OHALO WORKSHOP ON GROUP ACTIONS, GEOMETRY AND DYNAMICS

July 10 − 15, 2022 at Ohalo, Israel

Minicourses

1. Yair Hartman (Ben Gurion University)

Title: Furstenberg's Boundary Theories.
During the 60's and the 70's Furstenberg developed two theories regarding boundaries of groups. One is in terms of topological dynamics, and the other is known as the Furstenberg-Poisson boundary and is related to random walks on groups. The research of these two theories and their connections with rigidity theory and operator algebra theory is still very active. In the lectures, we will define and set the basics of these objects, sketch some of the recent applications, and some open problems.

2. Nir Lazarovich (Technion)

Title: Hyperbolic 3-manifolds.

The goal of this mini-course is to present various constructions of hyperbolic 3-manifold, using algebraic, topological, combinatorial and geometric tools. We will cover Mostow Rigidity, Poincaré's Polyhedron Theorem, Thurston's Hyperbolization Theorem, Thurston's hyperbolic Dehn surgery theorem, and hyperbolic knot complements.

3. Doron Puder (Tel Aviv University)

Title: Free groups, surfaces and linear programming.

The mini-course will revolve around several related invariants of words in free groups: commutator length, primitivity rank, and their stable versions. These invariants can be defined both algebraically and geometrically, and they are related to bounded cohomology and quasi-morphisms, properties of one-relator groups, word measures on groups and more. Some of the main results regarding these invariants are due to Calegari and Louder-Wilton, and a surprising role in the arguments is played by linear programming.

My plan is to introduce these invariants, explain the connection between them, sketch some proofs and present numerous open questions.

4. Uri Shapira (Technion)

Title: Dynamical manifestations of semisimplicity.
The aim of the mini-course is to survey instances where the group theoretic structure of a group has far-reaching implications on the way it acts on certain spaces. More concretely, we will try to show how the semisimplicity of a Lie group manifests dynamically. I will focus on the following: (1) Howe-Moore decay of matrix coefficients and some applications, (2) Positivity of Lyapunov exponents and some of its implications.

Research talks

5. Mahbub Alam

Rogers' moment formulae on the homogeneous space of affine lattices
In the '50s Rogers proved higher moment formulae for Siegel transforms on the homogeneous space of unimodular lattices in $\mathbb{R}^n$, extending the first-moment formula by Siegel. These moments allowed Rogers to conclude much more about the number of lattice points in a bounded set in $\mathbb{R}^n$ than what was known at the time. His prime application was sphere packing - using these formulae Schmidt (1956) proved a lower bound on the sphere packing density that is $O(n)$ as $n \to \infty$, a record which still stands.

In this talk, we will discuss a Rogers-type result on the homogeneous space of affine lattices, with applications to diophantine approximation with congruent conditions and a CLT for the number of (affine) lattice points in a set.

6. Reynold Fregoli

Randomenss and quantitative aspects of the Littlewood conjecture
In this talk, we will discuss an extension of a well-known work of Wolfgang Schmidt to the context of Littlewood's Conjecture, and, more broadly, to the multiplicative setting in the theory of Diophantine approximation. In particular, we will prove almost-everywhere counting estimates for Littlewood-type products, as well as a central limit theorem for multiplicative approximants. Our approach is based on a new powerful equidistribution result for certain subgroups of the diagonal group on intermediate manifolds in the moduli space. This is part of a joint work with Alexander Gorodnik and Michael Bjoerklund.

7. Daniele Garzoni

The group large sieve method and Hilbert's irreducibility theorem

Let G be a finitely generated group, and let Z be a subset of G. Assume we want to prove that Z is small. One way to do this is to show that a random walker on a Cayley graph of G is almost never in Z.

The group large sieve method, introduced by Kowalski and Lubotzky–Meiri, gives a way of doing this, provided G has many finite quotients satisfying certain properties.

We will review this method and an extension of it. We will then see an application that gives a quantitative version of Hilbert's irreducibility theorem for linear algebraic groups over the rationals, obtained in joint work with Lior Bary-Soroker.

8. Maria Gerasimova

Harmonic functions with gradient converging to zero at infinity

For which finitely generated groups does there exist a non-constant harmonic function with gradient converging to zero at infinity? We will see some positive and negative examples and discuss the connection of this question to the group cohomology. All notions will be explained during the talk. Joint work with Gidi Amir and Gady Kozma.

9. Gil Goffer

Compact IRS and compact URS

In 2016, Bader, Duchesne, and Lecureux proved that an amenable Invariant Random Subgroup must be contained in an amenable normal subgroup. Is the same true if we replace amenability by compactness? And what if we consider Uniformly Recurrent Subgroups instead of Invariant Random Subgroups? In the talk I will give a short introduction on IRS and URS and address these questions, presenting results from joint projects with Pierre-Emmanuel Caprace, Waltraud Lederle and Tal Cohen.

10. Izhar Oppenheim

Relative property (T) of the unitriangular group in SL_3

We introduce a new (very elementary) technique for showing that the unitriangular group in SL_3 has relative (Banach) property (T). Coupled with a bounded generation argument, this implies (Banach) property (T) for SL_3. All notions will be explained and no prior knowledge is assumed.