Abstracts

Corey Bregman (University of Southern Maine): *Outer space for RAAGs*

The classical symmetric space Q_n of positive definite quadratic forms and Culler-Vogtmann Outer Space CV_n are major tools in the study of $\mathrm{GL}(n, Z)$ and $\mathrm{Out}(F_n)$, respectively. The class of right-angled Artin groups (RAAGs) is a natural extension of free groups and free abelian groups, which has featured prominently in the study of CAT(0) cube complexes and low-dimensional topology. Let A be a RAAG. We build a finite-dimensional, contractible outer space O_A on which $\mathrm{Out}(A)$ acts with finite point stabilizers. This construction generalizes that of Q_n and CV_n and blends features of both. In this talk, we will describe the construction of O_A, then discuss open questions and directions for further study. This is joint work with Ruth Charney and Karen Vogtmann.

Matt Clay (University of Arkansas): *Minimal volume entropy for free-by-cyclic groups*

Let G be a free-by-cyclic group. We provide an algebraic and a geometric characterization for when each aspherical simplicial complex with fundamental group isomorphic to G has minimal volume entropy equal to 0. Our results rely upon a criterion for the vanishing of the minimal volume entropy for 2–dimensional groups with uniform uniform exponential growth. This is joint work with Corey Bregman.

Federica Fanoni (CNRS / Université Paris-Est Créteil): *Generating big mapping class groups*

In this talk we are interested in the following question: what are “good” generating sets for the mapping class group of a surface? If the surface is compact (or more generally of finite type), there are multiple satisfactory answers, while it it is of infinite type, the question is wide open. I will talk about this problem and present a partial (negative) answer for a large class of surfaces. Joint work with Sebastian Hensel.

Elia Fioravanti (MPIM / Universität Bonn): *Coarse median-preserving automorphisms*

We study fixed subgroups of automorphisms of right-angled Artin and Coxeter groups. If Phi is an untwisted automorphism of a RAAG, or an arbitrary automorphism of a RACG, we prove that Fix(Phi) is finitely generated and undistorted. Up to replacing Phi with a power, the fixed subgroup is actually quasi-convex with respect to the standard word metric (hence a separable subgroup by work of Haglund-Wise). The key observation is that these automorphisms preserve a (nice) coarse median structure on the group. Time permitting, I will discuss other applications of coarse median structures to the study of automorphisms of RAAGs and RACGs.

Maxime Fortier Bourque (Université de Montréal): *A divergent horocycle in the horoboundary of the Teichmuller metric*

There is a lesser-known cousin of the Thurston compactification of Teichmuller space known as the Gardiner-Masur compactification, which uses extremal length instead of hyperbolic length. This compactification turns out to be isomorphic to the horofunction compactification of the Teichmuller metric, a general compactification due to Gromov. While the Thurston compactification is homeomorphic to a closed ball, we do not know the shape of the Gardiner-Masur compactification. In this talk, I will describe an example of a horocycle in Teichmuller space which does not converge in the horofunction compactification. This is analogous to a result of Lenzhen about Teichmuller geodesics that diverge in the Thurston compactification.

Koji Fujiwara (Kyoto University): *Asymptotic dimension of the arc graphs and disk graphs*

We give quadratic upper bounds in terms of the genus for the asymptotic dimensions of the arc graphs and disk graphs. We use the distance formula for "witnesses" by Masur-Schleimer and the projection complex technique. This is a joint work with Schleimer.

Damien Gaboriau (CNRS / ENS Lyon): *On the homology torsion growth for mapping class groups,* $\mathrm{Out}(W_n)$*,* $\mathrm{SL}_d(Z)$*, and Artin groups*

This is joint work with Miklos Abert, Nicolas Bergeron and Mikolaj Fraczyk.
The growth of the sequence of Betti numbers is quite well understood when considering a suitable sequence of finite sheeted covers of a manifold or of finite index subgroups of a countable group.
We are interested in other homological invariants, like the growth of the mod p Betti numbers and the growth of the torsion of the homology. We produce new vanishing results on the growth of torsion homologies in higher degrees for such groups as mapping class groups, $\mathrm{Out}(W_n)$, $\mathrm{SL}_d(Z)$, and Artin groups. As a by-product, we prove that the ℓ^2-Betti numbers of $\mathrm{Out}(W_n)$ vanish up to degree $\lfloor \frac{n}{2} \rfloor$-1.
As a central tool, we introduce a quantitative homotopical method that constructs "small" classifying spaces for finite index subgroups, while controlling at the same time the complexity of the homotopy. Our method easily applies to free abelian groups and then extends recursively to a wide class of residually finite groups.
I will present the basic objects and some of the ideas.

Vincent Guirardel (Université de Rennes 1): *Strong Tits alternative for* $\mathrm{Out}(F_N)$

We prove that any subgroup of $\mathrm{Out}(F_N)$ is either virtually abelian or has a finite index subgroup with an acylindrically hyperbolic quotient. In particular,every subgroup of $\mathrm{Out}(F_N)$ is either virtually abelian or SQ-universal. This is a joint work with Camille Horbez.

Radhika Gupta (Temple University): *Limit sets of unfolding paths in Outer space*

Teichmuller geodesic rays exhibit an odd behaviour in that they do not always converge in the Thurston boundary. In contrast, folding rays in Outer space of a free group always converge in its boundary. In this talk, I will present a construction of an 'unfolding path' in Outer space that converges to a 1-simplex in the boundary, corresponding to a non-uniquely ergodic and non-uniquely ergometric arational tree. This is joint work with Mladen Bestvina and Jing Tao.

