

Workshop 1 - Operator Algebras: Groups and Dynamics

Operator Algebras: Approximation, Rigidity and Dynamics

28 September – 2 October 2026, IHP

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MONDAY 28	TUESDAY 29	WEDNESDAY 30	THURSDAY 1	FRIDAY 2
Uri Bader	Emmanuel Breuillard	P.-E. Caprace	Waltraud Lederle	Fanny Kassel
Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
Simon Machado	Tianyi Zheng	Denis Osin	Mehrdad Kalantar	David Fisher
Lunch	Lunch	Shirley Geffen	Lunch	Lunch
Adrian Ioana	Yehuda Shalom		Sven Raum	
Coffee break	Coffee break		Coffee break	
Ursula Hamenstädt	Goul'nara Arzhantseva		Itamar Vigdorovich	
Hanna Oppelmayer	Corentin Le Bars		Arie Levit	
	Cocktail			

Scientific committee

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University of Oslo

MAGDALENA MUSAT
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Abstracts of the talks

Goulmara Arzhantseva

University of Vienna, Austria

SIMPLE AND SELFLESS REDUCED GROUP C^* -ALGEBRAS

Tuesday, 29 September / 15:15–16:00

We discuss classical and recent examples of finitely generated groups whose reduced C^* -algebras are simple and selfless, and highlight a number of open questions.

Uri Bader

University of Maryland, US

HOW TO GET INFECTED WITH L^p -COHOMOLOGY AND HOW TO CURE IT?

Monday, 28 September / 10:00–10:45

The L^p -cohomology of a Riemannian manifold describes its geometry at infinity and could be non-trivial even for contractible manifolds, e.g. non-compact symmetric spaces. By a fundamental work of Pansu and a subsequent work of Bourdon-Remy, the cases of real and complex hyperbolic spaces are rather well understood, but the general case is yet out of reach. On another mathematical planet, Vogan and Zuckerman gave a satisfactory theory explaining the cohomology of irreducible unitary representations of semisimple groups. After introducing these subjects, I will draw a speculative picture aiming to completely explain the former geometric picture by means of the latter algebraic picture and the analysis of matrix coefficients. Based on a joint project with Michael Glasner and Yuval Gorfine.

Emmanuel Breuillard

Oxford University, UK

EXPANDER CAYLEY GRAPHS AND NON-ABELIAN LITTLEWOOD-OFFORD

Tuesday, 28 October / 10:00–10:45

I will discuss a new non-abelian version of the Littlewood-Offord theorem regarding products of independent matrix valued random variables and their concentration on algebraic sets. We obtain uniform exponential bounds that lead to uniform spectral gaps for actions of linear groups as well as sharp estimates for the "escape from subvarieties phenomenon". Although our bounds hold for matrices over the complex numbers, their proof requires an adelic input and the consideration of diophantine heights (height gap). We will then show how these new bounds can be used to prove that finite simple groups of Lie type of bounded rank have uniform expansion, except possibly for a small exceptional subfamily, improving on earlier works with Gamburd, Green, Guralnick, Tao and myself. This is joint work with Oren Becker.

Pierre-Emmanuel Caprace

Université Catholique de Louvain, Belgium

MIXING VERSUS AMENABILITY FOR UNITARY REPRESENTATIONS OF GROUPS ACTING ON BUILDINGS

Wednesday, 30 September / 09:30–10:15

This talk, based on joint work with Andreas Thom, concerns the unitary representations of locally compact groups acting properly and strongly transitively on locally finite buildings of arbitrary type. I will explain that such a representation is mixing unless its restriction to some parabolic subgroup is amenable. Several consequences will be discussed, among which the IRS rigidity of certain Kac-Moody groups of compact hyperbolic type. This establishes the existence of finitely presented infinite Kazhdan groups with exactly two ergodic invariant random subgroups.

David Fisher

Rice University, US

DENSE SUBGROUPS OF COMPACT GROUPS: TWO VIGNETTES

Friday, 2 October / 11:15–12:00

I will talk about two loosely related results about dense subgroups of compact groups, one with Sven Sandfeldt, the other with Michael Larsen. The first concerns local rigidity of group actions, the second spectral gaps. I hope to explain some questions that arise in this context and invite people to think about them.

Shirly Geffen

University of Münster, Germany

STABLE RANK ONE IN NONNUCLEAR C^* -ALGEBRAS

Thursday, 1 October / 10:00–10:45

I will talk about stable rank one, that is, the density of invertible elements in a C^* -algebra. For commutative C^* -algebras, this property occurs precisely in topological dimension zero or one, and can therefore be interpreted as a notion of noncommutative low dimensionality.

