Grigori Avramidi (University of Chicago)
Ends of negatively curved manifolds
Abstract:

A theorem of Gromov says that a complete finite volume Riemannian manifold of bounded negative curvature is the interior of a compact manifold with boundary. If, in addition, the curvature is bounded away from zero then the boundary is an aspherical manifold with virtually nilpotent fundamental group. I will discuss examples showing this is no longer true if the curvature is allowed to approach zero. Then, I will explain a recent result showing that in dimension four the boundary is aspherical. This is joint work with Yunhui Wu and Tam Nguyen Phan.

Florent Balacheff (University of Lille I)
Isosystolic inequalities for optical hypersurfaces
Abstract:

In this talk, we will explain how the study of systolic geometry for non-reversible Finsler metrics allows us to find surprising and nice relations between metric geometry, convex geometry and the geometry of the numbers. This is joint work with Juan-Carlos Alvarez Paiva and Kroum Tzanev.

Igor Belegradek (Georgia Institute of Technology)
Topology of open nonpositively curved manifolds
Abstract:

I will survey recent results on rank one open nonpositively curved manifolds focusing on the topology of ends and restrictions on the fundamental group. The talk is based on http://arxiv.org/abs/1306.1256.

Greg Chambers (University of Toronto)
Optimal homotopies of curves on surfaces.
Abstract:

In this talk, we will prove the following theorems. For any $\epsilon > 0$, we have that:

(1) If two simple closed curves on a 2-dimensional Riemannian manifold are homotopic through loops of length at most L, then they are also

homotopic through simple closed curves of length at most $L + \epsilon$ (joint work with Y. Liokumovich).
(2) If the boundary of a Riemannian 2-disc can be contracted through closed curves of length at most L, then it can be contracted through based loops of length at most $L + 2D + \epsilon$, where D is the diameter of the 2-disc (joint work with R. Rotman). This result can be generalized for simple closed curves on Riemannian 2-manifolds.
(3) A closed curve on an orientable Riemannian 2-manifold can be contracted through loops of length at most $L + \epsilon$ if the curve formed by traversing twice can be contracted through loops of length at most L (joint work with Y. Liokumovich). This can be seen as a quantitative version of the fact that the fundamental group of an orientable surface contains no elements of order 2.

Alexander Dranishnikov (University of Florida)
Scalar curvature, macroscopic dimension and inessential manifolds.
Abstract:

In his book dedicated to Gelfand's 80th anniversary [G] Gromov introduced the notion of macroscopic dimension and proposed a conjecture: The macroscopic dimension $dim_{mc}\tilde{M}$ of the universal cover $\tilde{M}$ of a closed n-manifold with positive scalar curvature is at most $n - 2$. We proved this conjecture in [BD] for spin manifolds whose fundamental group satisfies the Analytic Novikov Conjecture and the following K-theoretic condition (the Rosenberg-Stolz condition [RS]): $ko_*(\pi) \longrightarrow KO_*(\pi)$ is a monomorphism. In this presentation we will discuss the inequality $dim_{mc}\tilde{M} < n$ for for closed positive scalar curvature n-manifolds M. In particular, we prove it for manifolds whose fundamental group satisfies the Analytic Novikov Conjecture and the weaker K-theoretic condition: $ko^{lf}(E\pi) \longrightarrow KO^{lf}(E\pi)$ is a monomorphism. This allows to to prove the Gromov Conjecture for manifolds with the fundamental groups satisfying the Novikov conjecture which are duality groups. The inequality $dim_{mc}\tilde{M} < n$ is related to Gong-Yu's concept of a macroscopically large manifold as well as to Gromov's notion of inessential manifolds. We show that this inequality means exactly that $\tilde{M}$ is macroscopically large integrally. The large obstacle on the way to the Gromov conjecture is the difference between rational and integral versions of these concepts. The

rational inessentiality means that $f_*([M]) = 0$ in $H_n(B\pi; Q)$. In the case of a spin manifold with positive scalar curvature the rational inessentiality follows from Rosenberg's theorem [R] and the K-homology Chern character. In [G] Gromov conjectured that the condition $dim_{mc}\tilde{M} < n$ implies the rational inessentiality. It turns out that this his conjecture is closely related to the question of amenability of the fundamental group [Dr2] and generally has a counterexample [Dr3].

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Tullia Dymarz (University of Wisconsin)
Quasisymmetric vs Bi-Lipschitz maps
Abstract:

On a metric space, there are various classes of functions which respect aspects of the metric space structure. One of the most basic classes is the bi-Lipschitz maps Another possibly much larger class consists of the so-called quasisymmetric maps. On both Euclidean space and the p-adics, there are many quasisymmetric maps which are not bi-Lipschitz. However, on the product of Euclidean space with the p-adics, we show that all quasisymmetric maps are bi-Lipschitz. Furthermore,

our proof does not use any direct analysis but instead uses results on quasi-isometries and spaces of negative curvature.

