Group Theory and Low Dimensional Topology
Théorie des groupes et topologie en basses dimensions
(Org: **Adam Clay** (University of Manitoba) and/et **Dale Rolfsen** (University of British Columbia))

SINA ABBASI, University of Toronto
A Combinatorial Proof that Classical Knots Embed in Virtual Knots

In his paper "What is a virtual link?" Kuperberg showed that classical knots embed in virtual knots using three-dimensional topology. We present a combinatorial proof of this fact using Manturov's idea of a parity.

ANTONIO ALFIERI, CRM-ISM
Instanton Floer homology of almost-rational plumbings

Plumbed three-manifolds are those three-manifolds that can be be realized as links of isolated complex surface singularities. Inspired by Heegaard Floer theory Nemethi introduced a combinatorial invariant of complex surface singularities (lattice cohomology) that is conjectured to be isomorphic to Heegaard Floer homology. I will expose some recent work in collaboration with John Baldwin, Irving Dai, and Steven Sivek showing that the lattice cohomology of an almost-rational singularity is isomorphic to the framed instanton Floer homology of its link. The proof goes through lattice cohomology and makes use of the decomposition along characteristic vectors of the instanton cobordism maps found by Baldwin and Sivek.

IDRISSA BA, University of Manitoba
Circular orderability and 3-manifolds

This talk will be about circular orderability of the fundamental group of 3-manifolds. In particular, the circular orderability of the fundamental groups of graph manifolds and cyclic branched covers.

We will also talk about how circular orderability behavior with respect to cyclic branched covers compares to left-orderability. This is a joint work with Adam Clay.

DROR BAR-NATAN, University of Toronto, Mathematics
Kashaev's Signature Conjecture

(With Sina Abbasi) I will display side by side two nearly identical computer programs whose inputs are knots and whose outputs seem to always be the same. I'll then admit, very reluctantly, that I don't know how to prove that these outputs are always the same. One program I wrote mostly in Bedlewo, Poland, in the summer of 2003 and as of recently I understand why it computes the Levine-Tristram signature of a knot. The other is based on the 2018 preprint "On Symmetric Matrices Associated with Oriented Link Diagrams" by Rinat Kashaev (arXiv:1801.04632), where he conjectures that a certain simple algorithm also computes that same signature.

STEVE BOYER, UQAM
The ADE conjecture for hyperbolic links

The ADE links are obtained as the boundaries of the oriented surfaces obtained by plumbing positive Hopf bands according to one of the trees determined by the simply laced Dynkin diagrams A_m, D_m, E_6, E_7, E_8. The ADE conjecture characterises these links among fibred, strongly quasipositive links in terms of their cyclic branched covers. In this talk we use pseudo-Anosov flows to verify that the fundamental groups of the cyclic branched covers of hyperbolic, fibred, strongly quasipositive links are left-orderable, thus verifying the hyperbolic case of the conjecture.

This is joint work with Cameron Gordon and Ying Hu.

TYRONE GHASWALA, Université du Québec à Montréal
Covers and mapping class groups of orbifolds

This talk will be a 20 minute advertisement for treating branched covers of surfaces as honest-to-goodness covers of orbifolds whenever possible. The advertisement will feature a theorem relating the mapping class group of the covering orbifold to that of the base orbifold, and a theorem about braid group actions on free groups.

This is part of joint work with Rylee Lyman.

CAMERON GORDON, University of Texas at Austin
The ADE Conjecture for links

A fibered link L induces a contact structure on S^3, which is tight if and only if L is strongly quasipositive. Examples of such FSQP links are plumbings of positive Hopf links. We consider the question of when the n-fold cyclic branched cover $\Sigma_n(L)$ of an FSQP link L is an L-space. (Assuming the L-space Conjecture, for L prime this is equivalent to $\pi_1(\Sigma_n(L)$ not being left-orderable, and to $\Sigma_n(L)$ not supporting a co-orientable taut foliation.) The ADE Conjecture is that for L prime and FSQP, $\Sigma_n(L)$ is an L-space for some $n \geq 2$ if and only if L is a plumbing of positive Hopf links according to the tree corresponding to one of the ADE Dynkin diagrams.

The problem falls naturally into three cases, where the exterior of L is Seifert fibered, hyperbolic, or toroidal. In this talk we will discuss some background to the ADE Conjecture and the fact that it is true in the Seifert fibered case.

This is joint work with Steve Boyer and Ying Hu.

JONATHAN JOHNSON, Oklahoma State University
Bi-Orderability Techniques and Double Twist Links

The bi-orderability of link groups has become a fascinating research topic. In this talk, we will survey some useful tools that have been developed to investigate the bi-orderability of link complements, including results of Linnell-Rhemtulla-Rolfsen, Ito, and Kin-Rolfsen. In particular, we will apply these techniques to the double twist link groups.

THOMAS KOBERDA, University of Virginia
Hamiltonicity of graphs through cohomology of right-angled Artin groups

I will discuss the dictionary between the algebraic structure of a right-angled Artin group and the combinatorics of the defining graph. I will then use the cohomology of a right-angled Artin group to provide a characterization of Hamiltonicity of the underlying graph.

