Abstracts

Contents

Jacques Audibert *Max-Planck-Institute for Mathematics in the Sciences, Germany* 2
Emmanuel Breuillard Oxford University, UK 3
Nic Brody *University of California, Santa Cruz, USA* 4
Alla Detinko *University of Huddersfield, UK* 5
Alexander Hulpke *Colorado State University, USA* 6
Sang-hyun Kim *Korea Institute for Advanced Study, Korea* 7
Alex Kontorovich *Rutgers University, USA* 8
Emmanuel Kowalski *ETH Zürich, Switzerland* 9
Gaven Martin Massey *University, New Zealand* 10
Chen Meiri Technion – *Israel institute of Technology, Israel* 11
Andrei Rapinchuk *University of Virginia, USA* 12
Jeroen Schillewaert *University of Auckland, New Zealand* 13
Stephan Tornier *Uzbekistan* 14
Anne Thomas *University of Sydney, Australia* 15
N.Venkataramana *Tata Institute of Fundamental Research, India* 16

Jacques Audibert
Max-Planck-Institute for Mathematics in the Sciences, Germany

Constructing thin surface subgroups via Hitchin representations

It follows from the Tits alternative that higher rank lattices contain thin subgroups which are free. In this talk, we present a construction of thin subgroups that are isomorphic to surface groups. It relies on the theory of the Hitchin component, a connected component of the space of representations of a surface group in SL(n,R). This component has attracted a lot of attention recently, due to the fact that all its representations are injective and discrete. To construct Hitchin representations with images in higher rank lattices, we study how the irreducible embedding of SL(2,R) in SL(n,R) intertwines arithmetic groups and use the Strong Approximation theorem to distinguish mapping class group orbits of representations.

Back to Contents Page →

Emmanuel Breuillard
Oxford University, UK

Random character varieties

I will report on an attempt to understand the character variety of a "generic" finitely presented group with values in SL(2,C) or any given semisimple Lie group G. In our model the number of generators and the group G is fixed but the length of relators is allowed to grow. This raises questions of effective algebraic geometry and computational algebra. The most interesting case is when the defect of the presentation is equal to one as this leads to new examples of thin groups. The proofs are based on a sieve argument and rely in part of GRH. Work in progress with P. Varju and with O. Becker.

Back to Contents Page →

Nic Brody
University of California, Santa Cruz, USA

Rational Fuchsian groups

We will study general properties of Fuchsian groups contained in PSL(2,Q), and describe a construction of closed surface groups in

PSL(2,Z[1/p]) for each prime p. We'll discuss a condition under which such groups are coarsely maximal, and discuss higher dimensional examples.

Back to Contents Page →

Alla Detinko
University of Huddersfield, UK

Zariski density and algorithms for linear groups

We survey our novel methods and algorithms for practical computation with finitely generated linear groups over infinite domains. Special consideration is given to techniques exploiting properties of Zariski dense subgroups. We present applications of our algorithms to computer-aided experimentation with thin matrix groups. This is joint work with Dane Flannery and Alexander Hulpke.

Back to Contents Page →

Alexander Hulpke
Colorado State University, USA

Computing with Congruence Images

I will describe how the interplay of work in congruence images and of presentations can be used to investigate subgroups of arithmetic groups, in particular concerning the question whether the index is finite. The algorithms involved are primarily standard tools for finitely presented groups, as well as modern tools for working with matrix groups. This concerns both theoretical aspects and concrete calculations. Work is joint with Alla Detinko (Huddersfield) and Dane Flannery (Galway).

Back to Contents Page →

Sang-hyun Kim
Korea Institute for Advanced Study, Korea

Non-freeness of certain two-parabolic groups

For each positive rational number q, we study the (non-)freeness of the group G(q) generated by 2x2 matrices a = ((1,0), (1,1)) and b = ((1,q), (0,1)) in SL(2,Q). We give a computational criterion which allows us to prove that if q=s/r for s≤27 then G(q) is non-free, with the possible exception of s=24. In this latter case, we prove that the set of positive integers r for which G(24/r) is non-free has natural density 1. In the course of the proof, it will follow that for a fixed s, there are arbitrarily long sequences of consecutive denominators r such that G_(s/r) is non-free. (Joint work with Thomas Koberda).

Back to Contents Page →

Alex Kontorovich
Rutgers University, USA

Applications of Thin Orbits

We will discuss some recent advances in the theory of local-global principles in orbits, as well as applications to combinatorial graph theory, polygonal billiards, and number theory.

Back to Contents Page →

Emmanuel Kowalski
ETH Zürich, Switzerland

The sieve in discrete groups

This talk will be a survey of the key ideas involved in applying sieve methods to discrete groups, and of some of the applications of these ideas. Both "small sieve" and "large sieve" aspects will be explained, and the focus will lie in particular on thin groups, and on effective and quantitative aspects.

