Borel Seminar 2014 - Discrete group actions in geometry and topology

PROGRAM

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00-09:45	Kapovich I	Kapovich II	Kapovich III	DGK II	DGK III
Coffee break					
10:15-11:00	Iozzi I	Iozzi II	Iozzi III	Gelander II	Emery
11:20-12:05	de la Harpe	DGK I	Gelander I	Besson	Burger
Lunch					
16:00-16:45	–	–	–	Falbel	–
17:00-17:45	Rainbault	Paupert	–	Deraux	–
18:00-18:45	Ranicki	Pratoussevitch	–	Gelander III	–

MINI-COURSES

Jeffrey Danciger - François Guéritaud - Fanny Kassel

Title: Complete constant-curvature spacetimes in dimension 3

Abstract: This series of three lectures will focus on the geometry of complete Lorentzian 3-manifolds or "spacetimes" of constant nonpositive curvature. Throughout, we will emphasize a unifying "geometric transition" point of view which lets one realize all zero-curvature examples as limits of negative-curvature ones. We will:

1) Describe basic geometric features of Minkowski 3-space and anti-de Sitter 3-space (on which such spacetimes are modeled), as well as their isometry groups;

2) Explain how the search for quotients of these model spaces relates to the search for contracting, equivariant maps from the hyperbolic plane to itself;

3) Discuss recent results expressing the deformation space of a Lorentzian manifold in terms of the arc complex of a surface.

Alessandra Iozzi

Title: Bounded cohomology and rigidity

Abstract: In 1982 Gromov introduced bounded cohomology and showed that the bounded cohomology of a topological space is isometrically isomorphic to the bounded cohomology of its fundamental group. This result is at the basis of most rigidity results proven with cohomological methods. When dealing with manifolds with boundary, the use of bounded cohomology relative to the boundary components is paramount.

In this minicourse we present some of the results in relative bounded cohomology parallel to the one in relative cohomology and we show some applications to the study of the bounded cohomology of the fundamental group of appropriate graphs of groups.

Further, we define the volume of a representation of a three-manifold group and we prove some of its properties. As a corollary we obtain rigidity results for such representations into the isometry group of real hyperbolic space.

In a different direction, but for the same manifold groups, we define the volume of a representation into SL(n,C), prove that it satisfies a Milnor-Wood type inequality and study the properties of its maximality.

Tsachik Gelander

Title: Invariant Random Subgroups in rank one and higher rank Lie groups

Abstract: An Invariant Random Subgroups (IRS) in a locally compact group G is a conjugacy invariant probability measure on the space Sub(G) of closed subgroups of G. Special examples are normal subgroups (Dirac mass) and finite volume homogeneous spaces (corresponding to lattices). The space IRS(G), of all IRS's, equipped with the weak-* topology is a compact space which one wishes to analyse, in particular, in order to understand better some of its special points (e.g. the lattices). In recent years there has been a largely growing interest in studying IRS in various groups. I will concentrate in the case that G is a simple Lie group. The first talk will be dedicated to basic definitions and properties, including the analogy to Benjamini–Schramm topology. The second talk will be devoted to the higher rank case (following my joint work with Abert, Bergeron, Biringer, Nikolov, Raimbault and Samet). In particular I will explain Stuck–Zimmer rigidity theorem, its application to the asymptotic shape of locally symmetric spaces, and some further application concerning L_2 invariants. The third talk will be devoted to rank one groups, where the lack of rigidity plays an important role and could be used for instance to show that almost all hyperbolic manifolds are non-arithmetic (in an appropriate sense).

Misha Kapovich

Title: Kleinian groups and hyperbolic geometric

Abstract: In my lectures I will give a survey of properties of discrete isometry groups of higher-dimensional hyperbolic spaces, comparing and contrasting them with the properties of "classical" Kleinian groups of isometries of the hyperbolic plane and hyperbolic 3-space.

TALKS

Gérard Besson

Title: On open 3 manifolds
Abstract: We present two families of open 3-manifolds, some results and several open questions.

Marc Burger

Title: Volumes of representations
Abstract:

Pierre de la Harpe

Title: Differential equations and discontinuous groups, à la Poincaré
Abstract:

Martin Deraux

Title: Complex hyperbolic geometry of the figure eight knot
Abstract: In joint work with E. Falbel, we proved that the figure eight knot complement can be obtained as the manifold at infinity of a complex hyperbolic orbifold. I will outline a new proof of this result, which implies a stronger statement, namely there are uncountably many conjugacy classes of complex hyperbolic orbifolds that admit the figure eight knot complement as their manifold at infinity.

Vincent Emery

Title: Hyperbolic manifolds of small volume
Abstract: I will discuss a conjecture stating that except in dimension $n = 3$, the complete hyperbolic n-manifold of the smallest volume is noncompact. This is joint work with Misha Belolipetsky.

Elisha Falbel

Title: Character varieties for the figure eight knot
Abstract: We will describe the character variety of representations of the fundamental group of the complement of the figure eight knot into PSL(3,C).

Julien Paupert

Title: New non-arithmetic lattices in $SU(2,1)$
Abstract: In 1980 Mostow produced a small number of non-arithmetic lattices in $SU(2,1)$ by a direct geometric construction using complex reflections. The only other known examples were groups considered by Picard in his work on hypergeometric functions. We consider a generalization of Mostow's construction, which produces a new (finite) family of non-arithmetic lattices in $SU(2,1)$, none of which is commensurable to any Picard or Mostow lattice. This is joint work with M. Deraux and J.R. Parker.

Anna Pratoussevitch

Title: Some Disreteness Results for Complex Hyperbolic Triangle Groups

Abstract: Abstract: We will discuss some discreteness results for ultra-parallel (complex hyperbolic) triangle groups as well as some non-discreteness results for certain families of triangle groups. This is joint work with A. Monaghan.

Jean Rainbault

Title: Diffuse actions of groups

Abstract: Difuseness of groups and of group actions was introduced by B. Bowditch as a geometric replacement for the unique products property. It proves to be more tractable than the latter (while implying it), and in this talk we will present examples of groups with and without this property. This is a joint work with S. Kionke."

Andrew Ranicki

Title: Algebraic and geometric transversality

Abstract: The decomposition of manifolds and homotopy equivalences are topics of central importance in the surgery theory of manifolds, especially non-simply-connected ones in dimensions > 4. The geometric transversality is the familiar one for a map $f : M \to X$ of a manifold M to a space X with a subspace $Y \subset X$ which has a k-dimensional vector bundle neighbourhood: f is homotopic to a map such that $N = f^{-1}(Y) \subset M$ is a codimension k submanifold with the pullback normal bundle. Algebraic transversality is less familiar: it is the algebraic analogue for chain complexes of geometric transversality. It is particularly developed in the case when $k = 1$ and $\pi_1(Y) \to \pi_1(X)$ is injective, so that $\pi_1(X)$ is a generalized free product or an HNN extension. The cutting of X along Y and the corresponding decomposition of the universal cover of X has an algebraic analogue for $Z[\pi_1(X)]$-module chain complexes. The talk will concentrate on codimension 1 algebraic transversality and its application to the algebraic K- and L-theory of generalized free products and HNN extensions. These groups present splitting obstructions to a homotopy equivalence $f : M \to X$ being homotopic to a transverse map with the restriction $f\,|\colon N \to Y$ also a homotopy equivalence. There will also be a discussion of algebraic transversality for arbitrary codimensions k.