Stable rank one guarantees more accessible computations of K-theory and other C^* -algebraic invariants. The space $\text{Act}(G, X)$ of actions of a countable group G on the Cantor set X by homeomorphisms carries a natural Polish topology, making it amenable to methods from Baire category theory. By restricting to suitable Polish subspaces of $\text{Act}(G, X)$, we investigate situations in which stable rank one occurs generically, that is, on a dense G_δ subset, for the associated crossed product C^* -algebras.

Ursula Hamenstädt

Universität Bonn, Germany

MIXING AND COUNTING IN RELATIVELY HYPERBOLIC GROUPS

Monday, 28 September / 15:15–16:00

A group which is hyperbolic relative to a finite collection of amenable subgroups admits interesting actions on hyperbolic spaces. We show that under some mild condition on the action, elements of bounded translation lengths can be asymptotically counted. This relies on the action on what we call a universal boundary of the group and the study of invariant measure classes arising from random walks. Time permitting, we discuss some applications to ergodic properties of Cannon Thurston maps, meant in a very broad sense.

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Adrian Ioana

UC San Diego, US

RIGIDITY FOR GRAPH PRODUCT VON NEUMANN ALGEBRAS

Monday, 28 September / 14:00–14:45

I will present joint work with Camille Horbez in which we prove rigidity theorems for graph product von Neumann algebras M_Γ associated with finite graphs Γ and collections of tracial “vertex” von Neumann algebras $(M_v)_{v \in \Gamma}$. For diffuse, diffuse amenable, or II_1 factor vertex algebras, we identify broad classes of graphs for which any isomorphism $M_\Gamma \cong N_\Lambda$ forces the underlying graphs to be isomorphic, together with strong intertwining or even unitary conjugacy between the corresponding vertex algebras. These results yield a wide range of applications to the classification of graph product von Neumann algebras and the computation of their symmetry groups, including classification theorems for von Neumann algebras of right-angled Artin groups and graph products of ICC groups, new families of II_1 factors with trivial fundamental group, and computations of outer automorphism groups.

Mehrdad Kalantar

University of Oxford, UK

ON INVARIANT RANDOM SUBGROUPS OF C^* -SIMPLE GROUPS

Wednesday, September / 10:45–11:30

A discrete group G is called C^* -simple if its reduced C^* -algebra is simple, and it is said to have the unique trace property if its reduced C^* -algebra has a unique trace. Both of these properties pass to normal subgroups, and in this talk we discuss extensions of these inheritance properties to dynamical generalizations of normal subgroups, namely, invariant and stationary random subgroups (IRSs and SRSs), and uniformly recurrent subgroups (URSs). This is based on joint works with Tattwamasi Amrutam and Yair Hartman.

Fanny Kassel

Institut des Hautes Études Scientifiques, France

ANOSOV REPRESENTATIONS AND COMPACT QUOTIENTS

Tuesday, 29 September / 15:15–16:00

Anosov representations are representations of Gromov hyperbolic groups into noncompact semisimple Lie groups G (such as $\text{SL}(n, \mathbb{R})$) with good dynamical properties. Their images are discrete subgroups of G which, in higher rank, have infinite covolume and are much more flexible than lattices. I will explain how Anosov representations can be used to address a geometric problem: given a homogeneous space G/H , does there exist a discrete subgroup Γ of G such that $\Gamma \backslash G/H$ is a compact manifold? This is joint work with Nicolas Tholozan and Yosuke Morita.

Corentin Le Bars

École Normale Supérieure PSL, France

CHARMENABILITY OF TWIN BUILDING LATTICES

Tuesday, 29 September / 16:15–17:00

This talk will be about finitely generated groups that embed as lattices in a product $G_+ \times G_-$ of two automorphism groups of non-positively curved buildings that are twinned. When the buildings are hyperbolic, these lattices can combine features usually associated with higher-rank groups, such as property (T) and superrigidity phenomena, with interesting non-linear behavior. For instance, some of them are simple.

We will see that a family of these groups are charfinite. This notion was introduced by Bader, Boutonnet, Houdayer and Peterson and gives remarkable rigidity properties for unitary representations and for the stabilizer structure of measurable and topological actions. In particular, the lattices under consideration are character rigid.

An important ingredient in the proof is a recent result of Caprace and Thom showing that, under suitable assumptions, the topological completions G_+ and G_- have the Howe–Moore property. I will introduce these notions, describe twin-building lattices, and explain some of the main ideas of the proof. This is joint work with C. Houdayer.