TYE LIDMAN, North Carolina State University
Satellite operations and concordance homomorphisms

Two knots are (smoothly) concordant if they cobound a (smooth) annulus in $S^3 \times I$. The concordance classes of knots form a group called the concordance group. Conjecturally, satellite operations do not induce interesting endomorphisms of the concordance group. We use some standard techniques in Heegaard Floer homology to confirm this conjecture for a large number of satellite operations. If time, we will discuss one of the tools, which gives some relationship between Heegaard Floer homology and the Torelli group. This is joint work with Allison Miller and Juanita Pinzon-Caicedo.

BEIBEI LIU, Georgia Institute of Technology
Four manifolds with no smooth spines

It is an interesting question to ask whether a compact smooth 4-manifold which deformation retracts to a PL embedded closed surface contains a smooth spine, i.e. deformation retracts onto a smoothly embedded surface. In this talk, we will use Heegaard Floer homology and high-dimensional surgery theory to give some obstructions. We will also discuss some examples where the interior of the 4-manifold is negatively curved.

ALLISON MOORE, Virginia Commonwealth University
Cosmetic crossings, cosmetic surgery and Conway spheres

A tangle decomposition along a Conway sphere breaks a knot or link into simpler pieces, each of which is a two-string tangle. In this talk, we'll discuss (one of the ways) in which Khovanov homology can be calculated using tangle decompositions. In particular, the algebraic invariants can be realized geometrically as immersed curves on the four-punctured sphere. This strategy turns out to be quite useful for investigating two classic open problems: the cosmetic surgery conjecture and the cosmetic crossing conjecture. This is joint with Kotelskiy, Lidman, Watson and Zibrowius.

HANNAH TURNER, Georgia Insitute of Technology
Fractional Dehn twists and left-orders on mapping class groups

Three-manifolds admit descriptions called open book decompositions; in this setting a surface with boundary and a mapping class describe the 3-manifold. One invariant of an open book is the fractional Dehn twist coefficient (FDTC). The FDTC is a real number invariant of a mapping class of a surface with boundary, which has connections to contact topology and foliation theory. I'll show that the FDTC of a given surface can be computed using a multitude of geometrically defined left-orders on the mapping class group due to Thurston. This is joint work with Diana Hubbard.

LIAM WATSON, UBC
Symmetry & Mutation

Mutation is a relatively simple process for altering a knot in a non-trivial way, but it turns out to be quite tricky to see the difference between mutant pairs—a surprisingly wide range of knot invariants are unable to distinguish mutants. I will give some background on the symmetry group associated with a knot, and show that this group is sometimes able to see mutation.

CHENXI WU, UW Madison
Fibered cones and stable translation lengths on sphere graphs

I will discuss some of my prior works in collaboration with Harry Baik, Dongryul Kim, Hyunshik Shin and Eiko Kin on stable translation lengths on sphere graphs for maps in a fibered cone, and discuss the applications on maps on surfaces, finite graphs and handlebody groups.

BOJUN ZHAO, University at Buffalo
Left orderability, foliations, and transverse $(\pi_1, \mathbb{R})$ structures for 3-manifolds with sphere boundary

Let M be a closed orientable irreducible 3-manifold such that $\pi_1(M)$ is left orderable.

(a) Let $M_0 = M - Int(B^3)$, where B^3 is a 3-ball in M. We show that there exists a Reebless co-orientable foliation $\mathcal{F}$ in M_0, whose leaves may be transverse to ∂M_0 or tangent to ∂M_0 at their intersections with ∂M_0, such that $\mathcal{F}$ has a transverse $(\pi_1(M_0), \mathbb{R})$ structure and that $\mathcal{F}$ is analogous to taut foliations (in closed 3-manifolds) in the following sense: there exists a compact 1-manifold (i.e. a finite union of properly embedded arcs and/or simple closed curves) transverse to $\mathcal{F}$ that intersects every leaf of $\mathcal{F}$.

(b) We have a process to produce a foliation $\mathcal{F}$ as given in (a), which deponds on the choice of a left-invariant order of $\pi_1(M)$ and certain fundamental domain Γ of M. If M admits a taut foliation that has a transverse $(\pi_1(M), \mathbb{R})$ structure, then some resulting foliation of our process can extend to a taut foliation in M that has a transverse $(\pi_1(M), \mathbb{R})$ structure. If M admits an $\mathbb{R}$-covered foliation, then some resulting foliation of our process can extend to an $\mathbb{R}$-covered foliation in M. Furthermore, we conjecture that every resulting foliation of our process can extend to a taut foliation in M that has a transverse $(\pi_1(M), \mathbb{R})$ structure.

CLAUDIUS ZIBROWIUS, University of Regensburg

Rasmussen invariants

I will explain the ideas behind an eponymous postcard that appeared as

> Math. Res. Postc. (2021), vol. 1 no. 2
> https://secure.math.ubc.ca/Links/mrp/cards/mrp2.pdf

This is joint work in progress with Lukas Lewark and builds on earlier joint work with Artem Kotelskiy and Liam Watson.