
MOAB TOPOLOGY CONFERENCE

Schedule

All talks to be held in the Stage room of the Moab Arts and Recreation Center, 111 East 100 North, Moab, UT

	Wed 5/13	Thurs 5/14	Fri 5/15
8:30 am	Tara Mecham	David Futer	Mike Mihalik
9:30 am	Panos Papasoglu	Effie Kalfagianni	Craig Guilbault
10:30 am	Kim Ruane	Aaron Magid	Genevieve Walsh
11:30 am	Sean Cleary	Eric Chesebro	Jesse Johnson
Lunch			
1:30 pm	Beginning graduate lectures		
Free afternoon			
8:00 pm	Mark Sapir	Daryl Cooper	Juan Souto

Titles and Abstracts

Eric Chesebro (Rice and Montana), Right angled ideal polyhedra and virtually special 3-manifolds

We use the work of Haglund and Wise to prove that the fundamental group of any finite-volume 3-manifold with a right angled ideal cell decomposition has a finite index subgroup which is a word-quasiconvex subgroup of a right-angled Coxeter group. As a result, all such 3-manifolds are virtually fibered and LERF. This gives new examples of 3-manifolds which are virtually fibered and not fibered. Joint with Jason DeBlois and Henry Wilton

Sean Cleary (CCNY, CUNY), Weak almost convexity and tame combing conditions

Cannon introduced the notion of almost convexity for a Cayley graph of a group, developing effective algorithms for understanding the geometry of the Cayley graph. Though wide classes of groups are almost convex, there are a number of weaker notions of almost convexity satisfied by yet more groups. Mihalik and Tschantz introduced the notion of tame 1-combings for Cayley complexes, and there are

connections between the very strongest notions of tame combings and the strongest notions of almost convexity. We answer questions about possible further connections between these two notions by showing that there are groups which satisfy some of the strongest tame combing conditions which do not satisfy even the weakest non-trivial almost convexity conditions. Examples include some Baumslag-Solitar groups and Thompson's group F . This is joint work with Susan Hermiller, Melanie Stein and Jennifer Taback.

Daryl Cooper (UCSB), Manifolds, Real Projective Geometry and the Hyper-Reals

Abstract: We will discuss the Thurston boundary of Teichmüller space from the viewpoint of non-standard mathematics and then discuss an analog for real projective structures on manifolds and orbifolds.

David Futer (Temple), Cusp volume of fibered 3-manifolds

Abstract: Consider a 3-manifold M that fibers over the circle, with fiber a punctured surface F . I will discuss some recent results that estimate the volume of a maximal cusp of M (in the hyperbolic metric) directly from combinatorial properties of the monodromy map $\phi: F \rightarrow F$. These results can be applied to estimate the volume certain knot complements: for example, the complements of closed 3-braids.

Craig Guilbault (Wisconsin), A solution to de Groot's absolute cone conjecture

A compactum X is an *absolute suspension* if for any pair of points x, y in X , the space X is homeomorphic to a suspension with x and y corresponding to the suspension points. Similarly, X is an *absolute cone* if, for each point x in X , the space X is homeomorphic to a cone with x corresponding to the cone point.

At the 1971 Prague Symposium, J. de Groot made the following two conjectures:

Conjecture. Every n -dimensional absolute suspension is homeomorphic to the n -sphere.

Conjecture. Every n -dimensional absolute cone is homeomorphic to an n -cell.

In 1974, Szymanski proved the 'absolute suspension conjecture' in the affirmative for $n=1, 2$ or 3 . The remaining cases remain open. In 2005, Nadler presented solutions to the 'absolute cone conjecture' in dimensions 1 and 2.

In this talk, we will discuss issues related to the openness of the suspension conjecture for large n . More significantly, we will present our recently obtained solution to the absolute cone conjecture. In particular, the conjecture is true for n less than or equal to 4 and false for n greater than or equal to 5.

Jesse Johnson (Yale), Common stabilizations for Heegaard splittings

Abstract: A Heegaard surface is a surface embedded in a 3-manifold so that it cuts the 3-manifold into simple pieces called handlebodies. Given a Heegaard surface, there is a construction called stabilization that creates a new Heegaard surface of higher genus. It has long been known that any two Heegaard surfaces for the same manifold can be stabilized some number of times to produce isotopic surfaces, but it is not well understood how many stabilizations are, in general, necessary. I will describe how intuition from hyperbolic geometry and harmonic surfaces led to a topological approach to understanding common stabilizations.

Effie Kalfagianni (Michigan State), Polynomial invariants for links in 3-manifolds.

Abstract: I will discuss recent progress in obtaining polynomial invariants for links in rational homology 3-spheres and applications of these invariants.

