Interactions Between Geometric Group Theory, Low-Dimensional Topology and Geometry, and Dynamics
Interactions entre la théorie des groupes géométrique, la topologie et la géométrie en basse dimension, et la dynamique

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AZER AKHMEDOV, North Dakota State University

On (non-)embeddability of knot groups into the group of diffeomorphisms of compact 1-manifolds

For a compact 1-manifold M^1, we study the embeddability question of knot groups into the group $\mathrm{Diff}_+^r(M^1)$ where $r \in \mathbb{N} \cup \{\infty, \omega\}$. It is well known that every knot group embeds in $\mathrm{Homeo}_+(M^1)$ while the question for higher regularities remains mostly unexplored. Recently, some progresses are made (by numerous authors) in the embeddability questions of surface groups and RAAGs.

For both the circle $\mathbb{S}^1$ and the closed interval $I \cong [0,1]$, in the case of $r = \omega$ we provide a complete classification while for $r \geq 2$, we prove both positive and negative results for various classes and examples of knots. This is a joint work with Cody Martin.

HANS BODEN, McMaster University

Concordance invariants of virtual knots

Virtual knot theory concerns knots in thickened surfaces, and Turaev defined virtual concordance and non-classical concordance invariants for them. This talk is based on joint work with Micah Chrisman and Robin Gaudreau aimed at extending classical concordance invariants to the virtual setting. One of the obstacles to this program is the absence of Seifert surfaces from the virtual toolkit, and so we focus our attention on AC knots, which is the subclass of virtual knots with homologically trivial representatives. So a virtual knot is AC iff it admits a Seifert surface, in particular every classical knot is AC. Our first result is that stable Manturov projection gives a map from virtual knots to AC knots that preserves concordance. Consequently any concordance invariant defined for AC knots lifts to all virtual knots. We show how to construct virtual Seifert surfaces directly from the AC diagrams, and we also show how to slice virtual knots directly from their Gauss diagrams. Using virtual Seifert surfaces, we define the usual package of invariants, including Alexander-Conway polynomials, signatures, and twisted signatures, and we show how they often (but not always) give rise to concordance invariants of virtual knots. These invariants are applied to study sliceness of low crossing AC knots. In general, the twisted signatures will depend on the choice of Seifert surface, but less so in the untwisted case. This is established by computing the knot signatures in terms of checkerboard surfaces and Goeritz matrices à la Gordon-Litherland.

MATTHIEUX CALVEZ, UFRO

Acylindrical hyperbolically of Artin Groups of Spherical Type

We report on a joint work with Bert Wiest describing a good action of any Artin Group of spherical type on some associated hyperbolic complex.

ADAM CLAY, University of Manitoba

The number of circular orderings of a group

A group is left-orderable if it admits a strict total ordering that is invariant under multiplication from the left. For countable groups, this is equivalent to acting on the real line by order-preserving homeomorphisms. A group is circularly orderable if it admits a "cyclic orientation cocycle" satisfying a certain non-degeneracy condition, but in the countable case this boils down, as expected, to the existence of a orientation-preserving action by homeomorphisms on the circle.

The set of all left-orderings of a group forms a topological space, and similarly, so does the set of all circular orderings. I will provide an introduction to these spaces and describe the structure of groups whose spaces of left and circular orderings are degenerate, in that the consist simply of a finite set of points with the discrete topology. This is joint work with Cristobal Rivas and Kathryn Mann.

BRUNO AARON CISNEROS DE LA CRUZ, Instituto de matemáticas UNAM - Oaxaca
Normal forms on virtual braid groups

In this talk I will present a general background on virtual knot theory, then I will present normal forms on virtual braid groups, finally we'll see how this can help us to solve the genus problem for virtual braids.

Virtual knot theory was defined by L. Kauffman at the late 90's, it is a generalization to classical virtual knot theory. They are defined via knot - type diagrams identified up to certain Reidemeister type moves, however they have a topological counterpart as knots embedded in thickened surfaces, identified up to isotopy, diffeomorphisms and "stability". Virtual braids are the braid version of virtual knots and we have an Alexander and Markov theorem for virtual knots. Virtual braids generalize classical braids (i.e. classical braids embeds in virtual braids), however the properties of classical braids do not extend straight forward to virtual braids, for example solutions to the word problem, representations or normal forms on virtual braids are not as easy as in the classical case.

FRANCISCO GONZALEZ-ACUÑA, Instituto de Matematicas, Unidad Cuernavaca, UNAM
2-stratifold spines of 3-manifolds

Joint work with Jose Carlos Gomez Larrañaga end Wolfgang Heil.

We call a 2-stratifold a compact Hausdorff space such that every point has an open neighborhood homeomorphic to $R \times CL$ where CL is the open cone on L for some finite set L of cardinality greater than 1. We determine which closed 3-manifolds have a 2-stratifold as spine and which closed-3-manifold groups are 2-stratifold groups.

