Abstracts

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Debattam Das
IISER Mohali, Panjab, India

Combinatorial Growth of Reciprocal Geodesics in Hecke Groups

A geodesic in a hyperbolic orbifold is said to be `reciprocal' if it passes through at least one even ordered cone point. These geodesics correspond to conjugacy classes of reciprocal elements. First, we classify the reciprocal geodesics in the Hecke groups; then, we study the growth of the reciprocal geodesics in terms of word lengths on the hyperbolic orbifolds associated with Hecke groups. In particular, we have completed the results of Marmolejo for the even cases of Hecke groups. Furthermore, we generalize the relation between the low-lying words and geodesic with an excursion of the modular group to Hecke groups.

This is joint work with Dr. Krishnendu Gondopadhyay.

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Elias Dubno
University of Zurich, Switzerland

Zaremba's Conjecture for Geometric Sequences.

There are only a handful of explicit sequences known to satisfy the strong version of Zaremba's conjecture, all of which were obtained using essentially the same algorithm. In this talk, we discuss a refined algorithm using the folding lemma for continued fractions, which both generalizes and improves on the old one.

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Manisha Garg
University of Illinois Urbana Champaign, USA

Computational methods in search of units and zero-divisors of torsion-free group rings

In 1956-1957 Kaplansky presented a list of several questions about group rings FG, where F is a field and G is a group. Two of those questions are:

1. The unit conjecture: For any torsion-free group G and any a, b in FG, does ab = 1 imply that a and b are trivial units. This was answered by Gardam in 2021.

2. The zero-divisor conjecture: For any torsion-free group G and any a, b in FG, does ab = 0 imply that a and b are trivial zero-divisors.

In this talk we present a computational approach we employed in search of nontrivial units and zero divisors in a torsion-free group ring. We discuss an algorithm to find product structures satisfying various combinatorial conditions arising from the geometry of the units and the zero-divisors. Our goal is to find examples satisfying the combinatorial conditions which would provide multiple examples of groups with nontrivial units and zero-divisors. We will, moreover, discuss the implications of a negative computational result which would also be of interest from a geometric point of view.

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Mikko Korhonen
Southern University of Science and Technology, China

Maximal Solvable Subgroups

A subgroup of a group G is said to be maximal solvable if it is maximal among the solvable subgroups of G. In his 1870 Traité, Jordan gave a classification of the maximal solvable subgroups of symmetric groups.

The classification reduces to the primitive case, which is equivalent to the problem of classifying maximal irreducible solvable subgroups of GL(d,p), where p is a prime. In GL(d,p), the problem is reduced to the case of primitive irreducible solvable subgroups. These subgroups are then constructed in terms of maximal irreducible solvable subgroups of general symplectic groups GSp(2k,r) (r prime) and orthogonal groups O^±(2k,2).

In this talk, we will discuss Jordan's classification in modern terms. More generally, we consider the complete classification of maximal irreducible solvable subgroups of classical groups such as GL(n,q), GSp(n,q), and GO(n,q), where q is a power of a prime. We will also discuss the analogous problem for linear algebraic groups over algebraically closed fields.

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Khanh Le
Rice University, USA

Periodic order-preserving outer automorphisms of free and surface groups

A group is bi-orderable if it admits a total ordering that is conjugation invariant. Given a bi-orderable group G, it is natural to ask which outer automorphisms of G preserve a bi-ordering on G. In this talk, I will give a complete characterization of finite subgroups of outer automorphisms of non-abelian free and surface groups that are order-preserving. I will explain how this result directly generalizes the work of Kin and Rolfsen on order-preserving periodic braids and is related to the classification of bi-orderable Seifert fibred space by Boyer, Rolfsen and Wiest. This is a work in progress joint with Jonathan Johnson

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Ricky Lee
McGill University, USA

Strong density and hyperbolic geometry

A subgroup H of an algebraic group G is said to be strongly dense if every pair of non-commuting elements in H generates a Zariski dense subgroup of G. The existence of free strongly dense subgroups in various settings was established by Breuillard, Green, Guralnick, and Tao in 2012, and many surprising applications were given. But they remarked that it remains challenging to determine which Zariski dense subgroups contain strongly dense free groups.

Recently, there have been many improvements in our understanding of the strongly dense subgroup structure of SL(n,R) coming from hyperbolic geometry. We will talk about such developments, and introduce a new example of a hyperbolic 3-manifold group admitting strongly dense embeddings into SL(4,R).