Ursula Hamenstädt (Universität Bonn): *On the asymptotic geometry of the mapping class group*

We show that the mapping class group of a closed surface of higher genus admits a proper action on a nonpositively curved cube complex (which is however not simply connected). We use this information together with a construction of Ji and McPhearson to study its asymptotic geometry. As an application, we show that the covering dimension of the Gromov boundary of the curve graph is at most $4g - 6$ (which slightly improves a result of Gabai and is conjectured to be sharp).

Sebastian Hensel (Universität München): *Parabolics in the Fine Curve Graph*

The curve graph is a well-studied and useful tool to study 3-manifolds, and mapping class groups of surfaces. The fine curve graph is a recent variant on which the full homeomorphism group of a surface acts in an interesting way. In this talk we discuss some recent results which highlight behaviour not encountered in the "classical" curve graph. In particular, we will discuss the first entries in a dictionary between properties from surface dynamics and geometric properties of the action (and, while doing so, construct homeomorphisms acting parabolically). This is joint work with Jonathan Bowden, Katie Mann, Emmanuel Militon and Richard Webb.

Dawid Kielak (University of Oxford): *Kazhdan constants for symplectic groups*

I will explain how one can use computer calculations to give the very first bounds for Kazhdan constants of symplectic groups over the integers.

Anne Lonjou (Université Paris-Saclay): *Asymptotically rigid mapping class groups*

During this talk we will focus on a family of asymptotically rigid mapping class groups which includes a braided version of Ptolemy-Thompson groups. We will build a contractible cube complex on which these groups act and we will see which kind of properties can be deduced from this action.This work is joint with Anthony Genevois and Christian Urech.

Kathryn Mann (Cornell University): *Big mapping class groups and topology of end spaces*

Mapping class groups of infinite type surfaces and the automorphism groups of the spaces of ends of such surfaces (braid group analogs) are a fascinating class of "big" topological groups. I will describe some recent joint work with Rafi that answers two basic questions about the topology of end spaces that arose in our work on geometry of big mapping class groups, and then propose several questions for further exploration.

Yair Minsky (Yale University): *Skinning maps and a lost theorem of Thurston*

Thurston's proof of the hyperbolization theorem for Haken manifolds involved a gluing step, in which the matching conditions for the boundary components being glued are phrased in terms of a fixed-point problem for a certain self-map of Teichmuller space. A better quantitative understanding of this process would improve our control of the relation of topology to geometry of these manifolds. Thurston stated an appealing theorem: that a finite power of the self-map has bounded image, thus controlling the process of finding the fixed point. Nobody seems to know what Thurston's proof was. With Ken Bromberg and Dick Canary, we provide a proof that involves building uniform models for the internal geometry of hyperbolic manifolds of a given topological type. I will try to explain the background and the ingredients of this theorem, which include the machinery of hierarchical structure in the mapping class group.

Jean Pierre Mutanguha (Institute for Advanced Study): *Canonical forms for free group automorphisms*

The Nielsen–Thurston theory of surface homeomorphisms can be thought of as a surface analogue to the Jordan Canonical Form. I will discuss my progress in developing a similar canonical form for free group automorphisms. (Un)Fortunately, free group automorphisms can have arbitrarily complicated behaviour. This forms a significant barrier to translating specific arguments that worked for surfaces into the free group setting; nevertheless, the overall ideas/strategies do translate!

Piotr Przytycki (McGill University): *Tits alternative for the 3-dimensional tame automorphism group*

This is joint work with Stephane Lamy. Let k be a field of characteristic zero. The tame automorphism group $\mathrm{Tame}(k^3)$ is generated by the affine automorphisms of k^3, and the automorphisms of the form $(x, y, z) \to (x, y, z + P(x, y))$, where P is a polynomial in $k[x, y]$. We prove that every subgroup of $\mathrm{Tame}(k^3)$ is virtually solvable or contains a nonabelian free group.

Alessandro Sisto (Heriot-Watt University): *Extensions of Veech groups*

Given a subgroup of a mapping class group, there is a corresponding extension group. For example, in the case of a cyclic subgroup generated by a mapping class, the extension group is the fundamental group of the 3-manifold obtained as the mapping torus of the mapping class. Farb and Mosher introduced the notion of convex-cocompact subgroup of a mapping class group, and a subgroup is convex-cocompact if and only if the corresponding extension group is hyperbolic. Moving beyond this, I will discuss naturally occurring subgroups of mapping class groups that are not convex-cocompact, namely Veech groups, and the fact that the corresponding extension groups are hierarchically hyperbolic. I will explain what this means, what consequences this has, and discuss a simple criterion for hierarchical hyperbolicity that is useful for other applications as well. Based on joint work with Spencer Dowdall, Matt Durham, and Chris Leininger.

Richard D. Wade (University of Oxford): *Commensurator rigidity of* $\mathrm{Aut}(F_N)$

We say that a group G is commensurator rigid if it is equal to its own abstract commensurator. There is a pleasing blueprint for proving commensurator rigidity of a group, which runs like so:

1. Find a graph whose isometry group is exactly G,
2. Show that the action of G on this graph extends to an action of $\mathrm{Comm}(G)$,
3. Profit!

This method was used recently in proofs by Horbez and myself, and Guerch, to prove commensurator rigidity of outer automorphism groups of free groups and universal Coxeter groups, respectively (subject to necessary rank restrictions in each case). In this talk I will expand on the brief blueprint given above, and discuss forthcoming work with Bridson, where we show that $\mathrm{Aut}(F_N)$ is commensurator rigid when N is at least 3. The two main inputs are a classification theorem for direct products of $2N-3$ free groups in $\mathrm{Aut}(F_N)$, and rigidity of a certain subcomplex of the free factor complex.