Geometric group thery, Kyoto 2012

2012.6.4-6.8, RIMS (room 420), Kyoto U.

Program

4th June, Mon

9:30-9:45 Registration

9:45-10:45 Bestvina 1

Introduction to the geometry of $Out(F_n)$

11:00-12:00 Calegari 1

1. Ergodic theory and random walks on hyperbolic groups and spaces,
2. scl

1:30-2:30 Valette.

Graphs of groups and the Haagerup property

3:00-4:00 Zuk

5th June, Tue

9:45-10:45 Calegari 2

11:00-12:00 Bestvina 2

1:30-2:30 Fukaya

3:00-4:00 Monod

Simple amenable groups

6th June, Wed

9:45-10:45 Bestvina 3

11:00-12:00 Calegari 3

1:30-2:30 Wilson.

Finitely presented soluble groups, polynomials and polyhedra

2:45-3:45 Kohno.

Quantum symmetries in homological representations of braid groups and applications

4:30-5:30, Colloquium at RIMS (rm 420) by Bestvina "Group actions on quasi-trees and applications". Tea starts at 4:00.

7th June, Thu

9:45-10:45 Manning 1.

Height, multiplicity, and Dehn filling

11:00-12:00 Ozawa.

Survey on Weak Amenability

1:30-2:00 Kim.

Embeddability between Right-Angled Artin Groups

2:10-2:40 Matsuda.

Limits of geometrically finite convergence actions of a group

2:50-3:20 Ciobanu.

Geodesic growth in right-angled and even Coxeter groups

3:50-4:20 Chung.

The variational principle of topological pressure for actions of sofic groups

4:30-5:00 Mimura.

Property (TT)/T and homomorphism superrigidity into mapping class groups and into $Out(F_n)$

6:00 - Banquet (on campus)

8th June, Fri

9:45-10:45 Mineyev.

The Hanna Neumann Conjecture and the deep-fall property

11:00-12:00 Manning 2

Supported by RIMS International Project Research 2012 “Discrete Geometric Analysis” , GCOE program “Fostering top leaders in Mathematics”, and Grants-in-Aid for Scientific Research, No. 23244005.

Abstracts

Lectures

- M.Bestvina (Utah),
  Introduction to the geometry of $Out(F_n)$
  The recent work on $Out(F_n)$, the group of outer automorphisms of a free group F_n of rank n, focuses on understanding the geometry of spaces on which it acts. The study is very strongly influenced by what happens with mapping class groups. Culler-Vogtmann's Outer space is the analog of the Teichmuller space, and two complexes play the role of the curve complex: the complex of free splittings and the complex of free factors. Within the last year it was shown that these two complexes are delta-hyperbolic. I will present some of the ideas in this subject, which is still very much in development. A breakdown by lectures will roughly look like this: 1. Outer space, Lipschitz metric, train track structures. 2. Classification of automorphisms. 3. Complexes of free factors and free splittings. Hyperbolic features.

- D.Calegari (Cambridge),
  1. Ergodic theory and random walks on hyperbolic groups and spaces
  2. scl

- J.Manning (Buffalo, USA),
  Title: Height, multiplicity, and Dehn filling.
  Abstract: We show that given a virtually special quasiconvex subgroup H of a hyperbolic group G, and some $g \notin H$, there is a hyperbolic quotient of G in which H projects to a finite subgroup, disjoint from the image of the element g. This statement is used in Ian Agol's recent proof of the Virtual Haken Conjecture. The method of proof is an induction on the height of the quasiconvex subgroup, using relatively hyperbolic Dehn filling to reduce height. Along the way, we give a new characterization of height as the multiplicity of a certain map, and a new proof (which does not depend on torsion-freeness) that Dehn filling reduces height of quasi-convex subgroups. This is joint work with Ian Agol and Daniel Groves.

Talks

- K.Fukaya (Kyoto),

- T.Kohno (Tokyo),
  Quantum symmetries in homological representations of braid groups

and applications Abstract: We describe a relation between the homological representations of the braid groups studied by Lawrence, Krammer and Bigelow and the monodromy of the KZ equation with values in the space of null vectors in the tensor product of Verma modules of sl(2, C) when the parameters are generic. This correspondence shows that the homological representations of the braid groups admit symmetries of quantum groups. We discuss some applications of such symmetries to problems in combinatorial group theory.

- I.Mineyev (Illinois),
  The Hanna Neumann Conjecture and the deep-fall property.
  Abstract: We will sketch a proof of the Strengthened Hanna Neumann Conjecture (SHNC), and some more general results. Submultiplicativity is a generalization of the statement of SHNC from graphs to complexes, and from free groups to more general groups. Submultiplicativity holds for complexes under an additional assumption: the deep-fall property. We will discuss combinatorial and analytic ways to define this property.