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Chandan Maity
IISER Berhampur, India

Title: Lower dimensional Betti numbers of homogeneous spaces of Lie groups

We will discuss certain explicit descriptions of lower dimensional Betti numbers of homogeneous spaces of Lie groups. We derive an equivariant version of Cartan's theorem and apply it to describe the cohomology of homogeneous spaces. In particular, as an application, we got an interesting invariant of compact homogeneous space in terms of the number of simple factors in the ambient group and its associated closed subgroup. The talk is based on a joint work with I. Biswas and P. Chatterjee.

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Ari Markowitz
University of Auckland, New Zealand

Recognition and constructive membership for discrete finitely generated subgroups of SL(2, R).

We present an algorithm to decide whether a finitely generated subgroup of SL(2, R) is discrete. Additionally, we solve the constructive membership problem for discrete finitely generated subgroups of SL(2, R).

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Rogelio Niño Hernandez
Center of Mathematical Sciences, UNAM, Mexico

Arithmetic Kontsevich-Zorich monodromies of origamis

I will present some examples of arithmetic groups in the sense of Sarnak in the context of translation surfaces. In particular, the so called Konsevich-Zorich monodromies of certain origamis.

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James Rickards
University of Colorado Boulder, USA

The not-so-local-global conjecture

I will introduce Apollonian circle packings, and describe the local-global conjecture, which predicts the set of curvatures of circles occurring in a packing. I will then describe reciprocity obstructions, a phenomenon rooted in reciprocity laws (for instance, quadratic reciprocity), that disproves the conjecture in most cases. I will also describe follow-up work, where we find a similar phenomenon in a thin semigroup related to Zaremba's conjecture.

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Shashank Vikram Singh
IISER Mohali, Panjab, India

Thinness of some symplectic hypergeometric groups of rank three.

In this talk, I will focus on a particular group generated by the companion matrices of the polynomials (x-1)^6 and (x+1)^6. The group is the Zariski dense subgroup of a symplectic group. By applying ping-pong lemma, we prove the thinness of the group by computation. We will see some more hypergeometric groups of rank three that are thin. The method used to establish the thinness demonstrates that the specific process of Brav and Thomas works in higher dimensions with slight changes.

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Adem Zeghib
University of Grenoble Alpes, France

On the conjugacy problem in integral classical groups.

In this talk, we will consider rational square matrices whose minimal and characteristic polynomials coincide. For such matrices, we will introduce a new approach towards solving the conjugacy problem under the action of the integral symplectic group and other classical groups. This algorithm builds upon a solution to the conjugacy problem within GL(m,Z) and its associated centralizer calculations.

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Yongquan Zhang
Stony Brook University, USA

Combinatorial rigidity of circle packing limit sets

There is, up to Möbius transformations, a unique Apollonian circle packing, which arises as the limit set of a thin Kleinian group. In this talk, I will describe a generalization of this simple fact to any Kleinian group whose limit set is an infinite circle packing with connected nerve, based on a joint work with Y. Luo. Our result also produces a sequence of finite circle packings converging to the infinite one exponentially fast, suggesting a way to draw it efficiently based only on combinatorial information.

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Michael Zshornack
University of California, Santa Barbara, USA

Subarithmetic convex projective structures and computations.

The SL(3,R)-Hitchin component of a cocompact Fuchsian group is a deformation space parameterizing convex projective structures on the underlying orbifold. We'll indicate some questions about the representations on these components which are ubarithmetic, and provide a few indications on what can be said in the presence of some computational tools.

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Tejbir
Indian Institute of Technology Kanpur, India

Reversibility in special linear groups

Reversible elements in a group are those elements that are conjugate to their own inverses. These elements are also known as 'real' or 'reciprocal' elements in the literature. They are closely related to strongly reversible elements, which can be expressed as a product of two involutions. Such elements naturally appear in various areas, such as group theory, representation theory, geometry, complex analysis, functional equations, and classical dynamics. It has been a problem of broad interest to find the equivalence of these notions and to classify such elements in a group. Despite many works, a complete classification of the reversible and strongly reversible elements is not known for many families of groups. In this talk, we will classify the reversible and strongly reversible elements in the complex special linear group, quaternionic special linear group, and quaternionic projective linear group.

This is a joint work with Krishnendu Gongopadhyay and Chandan Maity.

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