

## Fall 2014

### ▪ September 11

*Speaker:* Ben McReynolds (Purdue University)

*Title:* Effective rigidity and counting

*Abstract:* In 1992, Alan Reid proved that if two arithmetic hyperbolic 2-manifolds have the same geodesic length spectrum, the two manifolds must be commensurable. In 2008, Chinburg-Hamilton-Long-Reid extended Reid's result to arithmetic hyperbolic 3-manifolds. In this talk, I will discuss effective versions of these results. Specifically, given two arithmetic hyperbolic 2- or 3-manifolds of some bounded volume  $V$  that are not commensurable, we ensure that a length  $L$  occurs in one but not both. More important, the length  $L$  can be bounded above as a function of the volume  $V$  and is explicitly given. These results rely on effective rigidity results for quaternion algebras. The main tools used are algebraic and geometric counting results of independent interest. Time permitting, I will discuss some of these counting results. This work is joint with Benjamin Linowitz, Paul Pollack, and Lola Thompson.

### ▪ September 18

*Speaker:* Russell Ricks (University of Michigan)

*Title:* Flat strips in rank one CAT(0) spaces

*Abstract:* Let  $X$  be a proper, geodesically complete CAT(0) space under a geometric (that is, properly discontinuous, cocompact, and isometric) group action on  $X$ ; further assume  $X$  admits a rank one axis. Using the Patterson-Sullivan measure on the boundary, we construct a generalized Bowen-Margulis measure on the space of geodesics in  $X$ . This additional structure allows us to prove some results about the original CAT(0) space  $X$ . Here are three such results: First, with respect to the Patterson-Sullivan measure, almost every point in the boundary of  $X$  is isolated in the Tits metric. Second, under the Bowen-Margulis measure, almost no geodesic bounds a flat strip of any positive width. Third, we characterize when the length spectrum is arithmetic (that is, the set of translation lengths is contained in a discrete subgroup of the reals). In this talk, we will discuss the constructions and a few of the wrinkles involved for CAT(0) spaces.

### ▪ September 25 no seminar.

### ▪ October 2

*Speaker:* Zhiren Wang (Pennsylvania State University)

*Title:* Global Rigidity of Anosov  $Z^r$  Actions on Tori and Nilmanifolds

*Abstract:* As part of a more general conjecture by Katok and Spatzier, it was asked if all smooth Anosov  $Z^r$ -actions on tori, nilmanifolds and infranilmanifolds without rank-1 factor actions are, up to smooth conjugacy, actions by automorphisms. In this talk, we will discuss a recent joint work with Federico Rodriguez Hertz that affirmatively answers this question.

**▪ October 9**

*Speaker:* David Constantine (Wesleyan University)

*Title:* Some marked-length spectrum rigidity results for Fuchsian buildings

*Abstract:* I will present a few results on the question of marked-length spectrum rigidity for compact quotients of Fuchsian buildings. That is, I will detail some cases where knowing the length of the geodesic representative in each free homotopy class of loops is enough to recover the entire geometry of the building. Similar results hold for non-positively curved locally symmetric spaces and non-positively curved surfaces. This is joint work in progress with Jean-Francois Lafont.

**▪ October 16**

*Speaker:* Andrew Nicol (Otterbein University)

*Title:* Quasi-isometries of graph manifolds do not preserve non-positive curvature

*Abstract:* In this talk, we will see the definition of high dimensional graph manifold and see that there are infinitely many examples coming from all dimensions 3 and higher of pairs graph manifolds with quasi-isometric fundamental groups, but where one supports a locally CAT(0) metric while the other cannot. We will use properties of the Euler class as well as various results on bounded cohomology.

**▪ October 23****▪ October 30**

*Speaker:* Matt Brin (Binghamton University)

*Title:* Groups of piecewise linear homeomorphisms of the unit interval

*Abstract:* It has long been a personal goal to understand the subgroup structure of the group of all piecewise linear, orientation preserving self homeomorphism of the unit interval, and it has been long accepted that this is not a particularly practical goal. However recent events have shown that while the ultimate goal might still be a long way off, we are a lot closer than we were a year ago. The talk is a progress report giving some results, some strong beliefs and some open questions. The work is joint with Collin Bleak and Justin Moore.

**▪ November 4** (cross listing with the Combinatorics Seminar)

*Speaker:* Emanuele Delucchi (Fribourg, Switzerland)

*Title:* Toric Arrangements – Towards Setting Up a Combinatorial Theory

*Abstract:* Recent work of De Concini, Procesi, and Vergne on vector partition functions gave a new impulse to the study of toric arrangements from algebraic, topological, and combinatorial points of view. In this context, many new discrete structures have appeared in the literature, each describing some aspect of the theory (i.e., either the arithmetic-algebraic one or the topological one) and trying to mirror the combinatorial framework which revolves

around arrangements of hyperplanes. I will give a quick overview of the state of the art and, taking inspiration from some recent results of topological flavor, I will try to suggest a possible approach towards unifying these different objects.

▪ **November 13**

*Speaker:* Matt Zaremsky (Binghamton University)

*Title:* HNN decompositions of Lodha-Moore groups, and topological applications

*Abstract:* In 1979, Geoghegan made four conjectures about Thompson's group  $F$ , three out of four of which have since been proved; the last one, non-amenability, is (in)famously still open. In 2013, Lodha and Moore found examples of finitely presented groups, closely related to  $F$ , which are non-amenable. They also showed that three out of four of Geoghegan's conjectures hold (this time including non-amenability). I have recently shown that they also satisfy the fourth conjecture, thus yielding the first examples of groups satisfying all four of Geoghegan's requirements. This talk will be an introduction to the Lodha-Moore groups, and a discussion of the key tool, that they are isomorphic to ascending HNN extensions of each other. If time permits I will also discuss my computation of the Bieri-Neumann-Strebel invariants for the Lodha-Moore groups.

▪ **November 20**

*Speaker:* Christoforos Neofytidis (Binghamton University)

*Title:* Fundamental groups of aspherical manifolds and maps of non-zero degree

*Abstract:* We discuss obstructions to the existence of maps of non-zero degree from direct products to rationally essential manifolds, with special emphasis to aspherical manifolds whose fundamental groups have non-trivial center. As an application, we obtain an ordering of all non-hyperbolic 4-manifolds possessing a Thurston aspherical geometry.

▪ **November 27** no seminar.

▪ **December 4**

▪ **December 11**

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