YING HU, Université du Québec à Montréal

THOMAS KOBERDA, University of Virginia
Square roots of Thompson's group F

I will discuss square roots of Thompson's group F, which are certain two-generator subgroups of the homeomorphism group of the interval, the squares of which generate a copy of Thompson's group F. We prove that these groups may contain nonabelian free groups, they can fail to be smoothable, and can fail to be finitely presented. This represents joint work with Y. Lodha.

TYE LIDMAN, North Carolina State University
Concordance in homology spheres

Although not every knot in the three-sphere can bound a smooth embedded disk in the three-sphere, it must bound a PL disk in the four-ball. This is not true for knots in the boundaries of arbitrary smooth contractible manifolds. We give new examples of knots in homology spheres that cannot bound PL disks in any bounding homology ball and thus not concordant to knots in the three-sphere. This is joint work with Jen Hom and Adam Levine.

FABIOLA MANJARREZ-GUTIERREZ, UNAM
Genus one knots and circular thin position

A circular position of a knot is a handle decomposition of the knot exterior whose level surfaces are Seifert surfaces for the knot. A complexity is assign to such decomposition, and when it attains its minimal value, we say that the decomposition is thin. A nice property of a circular thin position is that the level surfaces are incompressible and weakly incompressible Seifert surfaces, which alternate. For all the known examples of circular thin position a minimal genus Sefert surface shows up, so it is natural to ask if this is generic. In this talk we will see that this is true for genus one knots. This is joint work with Carlos Barrera-Rodriguez.

ANDRÉS NAVAS, Universidad de Santiago de Chile
Some problems concerning orders on groups of geometric origin

This talk will be an overview on recent progress and open questions concerning orderability properties of certain groups of geometric origin.

ENRIQUE RAMIREZ-LOSADA, CIMAT
Genus of satellite tunnel number one knots

Morimoto and Sakuma determined the knots types of satellite tunnel number one knots in the 3-sphere. Roughly speaking such knots are certain satellites of torus knots via 2-bridge links. In this work we compute the genus of these knots.

Joint work with Mario Eudave, Fabiola Manjarrez, and Jesús Rodríguez.

DALE ROLFSEN, University of British Columbia
Ordering fundamental groups of small hyperbolic 3-manifolds

We'll discuss the orderability properties of fundamental groups of minimal volume hyperbolic 3-manifolds with various properties: closed, cusped, nonorientable. This involves some observations regarding braids, and is joint work with Eiko Kin and Adam Clay.

JAVIER SANCHEZ, Department of Mathematics-IME, University of Sao Paulo
A way of obtaining free group algebras inside division rings

In the mid eighties, L. Makar-Limanov conjectured:

- Let D be a division ring with center Z. If D is finitely generated (as a division ring) over Z and $[D:Z]=\infty$, then D contains a noncommutative free Z-algebra.

In many examples for which the conjecture holds, the division ring D contains a (noncommutative) free group algebra over Z, not only a free Z-algebra. Note that if X is the set of free generators of a free algebra, X need not be a set of free generators of a free group algebra.

Let D be a division ring and $(G,<)$ be a (bi)ordered group. Let ∞ be a symbol and extend the operations and ordering on G in the natural way. A *valuation* with values on $(G,<)$ is a map $\upsilon\colon D\to G\cup\{\infty\}$ that satisfies, for all $x,y\in D$,

(a) $\upsilon(x)=\infty$ if, and only if, $x=0$.

(b) $\upsilon(x+y)\geq\min\{\upsilon(x),\upsilon(y)\}$.

(c) $\upsilon(xy)=\upsilon(x)\upsilon(y)$.

For each $g\in G$, the sets $D_{\geq g}=\{x\in D\colon \upsilon(x)\geq g\}$ and $D_{>g}=\{x\in D\colon \upsilon(x)>g\}$ induce a filtration on D whose associated graded ring is $\operatorname{grad}_\upsilon(D)=\bigoplus\limits_{g\in G}\frac{D_{\geq g}}{D_{>g}}$

We show that D contains a free group Z-algebra provided that there exist $x_1,x_2\in D$ with

(1) $v(x_i) > 1$, $i = 1, 2$.

(2) The elements $x_1 + D_{>v(x_1)}, x_2 + D_{>v(x_2)} \in \mathrm{grad}_v(D)$ generate a free $\mathrm{grad}_v(Z)$-subalgebra of $\mathrm{grad}_v(D)$.

First we prove our result for the case of G a subgroup of the real numbers. Using theory of ordered groups, we prove that the general case can be reduced to the foregoing case.

LIAM WATSON, Université de Sherbrooke
Bordered Floer homology via immersed curves

I'll describe a joint project with Jonathan Hanselman and Jake Rasmussen that gives a geometric interpretation of bordered Heegaard Floer homology for manifolds with torus boundary in terms of immersed curves in a punctured torus. This point of view gives rise to a number of new results about the Heegaard Floer theory of manifolds with torus boundary, which will serve as the main focus of the talk.