

**Science Atlantic  
2012 Mathematics, Statistics, and Computer Science  
Conference at Mount Allison University**

**AARMS Session**

**Atlantic Algebra Centre**

Mini conference

*Combinatorial Theory of Groups and  
Hopf Algebras*

***October 14, 2012***

Time: 8:00am – 2:00pm

Room: Avarð Dixon 118

**8:00 – 8:50** ALEXANDER OLSHANSKII (*Vanderbilt University, USA*)

Title: “Bi-Lipschitz embeddings of groups”

Abstract: My talk will be based on recent joint results with Denis Osin. We show that every group  $H$  of at most exponential growth with respect to some left invariant metric admits a bi-Lipschitz embedding into a finitely generated group  $G$  such that  $G$  is amenable (respectively, solvable, satisfies a non-trivial identity, elementary amenable, of finite decomposition complexity, etc.) whenever  $H$  is. The basic definitions will be given. Then we will briefly discuss some applications to subgroup distortion, compression functions of Lipschitz embeddings into uniformly convex Banach spaces, Følner functions, and elementary classes of amenable groups.

**8:55 – 9:45** OLGA KHARLAMPOVICH (*City University of New York, USA*)

Title: “Group actions on trees”

Abstract: I will talk about results extending Bass-Serre theory to  $R$ -trees and arbitrary  $\Lambda$ -trees.

**9:45 – 10:15** *Coffee break*

**10:15 – 11:05** ALEXEI MIASNIKOV (*Stevens Institute, USA*)

Title: "Definable sets in free and hyperbolic groups"

Abstract: I will talk about the structure of definable sets in a free or a torsion-free hyperbolic group  $G$ . Recall, that a subset of  $n$ -tuples in  $G$  is definable if it is the truth set in  $G$  of some first-order formula with  $n$  free variables. In our joint work with Olga Kharlampovich we give a natural description of definable sets in  $G$ , which allows us to solve several old open problems.

**11:10 – 11:40** EDUARDO MARTINEZ-PEDROZA (*Memorial University*)

Title: “Coherence and Negative Sectional Curvature in Complexes of Groups”

Abstract: A group is coherent if finitely generated subgroups are finitely presented. We examine a condition on a simply connected 2-complex  $X$  ensuring that if a group  $G$  acts properly on  $X$  then is coherent. This extends a coherence criterion of D. Wise on free actions on 2-complexes with negative sectional curvature. Our extension of this result involves a generalization of the notion of combinatorial sectional curvature, a version of the combinatorial Gauss-Bonnet theorem to complexes of groups, and requires the use of  $\ell^2$ -Betti numbers. This is joint work with D. Wise of McGill University.

**11:45 – 12:15** MIKHAIL KOTCHETOV (*Memorial University*)

Title: “Applications of Hopf algebras to the study of gradings”

Abstract: The Cartan decomposition of a semisimple Lie algebra with respect to a Cartan subalgebra can be regarded as a grading by a free abelian group (the root lattice). Gradings on Lie algebras by various abelian groups arise in the theory of symmetric spaces, Kac-Moody algebras, and colour Lie superalgebras. In the 1960s, V. Kac classified all gradings by cyclic groups on finite-dimensional simple Lie algebras over complex numbers. We will discuss recent progress in the classification of gradings on simple Lie algebras by arbitrary groups. In particular, we will concentrate on Hopf - algebraic methods that allow us to "transfer" gradings from one algebra to another over an arbitrary field.

**12:15 – 12:45**

*Coffee/pizza break*

**12:45 – 1:05** SHANNON EZZAT (*University of Canterbury, New Zealand*)

Title: “Representation Growth and the Constructive Method”

Abstract: Representation growth is a branch of asymptotic group theory in which groups are studied indirectly by counting its complex irreducible representations. This talk will explore representation growth of finitely generated nilpotent groups and give some results obtained by using a constructive method, as opposed to the more prevalent Kirillov orbit method. This talk is based on the paper “Counting Irreducible Representations of the Heisenberg Group Over the Integers of a Quadratic Number Field” recently submitted for publication.

**1:10 – 1:30** CHARLES PAQUETTE (*University of New Brunswick*)

Title: “Representations of infinite quivers and Auslander-Reiten theory”

Abstract: Let  $k$  be a field and  $Q$  be an infinite (but strongly locally finite) quiver. In this talk, I will describe the Auslander-Reiten theory of the category of finitely presented representations of  $Q$ , and in particular, I will provide a complete description of its Auslander - Reiten quiver. This is joint work with R. Bautista and S. Liu.

**1:35 – 2:00** YURI BAHTURIN (*Memorial University*)  
JONATHAN LOMOND (*Memorial University*)

Title: “Some problems in the theory of group actions”

Abstract: We will discuss the current status of some problems that remained open in the paper Yuri Bahturin and Alexander Olshanskii “*Actions of Maximal Growth*”, Proc. London Math. Soc. **101**(2010), 27 - 72.

## **Participants of the Mini-Conference**

1. Bahturin, Yuri
2. Ezzat, Shannon
3. Gardner, Adam
4. Hanlon, Gaelan
5. Kharlampovich, Olga
6. Kotchetov, Mikhail
7. Lomond, Jonathan
8. Martinez-Pedroza, Eduardo
9. McGraw, Jason
10. Miasnikov, Alexei
11. Olshanskii, Alexander
12. Paquette, Charles
13. Parsons, Nicholas
14. Shaqhaqa, Shadi
15. Sullivan, Matthew
16. Sütlü, Serkan
17. Usefi, Hamid