

IMPACTS DE LA GÉOMÉTRIE DES GROUPES  
13 AU 17 JUILLET 2015

IMPACTS OF GEOMETRIC GROUP THEORY  
JULY 13 - 17, 2015

MARSEILLE – CIRM

RÉSUMÉS

ABSTRACTS

**Miklos Abert**

*Rank and homology log torsion growth in higher rank lattices*

A group is right angled if it can be generated by a set of infinite order elements with a connected commuting graph. We prove the vanishing of rank gradient and log torsion growth in the first homology, for right angled higher rank lattices and for any sequence of finite index subgroups with index tending to infinity.

Our proofs are of geometric nature and uniform vanishing comes from rigidity theory. The homological result uses an effective version of cost, a notion initiated by Levitt. When the lattice has the Congruence Subgroup Property (in particular when it is non-uniform), both results admit straightforward proofs of arithmetic nature, using an earlier work of Sharma and Venkataramana and some knowledge of finite simple groups. We exhibit a class of cocompact higher rank right angled lattices where CSP is not known.

This is joint work with Tsachik Gelander and Nikolay Nikolov.

**Michel Boileau**

*Virtual Thurston norms and simplicial volume*

We show that the Thurston seminorms of subregular finite covers of an aspherical 3-manifold determine whether its simplicial volume vanishes or not.

This is a joint work with Stefan Friedl.

### **Martin Bridson**

#### *Automorphisms of the free factor complex*

After a brief survey of rigidity results for automorphism groups of free groups, I will describe recent work proving that the natural map from  $\text{Aut}(F)$  to the group of simplicial automorphisms of the free-factor complex is an isomorphism. The corresponding theorem for  $\text{Out}(F)$  is also proved. If time allows, I'll discuss applications. This is joint work with Mladen Bestvina.

### **Thierry Coulbois**

#### *Index realization for automorphisms of free groups*

This is a joint work with Martin Lustig.

The index of a non-geometric automorphism of a free group  $F_N$  is the number of its attracting fix point minus two. The historical [GJLL] paper proves that the sum over isogrediency classes in an outer automorphism of indices is bounded above by  $2N - 2$ . We will explain that all list with the condition that the sum is bounded between 1 and  $2N - 2$  can be realized as the index list of an iwip automorphism of  $F_N$ .

The analogous of this result for pseudo-Anosov mapping classes was established by Masur and Smillie.

Our work relies on controlling the appearance of so-called INP and defining legalizing train-track maps.

### **Rémi Coulon**

#### *Automorphisms of lacunary hyperbolic groups*

Asymptotic cone is a tool to capture the large scale geometry of a group  $G$ . Roughly speaking it is a metric space obtained by viewing  $G$  from infinitely far away. A finitely generated group is lacunary hyperbolic if one of its asymptotic cones is an  $\mathbb{R}$ -tree. Introduced by Ol'shanskii, Osin and Sapir this class of groups is very broad. It contains for instance hyperbolic groups, some infinite torsion groups, some elementary amenable groups, etc. In this talk we will focus on the outer automorphism group  $\text{Out}(G)$  of a lacunary hyperbolic group  $G$ . One of the goal is to understand the structure of  $\text{Out}(G)$  when every action of  $G$  on an  $\mathbb{R}$ -tree has a global fixed point. We will also investigate the Hopf and co-Hopf properties for lacunary hyperbolic groups. This is a joint work with Vincent Guirardel.

### **François Dahmani**

#### *Recognition of relatively hyperbolic groups by Dehn Fillings; rigidity and flexibility*

It is possible to determine a finite volume hyperbolic 3-manifold by looking at the manifold obtained by filling the cusps with solid tori glued along a very steep slope. In certain circumstances, but not all, it is also possible to determine a relatively hyperbolic group by looking at the collection of its group theoretic Dehn fillings. This has applications in the solvability of isomorphism problems for some relatively hyperbolic groups in some rigid cases, and even in some flexible cases. We'll discuss joint works in this direction with V. Guirardel and with N. Touikan.

### **Cornelia Drutu**

#### *Kazhdan projections*

Kazhdan projections are usually considered objects relevant in operator algebras. In particular, they played a central part in the construction of counterexamples to the Baum-Connes conjecture.

In this talk I shall explain how, in the general setting of a family of representations on Banach spaces, one can reformulate the Kazhdan property “almost invariant implies invariant vectors” in terms of Kazhdan projections, providing also an explicit formula of the latter, using Markov operators associated to a random walk on the group. I will then explain some applications of this new approach.

This is joint work with Piotr Nowak.

### **Mark Feighn**

#### *The boundary of the free splitting complex*

I will talk about ongoing work with Mladen Bestvina and Patrick Reynolds using fold paths in Culler-Vogtmann's Outer space as a tool to explore/describe the boundary of the free splitting complex.

### **Étienne Ghys**

#### *Variations on Gilbert's first paper*

### **Vincent Guirardel**

#### *Subgroups of automorphisms of hyperbolic groups*

I will survey our common work with Gilbert Levitt about subgroups of automorphisms of hyperbolic and relatively hyperbolic groups : McCool groups, stabilizers of trees, stabilizers of subgroups.

### **Eriko Hironaka**

#### *Dual Digraphs and Entropy*

A 2-complex with semi-flow has a corresponding dual directed graph. In this talk, I will explain how to obtain from this information a polynomial invariant that is independent of homotopy equivalences preserving the topological semi-flow. Under certain conditions, we show that this is analogous to McMullen's Teichmueller polynomial, and computes the monodromy entropies of maps from the fundamental group of the complex to the infinite cyclic group. Much of this work is joint with Yael Algom-Kfir and Kasra Rafi.