Mohammad Ghomi (Georgia Institute of Technology)
Affine unfoldings of convex polyhedra
Abstract:

A well-known problem in geometry, which may be traced back to the Renaissance artist Albrecht Durer, is concerned with cutting a convex polyhedral surface along some spanning tree of its edges so that it may be isometrically embedded into the plane. We show that this is always possible after an affine transformation of the surface. In particular, unfoldability of a convex polyhedron does not depend on its combinatorial structure, which settles a problem of Croft, Falconer, and Guy. Among other techniques, the proof employs a topological characterization for embeddings among immersed planar disks.

Herman Gluck (University of Pennsylvania)
Lipschitz minimality of group multiplication on the three-sphere.
Abstract:

I will discuss the new result of Haomin Wen, a graduate student at Penn, that group multiplication on the three-sphere is a Lipschitz constant minimizer in its homotopy class, unique up to composition with isometries of domain and range. The proof is based on some insightful new geometric inequalities.

In the talk I will provide the background for Haomin's result, and will end with a list of problems that point the way to future work.

Ursula Hamenstädt (University of Bonn)
Surface bundles over surfaces do not admit real hyperbolic metrics
Abstract:

We show that the signature of a surface bundle over a surface with word hyperbolic fundamental group does not vanish. As a consequence, a closed real hyperbolic 4-manifold does not admit the structure of a surface bundle.

Dmitry Jakobson (McGill University)

Gaussian measures no spaces of metrics.
Abstract:

The first part of the talk is joint work in progress with B. Clarke, N. Kamran, L. Silberman and J. Taylor. We define Gaussian measures on manifolds of metrics with the fixed volume form. We next compute the moment generating function for the L^2 (Ebin) distance to the reference metric.

The second part of the talk is joint work with Linan Chen. We use the two-dimensional approach of Duplantier-Sheffield to define a 4-dimensional analogue of Gaussian Free Field, and use it to construct a canonical measure on a conformal class of metrics in R^4. We derive a KPZ type relation for those measures.

Matthew Kahle (Ohio State University)
Recent progress on random groups
Abstract:

In this talk I will discuss recent work by Hoffman, Paquette, and myself, where we find a sharp threshold for the fundamental group of random 2-complexes to have Kazhdan's property (T). Our result depends on a spectral gap criterion due to Zuk, but we also require new concentration results for spectral gaps of Erdos-Renyi random graphs. I will also put this work in the context of other work on random fundamental groups (hyperbolicity, cohomological dimension, etc.), and compare what is know for this model with what is known for Gromov's density model and Zuk's triangular model.

Vitali Kapovitch (University of Toronto)
Manifolds without conjugate points and their fundamental groups (joint with S. Ivanov)
Abstract:

We show that in the fundamental groups of closed manifolds without conjugate points centralizers of all elements virtually split. We also prove that a closed 3-manifold admits a metric without focal points if and only if it admits a metric of nonpositive curvature.

Enrico Le Donne (ETH, Zurich)

Growth rate of nilpotent groups and subFinsler geometry.
Abstract:

This talk is introductory. We explain the role of Carnot groups and their subFinsler geometry in Geometric Group Theory, recalling whole of the terminology. We discuss a link between fine volume estimates, rate of convergence to asymptotic cones, and presence of abnormal geodesics. The results on rate of convergence for nilpotent groups are in collaboration with Breuillard (Paris). The results on abnormal curves in Carnot groups are in collaboration with Leonardi (Modena), Monti (Padova), and Vittone (Padova).

Yevgeny Liokumovich (University of Toronto)
Slicing of Riemannian 2-surfaces by short curves
Abstract:

Consider Riemannian 2-sphere M of area A and diameter d. We prove that there exists a slicing of M by loops of length $\leq 200d \max\{1, \log(A/d^2)\}$. We construct examples showing that this bound is optimal up to a constant factor. This is a joint work with A. Nabutovsky and R. Rotman. Related questions about sweep-outs and slicings of surfaces will also be discussed.

Fedor Manin (University of Chicago)
Algebraic versus geometric complexity in homotopy groups
Abstract:

Given a metric space X and an element $\alpha \in \pi_n(X)$, how does the minimal geometric complexity of a representative of $k\alpha$ grow as a function of k? If we can find a representative simpler than the "obvious" one, as quantified by measures such as Lipschitz constant or volume, we say, by analogy to the π_1 case, that α is distorted. Asymptotically, distortion functions are topological invariants of nice compact spaces. For such spaces, we discuss various ways in which distortion can arise and establish conditions on X under which homotopy elements are or are not distorted. Methods include rational homotopy theory, filling functions, and L^∞ cohomology.