Back to Contents Page →

Gaven Martin
Massey University, New Zealand

The thin Heckoid groups

It is conjectured that there are finitely many rank-two thin subgroups of PSL(2,C) = $Isom^+(H^3)$ which do not split as a free product. A Heckoid group is a discrete subgroup of PSL(2,C) generated by two elements of finite order (or parabolic) which does not split as a free product. We show that there are only finitely many thin Heckoid groups -in fact there are surprisingly few [there are none in PSL(2,R)]. We give a (nearly complete) enumeration of all such groups and their presentations. This work builds on earlier work with C. Maclachlan and more recent work with A.Elzenaar and J. Schillewaert.

Back to Contents Page →

Chen Meiri
Technion – Israel institute of Technology, Israel

Problems of Waring type in arithmetic groups

The research concerning problems of Waring type is a well-established line of research in Number Theory. Analogous questions in Group Theory were studied in many families of groups, e.g., finite groups, finite simple groups and hyperbolic groups. The focus of this talk will be on Waring type problems in higher rank arithmetic groups and recent progress therein.

Back to Contents Page →

Andrei Rapinchuk
University of Virginia, USA

Groups with bounded generation

A group is said to have *bounded generation* (BG) if it is a finite product of cyclic subgroups. While such groups are known to have quite remarkable properties, proving bounded generation is a difficult problem. Conjecturally, all higher rank S-arithmetic subgroups of simple *isotropic* linear algebraic groups over number fields have (BG), and we will discuss some results in this direction. However, even in the cases where (BG) is known, there are interesting open questions about finding a bounded length factorization for a given element efficiently. On the other hand, a linear group over a field of positive characteristic has (BG) if and only if it is virtually abelian, so in this case one should modify the original question and ask about bounded generation of standard groups over arithmetic rings by elementary subgroups. We will report on a recent result concerning bounded generation of SL_2 by elementary matrices over the coordinate rings of affine curves defined over finite fields provided that the ring has infinitely many units. Finally, we will discuss another recent result stating that non-virtually abelian *anisotropic* linear groups (i.e. those consisting entirely of semi-simple elements) over fields of characteristic zero do not have (BG), and outline how techniques involved in the proof may lead to a classification of boundedly generated linear groups.

Back to Contents Page →

Jeroen Schillewaert
University of Auckland, New Zealand

Discrete two-generator subgroups of over non-archimedean local fields

Let *K* be a non-archimedean local field whose residue field has characteristic *p* >5 if K has characteristic 0. We give necessary and sufficient conditions for a two-generator subgroup *G* of to be discrete, and we give a practical algorithm to decide whether such a subgroup *G* is discrete. We also give practical algorithms to decide whether a two-generator subgroup *G* of either or (where = 0) is dense. Crucial for this work is a structure theorem for two-generator groups acting by isometries on a Λtree.

This is joint work with Matthew Conder.

Back to Contents Page →

Stephan Tornier
University of Newcastle, Australia

Recent developments in groups acting on trees

Groups acting on trees play an important role in the general theory of locally compact groups for both theoretical and practical reasons. In hindsight, many recent results can be motivated by asking which of them are determined by their action on balls of a given radius k∈N around vertices, so called (P_k) closed groups. We provide examples of (P_k) closed groups and survey recent advances, including ReidSmith's elegant parametrisation of (P_1)-closed groups using graph-based combinatorial structures known as local action diagrams. As an illustration, we discuss joint work with Marcus Chijoffof - both computational and theoretical nature – characterising discreteness among (P_1)-closed groups.

Back to Contents Page →

Anne Thomas
University of Sydney, Australia

The geometry of conjugation in Euclidean isometry groups

We give a simple and beautiful description of the geometry of conjugation within any split subgroup H of the full isometry group G of Euclidean space. We prove that for any h in H, the conjugacy class [h] is described geometrically by the move-set of its linearisation, while the set of elements conjugating h to a given h' in [h] is described by the fix-set of its linearisation. Examples include affine Coxeter groups, where we give finer results, certain crystallographic groups, and the group G itself. This is joint work with Elizabeth Milićević and Petra Schwer.

Back to Contents Page →

N. Venkataramana
Tata Institute of Fundamental Research, India

A question of Grothendieck on integral linear groups

Given a finitely generated subgroup Γ of $SL_n(\mathbb{Z})$, Grothendieck considered the category of integral representations of Γ (i.e. those of the form $\rho : \Gamma \to GL_m(\mathbb{Z})$ for varying m and ρ) and asked whether Γ can be recovered from these representations. In a joint work with Alex Lubotzky, we show that this is possible if and only if Γ is an arithmetic group satisfying the congruence subgroup property.

Using the method of proof, an abstract criterion for a subgroup $\Gamma \subset SL_n(\mathbb{Z})$ to be a thin group can be obtained.

Back to Contents Page →