Aaron Magid (University of Michigan), The Topology of Deformation Spaces of Hyperbolic 3-Manifolds

Abstract: For any closed surface S , the deformation space $AH(S)$ is the space of all marked hyperbolic 3-manifolds homotopy equivalent to S . After reviewing some of the classical results that describe topology of the interior of $AH(S)$, we will show that there are certain points on the boundary where $AH(S)$ is not locally connected. This is a generalization of Ken Bromberg's result that the space of Kleinian punctured torus groups is not locally connected.

Tara Mechem (Oklahoma), Hyperbolic groups which fiber in infinitely many ways.

Abstract. We construct examples of $CAT(0)$, free-by-cyclic, hyperbolic groups which fiber in infinitely many ways over Z . The construction involves adding a specialized square 2-cell to a non-positively curved, squared 2-complex defined by labeled oriented graphs. The fundamental groups of the resulting complexes are $CAT(0)$, hyperbolic, free-by-cyclic and can be mapped onto Z in infinitely many ways.

Mike Mihalik (Vanderbilt)

The idea of "JSJ-decompositions" for 3-manifolds began with work of Waldhausen and was developed later through work of Jaco, Shalen and Johansen. It was shown that there is a finite collection of 2-sided, incompressible tori that separate a given closed irreducible 3-manifold into pieces with strong topological structure.

Sela introduced the idea of JSJ-decompositions for groups, an idea that has flourished in a variety of directions. The general idea is to consider a certain class X of groups and splittings of groups in X by groups in another class Y . E.g. Rips and Sela considered splittings of finitely presented groups by infinite cyclic groups. For an arbitrary group G in X the goal is to produce a unique graph of groups decomposition T of G with edge groups in Y so that T reveals all splittings of G by groups in Y . More specifically, if V is a vertex group of T then either there is no Y -group that splits both G and V , or V has a special "surface group-like" structure. It is standard to call vertex groups of the second type "orbifold groups".

For a finitely generated Coxeter system (W,S) we produce a (reduced) JSJ-decomposition T for splittings of W over virtually abelian subgroups. We show T is unique with each vertex and edge group generated by a subset of S (and so T is "visual"). The construction of T is algorithmic. If V , a subset of S , generates an orbifold vertex group of T then V is the disjoint union of K and M , where $\langle M \rangle$ is virtually abelian, $\langle K \rangle$ is virtually a closed surface group or virtually free and $\langle V \rangle$ is the direct product of $\langle M \rangle$ and $\langle K \rangle$.

Fujiwara-Papasoglu have a more general JSJ decomposition result for finitely presented groups over slender splittings. We compare these decompositions.

Panos Papasoglu (Athens), Title: Topology of the boundary and splittings

Abstract: Stallings ends theorem has been generalized to splittings over 2 ended groups for hyperbolic groups by Bowditch using the boundary of the group. Such splittings correspond to local cut points of the boundary. One might hope to generalize this further and give a topological characterization of splittings

of hyperbolic groups over any subgroups- at least generically. We present a negative and a positive result related to this question. (joint work with T. Delzant)

Kim Ruane (Tufts), Automorphisms of right-angled Coxeter groups.

In this talk, I will try to convince you that the automorphism group of a right-angled Coxeter group is an interesting group to study. We begin with some standard examples to show how these groups are, in some ways, easier to study than other automorphism groups (i.e. $\text{Aut}(F_n)$ for example) yet even the some of the most elementary questions concerning these groups are not yet answered. I will also discuss ongoing joint work with Adam Piggott concerning these groups.

Mark Sapir (Vanderbilt), Almost all 1-related groups with at least three generators are virtually residually (finite p-groups)

I am going to talk about joint work with A. Borisov and I. Kozakova proving the result from the title.

Juan Souto (University of Michigan, Ann Arbor), Geometric limits of knot complements.

Abstract: I will discuss joint results with Jessica Purcell and Richard Kent showing that while surprisingly many hyperbolic 3-manifolds arise as geometric limits of knot complements, there are also non-obvious geometric and hyperbolic obstructions to be such a limit.

Genevieve Walsh (Tufts), Commensurability of knot complements

Two three-manifolds are *commensurable* if they admit homeomorphic finite-sheeted covers. Here we investigate the commensurability classes of hyperbolic 3-manifolds. In particular we show that if K is a hyperbolic knot without hidden symmetries, there are at most three knot complements in the commensurability class of $S^3 - K$. There are only two knots in the tables which admit hidden symmetries, so this is conjecturally the generic case. We also give a characterization of cyclically commensurable knots which are periodic. This is joint work with Michel Boileau and Steve Boyer.
