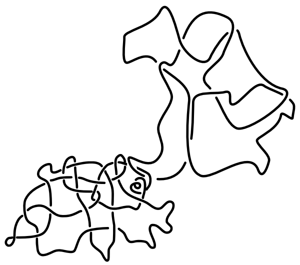
# Swiss Knots 2023

## September 6 – 8 at University of Regensburg
## Program

| Wednesday | | Thursday | | Friday | |
|---|---|---|---|---|---|
| $9^{00} - 9^{30}$ | registration & coffee | $9^{00} - 9^{30}$ | coffee | $9^{00} - 10^{00}$ | coffee |
| $9^{30} - 10^{30}$ | **Hamenstädt** | $9^{30} - 10^{30}$ | **Bowden** | $10^{00} - 11^{00}$ | **Hensel** |
| | coffee | | coffee | | coffee |
| $11^{00} - 12^{00}$ | **Truöl** | $11^{00} - 12^{00}$ | **Kosanović** | $11^{30} - 12^{30}$ | **Löh** |
| | lunch break | | lunch break | | |
| $14^{15} - 15^{15}$ | **Kegel** | $14^{15} - 15^{15}$ | **Martel** | | |
| | coffee | | coffee | | |
| $15^{45} - 16^{45}$ | **Ferretti** | $15^{45} - 16^{45}$ | **Liechti** | | |
| | | $18^{30}$ | dinner | | |



All talks take place in the lecture hall H51 of the university campus.
The dinner takes place at the beer garden *Spitalgarten*, St. Katharinenplatz 1 (by Steinerne Brücke in Stadtamhof).

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## Abstracts

**Hamenstädt:** *Heegaard splittings and short curves in hyperbolic 3-manifolds*

By the celebrated work of Perelman, a closed aspherical atoroidal 3-manifold $M$ admits a hyperbolic metric. Moreover, sufficient conditions for being aspherical atoroidal can be read off from a Heegaard splitting $M$. Given such a splitting, a closed curve in $M$ is unknotted if it is homotopic into a Heegaard surface. We explain a result of Minsky and Moriah which shows that certain curves in $M$ are unknotted for every Heegaard splitting, and we show that these curves are short for the hyperbolic metric. We'll end the talk with open questions.

**Truöl:** *Strongly quasipositive knots are concordant to infinitely many strongly quasipositive knots*

We show that every non-trivial strongly quasipositive knot is smoothly concordant to infinitely many pairwise non-isotopic strongly quasipositive knots. In contrast to our result, Baader, Dehornoy and Liechti showed that every concordance class contains at most finitely many positive knots. Moreover, Baker conjectured that smoothly concordant strongly quasipositive fibered knots are isotopic. Our construction uses a satellite operation with companion a slice knot with maximal Thurston-Bennequin number $-1$. In the talk, we will define the relevant terms necessary to understand the theorem in the title, and explain the context of this result. If time permits, we will say a few words about how the construction extends to links.

**Kegel:** *Characterizing and non-characterizing knots by 3-manifolds*

From a knot $K$, we can build 3-manifolds by performing Dehn surgery on that knot. We will discuss some new results explaining in which sense the diffeomorphism types of these 3-manifolds characterize the isotopy class of the knot $K$. This talk is based on joint work with Baker, Baker–McCoy, and Weiss.

**Ferretti:** *Positive braids and monodromy groups of plane curve singularities*

The geometric monodromy group is a classical yet rather poorly understood topological invariant of isolated plane curve singularities. In this talk we will discuss a generalization of it to the setting of positive braids, and see how working in this wider context can help understanding the original invariant of singularity theory. In particular we obtain that, for irreducible singularities not of type $A_n$, up to finitely many exceptions the geometric monodromy group is determined by two simple knot invariants: the genus and the Arf invariant.

**Bowden:** *The Fine Curve Graph and Surface Diffeomorphism Groups I*

We introduce a refinement of the classical curve graph first studied by Harvey in the 70's – the Fine Curve Graph – which is a Gromov hyperbolic metric space upon which the group of surface diffeomorphism naturally act by isometries. In this talk I will discuss applications to the large scale geometry of group of surface diffeomorphisms and ask some questions concerning the dynamics of this action and how they relate to the underlying surface dynamics. (joint with S. Hensel and R. Webb)

**Kosanović:** *Knotted families from graspers*

I will introduce a geometric object called a grasper, and explain how it gives rise to families of embeddings of an arc or a circle into an arbitrary manifold of any dimension. These families are detected by Goodwillie–Weiss embedding calculus, so the question of their nontriviality is reduced to algebraic topology. In dimension 3 our discussion reduces to constructions of knots using gropes/claspers.

**Martel:** *Quantum representations in nature**

Low dimensional topology has this advantage of being presented by generators (e.g. diagrams) up to relations between them, while quantum groups are (more than) algebras perfectly providing these relations. Using their modules, one can thus construct topological invariants of low dimensional objects: Jones polynomials for knots, quantum invariants, TQFTs... The underlying purely algebraic constructions make their eventual topological content hard to catch, while quantum groups should indeed have a topological nature. Fortunately we recently found their modules in nature* and can now rebuild topological invariants but keeping track of their geometric flavor. We will focus precisely on quantum representations of mapping class groups of surfaces, and if I have time I'll say a word on why this geometric construction brings a new strategy for studying the faithfulness of these representations and eventually the linearity of these groups. Mainly joint with Marco De Renzi. (* where nature is twisted homology of configuration spaces of surfaces. And a base point.)

**Liechti:** *Multicurve intersection degrees*

Two multicurves that fill a closed orientable surface define a bipartite graph whose vertices correspond to multicurve components and whose edges correspond to geometric intersections between multicurve components. What algebraic degrees arise among leading eigenvalues of adjacency matrices of such bipartite graphs? We discuss refinements of this question as well as how it relates to a still unproven claim by Thurston on the algebraic degrees of pseudo-Anosov stretch factors. We then present a semi-explicit construction realising every algebraic degree smaller than or equal to the genus of the surface. Our construction can be applied to realise all possible trace field degrees in all strata of translation surfaces. This is joint work with Erwan Lanneau.

**Hensel:** *Towards the boundary of the fine curve graph*

The fine curve graph is a hyperbolic graph on which the homeomorphism group of a surface acts (in an interesting way). It is motivated by, and shares many properties with, the wildly successful curve graph machinery for mapping class groups – but it also shows new behaviour not encountered in the classical setting. In this talk, we will explore some of this new behaviour by describing (certain) Gromov boundary points and their stabilisers. In particular, we describe homeomorphisms acting as parabolic isometries on the fine curve graph and their fixed points at infinity. This is joint work with Jonathan Bowden and Richard Webb.

**Löh:** *Unattainable values*

The values of many invariants in group theory and geometric topology carry intrinsic computable structure; therefore, sufficiently non-computable real numbers cannot arise as values of such invariants.

Example invariants include the stable commutator length of finitely presented groups, the simplicial volume of closed manifolds, the $L^2$-Betti numbers of finitely generated groups with solvable word problem, and the stable smooth 4-genus of knots. In this talk, I will explain this phenomenon at the example of the stable smooth 4-genus (based on an ongoing project with Lukas Lewark).