- N.Monod (Lausanne),
  Title: "Simple amenable groups"
  Abstract: We provide the first examples of finitely generated simple groups that are amenable (and infinite). This follows from a general existence result on invariant states for piecewise-translations of the integers, and from work of Matsui. The states are obtained by constructing a suitable family of densities on the classical Bernoulli space. Joint work with Kate Juschenko.

- N.Ozawa (Kyoto),
  Title: Survey on Weak Amenability
  Abstract: Weakly amenability (aka Cowling–Haagerup property) is a generalization of amenability and is a convenient tool in the study of group algebras. Besides amenable groups, the class of weakly amenable groups contains many interesting examples such as free groups. I will give a survey on weak amenability.

- A.Valette (Neuchatel),
  title: Graphs of groups and the Haagerup property
  abstract: A group has the Haagerup property if it admits a proper isometric action on a Hilbert space. It is an open question to find a criterion for the Haagerup property for groups acting on trees, as-

suming that the vertex-stabilizers do have it. We find such a criterion under the assumption that the action on the tree is co-compact, and all vertex- and edge-stabilizers are isomorphic to the same ^{n}. In particular, for $n = 1$ (generalized Baumslag-Solitar groups), the group has the Haagerup property. This is a joint work with Yves Cornulier.

- J.Wilson (Oxford),
  'Finitely presented soluble groups, polynomials and polyhedra'.
  'Finitely presented soluble groups have been studied seriously for about 40 years. In this lecture old and very new results will be described, together with some of the remarkably diverse methods from algebra, number theory and geometry used in establishing them'.

- A.Zuk (Paris)

Short talks:

- Sang-hyun Kim (KAIST)
  Embeddability between Right-Angled Artin Groups
  Using mapping class groups, we study the question of which right-angled Artin groups (RAAGs) embed into which RAAGs. In particular, we have a graph theoretical characterization for the cases when the defining graph of the target RAAG is two-dimensional. We can explicitly write down the conditions when both defining graphs are cycles or trees (joint work with Thomas Koberda).

- Yoshifumi Matsuda (University of Tokyo)
  Title: Limits of geometrically finite convergence actions of a group
  Abstract: The notion of geometrically finite convergence groups is a generalization of the notion of geometrically finite Kleinian groups and is deeply related to the notion of relatively hyperbolic groups. In this talk, given a compact metrizable space endowed with a geometrically finite convergence action of a group, we construct compact metrizable spaces endowed with geometrically infinite convergence actions of the group as inverse limits of compact metrizable spaces endowed with geometrically finite convergence actions of the group. This is a joint work with Shin-ichi Oguni and Saeko Yamagata.

- Laura Ciobanu (University of Fribourg)
  Title: Geodesic growth in right-angled and even Coxeter groups
  Abstract: It has long been known that the spherical or standard growth of a right-angled Coxeter (or Artin) group depends only on

the f-polynomial of the graph it is based on. Thus there are many non-isomorphic right-angled Coxeter (or Artin) groups with the same spherical growth. In this talk we consider geodesic instead of spherical growth, and discuss which combinatorial properties of a regular graph can completely determine the geodesic growth of the right-angled Coxeter group this graph defines. As a consequence, we provide the first known examples of right-angled and even Coxeter groups with the same geodesic growth series. This is joint work with Yago Antolin.

- Phu Chung (SUNY)
  The variational principle of topological pressure for actions of sofic groups
  Sofic groups were first introduced by Mikhail Gromov as a common generalizations of amenable groups and residually nite groups. In 2008, in a remarkable break- through, via modeling the dynamics of a measurable partition of probability space by means of partitions of a finite space, Lewis Bowen showed how to define entropy for measure-preserving actions of countable sofic groups. Later, using ideas in operator algebras, David Kerr and Hanfeng Li, developed a more general approach for both measure and topological sofic entropies and established the variational principle for this context. In this talk, applying Kerr and Li's method, we will define the topological pressure for actions of sofic groups and establish the variational principle for topological pressure.

- M. Mimura (Tohoku U)
  title: Property (TT)/T and homomorphism superrigidity into mapping class groups and into $Out(F_n)$
  abstract: Mapping class groups of compact surfaces (connected, oritented, possibly with punctures) of nonexceptional type; and $Out(F_N)$ for N at least 3 are very mysterious: they behave like higher rank lattice in some aspects, but they also do like rank one lattices in other aspects. The following theorems, well-known as the Farb–Kaimanovich–Masur; and the Bridson–Wade superrigidity, states a typical rank one phenomenon for MCG's: "every homomorphism from higher rank lattices into MCG's; or into $Out(F_N)$ has FINITE image."

  In this talk, we will generalize these theorems to the case where higher rank lattices are replaced with certain matrix groups over general (non-arithmetic) rings, such as SL(3,Z[x]) and Sp(4,Z[x,y]). For the proof, we will introduce the notion of "property (TT)/T", which is a strengthening of Kazhdan's property (T) and is a weakening of Monod's property (TT). If time permits, we will also discuss some generalization of the FKM and BW theorems for cocompact lattices.