### **Camille Horbez**

#### *Growth under random products of automorphisms of a free group*

Given a nontrivial conjugacy class  $g$  in a free group  $F_N$ , what can we say about the typical growth of  $g$  under application of a random product of automorphisms of  $F_N$ ? I will present a law of large numbers, a central limit theorem and a spectral theorem in this context. Similar results also hold for the growth of simple closed curves on a closed hyperbolic surface, under application of a random product of mapping classes of the surface. This is partly joint work with François Dahmani.

### **Ilya Kapovich**

#### *Endomorphisms, train track maps, and fully irreducible monodromies*

An endomorphism of a finitely generated free group naturally descends to an injective endomorphism on the stable quotient. We establish a geometric incarnation of this fact : an expanding irreducible train track map inducing an endomorphism of the fundamental group determines an expanding irreducible train track representative of the injective endomorphism of the stable quotient. As an application, we prove that the property of having fully irreducible monodromy for a splitting of a hyperbolic free-by-cyclic group  $G$  depends only on the component of the BNS invariant  $\Sigma(G)$  containing the associated homomorphism to the integers. In particular, it follows that if  $G$  is the mapping torus of an atoroidal fully irreducible automorphism of a free group and if the union of  $\Sigma(G)$  and  $\Sigma(G)$  is connected then for every splitting of  $G$  as a (f.g. free)-by-(infinite cyclic) group the monodromy is fully irreducible.

This talk is based on joint work with Spencer Dowdall and Christopher Leininger.

### **François Le Maître**

#### *Full groups, cost, symmetric groups and IRSS*

In this talk, we will first review some of the analogies between full groups of measure-preserving equivalence relations and the symmetric group over the integers, which have been used by A. Eisenmann and Y. Glasner to provide interesting examples of invariant random subgroups (IRSs) of the free group. We will then see how the notion of cost, introduced by G. Levitt, naturally enters this picture. After that, we will explain how a stronger analogy between

full groups and the symmetric group over the integers holds in the type III case. A joint result with A. Kaïchouh which uses this analogy will be presented : full groups of hyperfinite type III equivalence relations have ample generics. This provides a positive answer to a question of A. Kechris and C. Rosendal on the existence of connected Polish group with ample generics.

### **Lars Louder**

*Wise's w-cycle conjecture and homological coherence for one-relator groups*

A two-complex  $X$  has non-positive immersions if, for every immersion  $Y \rightarrow X$ ,  $Y$  compact, either  $\chi(Y) \leq 0$  or  $Y$  has trivial fundamental group. In this talk I'll show that presentation complexes for one-relator groups have non-positive immersions, and, as a corollary, that finitely generated subgroups of one-relator groups have finite second betti numbers. This is joint work with Henry Wilton.

### **Alexandre Martin**

*The cubical geometry of Higman's group*

Higman's group was constructed as the first example of a finitely presented infinite group without non-trivial finite quotients. Despite this pathological behaviour, I will describe striking similarities with mapping class groups of hyperbolic surfaces, outer automorphisms of free groups and special linear groups over the integers. The main object of study will be the cocompact action of the group on a CAT(0) square complex naturally associated to its standard presentation. This action, which turns out to be intrinsic, can be used to explicitly compute the automorphism group and outer automorphism group of the Higman group, and to show that the group is both Hopfian and co-Hopfian. A surprisingly stronger result actually holds : Every non-trivial morphism from the Higman group to itself is an automorphism.

### **Yoav Moriah**

*Nielsen equivalence revisited*

The  $N(G)$  functor defined by Lustig-Moriah to distinguish different Nielsen equivalence classes of generating systems for finitely generated groups will be described and various remaining open problems will be discussed.

### **Anne Parreau**

*Invariant trees and surfaces for some surface groups acting on  $A_2$ -buildings*

We study actions of a punctured surface group on a  $A_2$  euclidean building  $X$ . The main motivation is to understand degenerations of real convex projective structures on surfaces. We introduce a notion of weak convexity for subsets of euclidean buildings. Using Fock-Goncharov generalized shearing parameters associated with an ideal triangulation of the surface, under simple open conditions,

we construct a weakly convex invariant subspace  $Y$  of  $X$ , cocompact under the action. It allows to associate a finite  $A_2$ -complex  $K$  encoding the marked length spectrum. In (open) particular cases  $Y$  is a tree, and  $K$  the quotient graph, or a surface, and  $K$  correspond to a cubic differential on the surface. As an application we describe degenerations of convex projective structures in an open cone of parameters.

### **Zlil Sela**

#### *Word Equations*

We use techniques and constructions from low dimensional topology and from geometric group theory to study sets of solutions to systems of equations (varieties) over a free semigroup.

### **Richard Weidmann**

#### *Nielsen equivalence in a class of random groups*

We show that for every  $n \geq 2$  there exists a torsion-free one-ended word-hyperbolic group  $G$  of rank  $n$  admitting generating  $n$ -tuples  $(a_1, \dots, a_n)$  and  $(b_1, \dots, b_n)$  such that the  $(2n - 1)$ -tuples

$$(a_1, \dots, a_n, \underbrace{1, \dots, 1}_{n-1 \text{ times}}) \text{ and } (b_1, \dots, b_n, \underbrace{1, \dots, 1}_{n-1 \text{ times}})$$

are not Nielsen-equivalent in  $G$ . The group  $G$  is produced via a probabilistic construction.