gaetan Borot *Modular functors, cohomological field theories and topological recursion*

Topological modular functors were introduced about 25 years ago by Segal as a axiomatization of rational conformal field theory. Given any topological modular functor, I will explain how to construct a vector bundle over the moduli space of curves, whose Chern class defines a cohomological field theory. The intersection of this Chern class with psi-classes in $M_{g,n}$ can be computed by the topological recursion of Eynard and Orantin. The initial data of the recursion involve the Dehn twists, the central charge and the S-matrix prescribed by the modular functor. The talk is based on a joint, ongoing work with Jorgen Ellegaard Andersen and Nicolas Orantin.

Christine Lescop *On a cube of the equivariant linking pairing of a knot and its generalizations*

We will describe some knot invariants and some of their properties. All the notions in the more specific abstract below will be explained during the talk.

We will first construct a polynomial knot invariant as an equivariant algebraic intersection of three parallel chains, which represent the knot Blanchfield pairing, in an equivariant configuration space of pairs of points in the knot exterior.

We will next outline generalizations of this “cubic” topological construction, which produce a "universal equivariant finite type knot invariant". Our generalized invariant is conjecturally equivalent to the Kricker lift of the Kontsevich integral (generalized by Le, Murakami and Ohtsuki) and is indeed equivalent to this lift for knots with trivial Alexander polynomial. It contains the perturbative invariants associated with Chern-Simons field theory of the finite cyclic branched covers over the knot.

Rinat Kashaev *On the structure of partition functions in the Teichmüller TQFT*

The Teichmüller Topological Quantum Field Theory (TQFT) is an example of a generalized TQFT with corners where the state vector space is infinite dimensional. It is expected to be part of the quantized Chern-Simons theory with non-compact gauge groups. I will talk about the structure of the partition functions of the Teichmüller TQFT emphasizing their hidden 4-dimensional aspects and potential generalizations to the setting of Locally Compact Abelian groups.

Wednesday morning

Fathi Ben Aribi *The L^2 Alexander invariant detects the trivial knot*

The L^2 Alexander invariant is a knot invariant introduced by Li and Zhang in 2006. This invariant can be seen as a certainL^2-torsion on a L^2 - chain complex associated to the knot exterior. It can also be constructed from a presentation of the knot group, with Fox calculus, similarly to the classical Alexander polynomial. In my talk I will present this construction after some preliminaries on knot invariants and the theory of L^2-invariants. Then I will present several properties of the L^2-Alexander invariant, notably the fact that it detects the trivial knot. If time permits, I will mention the possible generalisations to links due to Dubois-Friedl-Lück, the wide toolbox of existing techniques for computations for knots and links, and other knot detection properties.

Peter Feller *The Alexander polynomial and the slice genus*

Using Freedman's disk Theorem, we establish the following result: for all knots, the degree of the Alexander polynomial is larger than the topological slice genus. We also discuss the slice genus of torus knots and connected sums of torus knots, in both the topological and smooth setting. If time permits, we relate the latter to questions about Riemann surfaces embedded in 2-dimensional complex space and their intersection with 3-spheres of different radii.

Norbert A'Campo *A real analytic cell complex for braid groups*

We construct a real analytic cell complex for the braid groups B_n. All boundary attachings are controlled by planar moves of special graphs in the disk. The boundary maps are algorithmic, but a lot of work has to be done in order to make this approach effective. This is work in common with Noémie Combe.