Piotr Nowak (University of Warsaw)

Cohomology of deformations
Abstract:

The theme of this talk will be the question of how the cohomology of a fixed group with coefficients in a representation on a Hilbert space behaves under deformations of the representation. We will show that under certain conditions the vanishing is preserved by epsilon-deformations on the generators. The techniques we use allow to give an estimate on this epsilon in terms of n-dimensional Kazhdan-type constants which we introduce and which are natural generalizations of the classical Kazhdan constants. We will also discuss some examples and applications. This is based on joint work with Uri Bader.

Anoton Petrunin (Penn State University)
Telescopic actions (joint work with D. Panov).
Abstract:

A group action H on X is called "telescopic" if for any finitely presented group G, there exists a subgroup H' in H such that G is isomorphic to the fundamental group of X/H'.

We construct examples of telescopic actions on some CAT[-1] spaces, in particular on 3 and 4-dimensional hyperbolic spaces. As applications we give new proofs of the following statements:

(1) Aitchison's theorem: Every finitely presented group G can appear as the fundamental group of M/J, where M is a compact 3-manifold and J is an involution which has only isolated fixed points;

(2) Taubes' theorem: Every finitely presented group G can appear as the fundamental group of a compact complex 3-manifold.

John Roe (Penn State University)
Ghostbusting and property A.
Abstract:

Guoliang Yu's property A for metric spaces is a weak version of amenability that has found applications in geometry, topology and analysis. Recently, it has become clear that property A is in fact equivalent to several other natural regularity conditions. In this talk I'll report on these developments, with particular reference to the existence or not of "ghost operators" ... operators in the Roe algebra whose behavior at

infinity is trivial, but which are not compact. This is joint work with Rufus Willett (Hawai'i).

Regina Rotman (University of Toronto)
Short geodesic segments on closed Riemannian manifolds.
Abstract:

A well-known result of J. P. Serre states that for an arbitrary pair of points on a closed Riemannian manifold there exist infinitely many geodesics connecting these points. A natural question is whether one can estimate the length of the "k-th" geodesic in terms of the diameter of a manifold. We will demonstrate that given any pair of points on a closed Riemannian manifold M of dimension n and diameter d, there always exist at least k geodesics of length at most $4nk^2d$ connecting them. We will also demonstrate that for any two points of a manifold that is diffeomorphic to the 2-sphere, there always exist at least k geodesics between them of length at most $22kd$. (Joint with A. Nabutovsky).

Stephane Sabourau (University Paris-Est Creteille)
Growth of quotients of isometry groups.
Abstract:

We will present some gap properties regarding the exponential growth rate of quotient of isometry groups in geometry group theory and Riemannian geometry.

Egor Shelukhin (University of Montreal)
Braids and L^p-norms of area-preserving diffeomorphisms
Abstract:

We consider large-scale metric properties of groups area-preserving diffeomorphisms of surfaces endowed with the hydrodynamic L2-metric (or more generally the L^p-metric). The first such property is the unboundedness of the metric, which we establish for the last open case among compact surfaces, the two-sphere. Our methods involve quasimorphisms on braid groups and differential forms on configuration spaces. This talk is based on a joint work with Michael Brandenbursky.

Burkhard Wilking (University of Münster)

A generalization of Gromov almost flat manifold theorem

Abstract:

By Gromov a manifold with diameter 1 and sectional curvature sufficiently small in absolute value is finitely covered by a nilmanifold. We generalize the theorem by relaxing the curvature condition in the theorem.

Michael Yampolsky (University of Toronto)

Geometrization of branched coverings of the sphere and decidability of Thurston equivalence

Abstract:

I will discuss a recent result obtained jointly with M. Braverman and S. Bonnot on the algorithmic decidability of the question whether a postcritically finite branched covering map of the 2-sphere is Thurston equivalent to a rational map. I will further describe the connection of the general question of algorithmic decidability of Thurston equivalence with geometrization of branched coverings, and will present a new theorem joint with N. Selinger on an algorithmic construction of a canonical geometrization of a branched covering.

Robert Young (University of Toronto)

Filling multiples of embedded curves.

Abstract:

Filling a curve with an oriented surface can sometimes be "cheaper by the dozen". For example, L. C. Young constructed a smooth curve drawn on a Klein bottle in R^n which is only about 1.3 times as hard to fill twice as it is to fill once and asked whether this ratio can be bounded below. We will use methods from geometric measure theory to answer this question and pose some open questions about systolic inequalities for surfaces embedded in R^n.