Waltraud Lederle

Universität Bielefeld, Germany

BOOMERANG SUBGROUPS, SCHREIER GRAPHS AND AVOIDING INVARIANT MEASURES

Wednesday, 30 September / 11:30–12:15

Boomerang subgroups, introduced in joint work with Yair Glasner, are subgroups (of a countable group) that are recurrent points in the Chabauty space for the action of each group element separately. The motivation behind has been that, given any invariant random subgroup (IRS), almost every subgroup is a boomerang; and consequently we like to think of them as "deterministic instances of IRSs". In many lattices of high rank, this is accurate. This talk focuses on various aspects in which this is not true in the free group.

Based on joint work with Glasner and Hartnick, and Bontemps and Kalma.

Arie Levit

Tel Aviv University, Israel

**INVARIANT RANDOM SUBGROUPS OF THE FINITARY SPECIAL LINEAR
GROUP OVER A FINITE FIELD**

Thursday, 1 October / 16:15–17:00

The finitary special linear group $SL(F)$ over a finite field F consists of all unit-determinant infinite matrices equal to the identity at almost all entries. Skudlarek (76) has classified the characters of $SL(F)$. Motivated by this, we classify the invariant random subgroups of $SL(F)$. There are countably many characters and the Vershik map from ergodic IRS to characters turns out to be finite-to-one and surjective. The proof relies on the fact that $SL(F)$ admits many embedded copies of the finitary alternating group as permutation matrices, and on the classifications of the characters and IRS of the latter group by Thoma (64) and Vershik (12), respectively. We also employ ergodic theory and the theory of finite linear groups. The talk is based on a recent work joint with Noam Atar.

Simon Machado

Laboratoire de Mathématiques d'Orsay, France

QUANTITATIVE GROWTH OF THE INJECTIVITY RADIUS

Monday, 28 September / 11:15–12:00

In this talk, we will discuss the following question: how does the volume of a locally symmetric space constrain the distribution of its injectivity radius?

Let $Y = K \backslash G / \Gamma$, where G is a simple Lie group of real rank at least two and Γ is a discrete subgroup. We prove a quantitative alternative, valid for all $V > 0$: (i) either Y has volume at most V , (ii) or a point sampled from a time-averaged heat distribution on Y has injectivity radius at least $r(V)$ with probability at least $1 - \epsilon(V)$.

The functions $r(V)$ and $\epsilon(V)$ are explicit, with $r(V) \rightarrow \infty$ and $\epsilon(V) \rightarrow 0$ as $V \rightarrow \infty$.

For infinite-volume quotients, this quantifies the theorem of Frączyk–Gelander on unbounded injectivity radius, giving rates for both the growth of the maximal injectivity radius on expanding balls and the concentration of heat mass in thick regions. For finite-volume quotients, this gives a quantitative rate of Benjamini–Schramm convergence to the symmetric space for finite-volume quotients, without additional arithmetic assumptions on the lattice.

The main input is a quantitative version of the Nevo–Zimmer theorem for almost stationary measures. We will outline this result and discuss the entropy arguments and growth estimates in simple Lie groups underlying the proof.

This talk is based on joint work with Ilya Gekhtman, Omri Solan and Yuval Yifrach.

Hanna Oppelmayer

University of Innsbruck, Austria

RANDOM SUBALGEBRAS

Monday, 28 September / 16:15–17:00

Invariant random subgroups (IRS) are a well-studied concept in dynamics with interesting applications. I will explain how this can be generalised to an operator algebraic setting. This is based on two works: For von Neumann algebras, this is a joint work with Tattwamasi Amrutam and Yair Hartman. For C^* -algebras, this is ongoing work with Pierre Fima and Leyan Tao. I will give a gentle introduction to both works. Our applications concern amenability (injectivity, nuclearity) and simplicity.

Denis Osin

Vanderbilt University, US

A PARADOXICAL ROUTE FROM HYPERBOLIC GEOMETRY TO PROPER PROXIMALITY

Thursday, 1 October / 11:15–12:00

For every integer $n \geq 2$, we introduce a new combinatorial condition $PP(n)$ inspired by paradoxical decompositions of groups. As n increases, the property $PP(n)$ weakens, and the resulting hierarchy interpolates between group-theoretic manifestations of negative curvature and proper proximality. More precisely, we prove that a countable group is properly proximal if and only if it satisfies $PP(n)$ for some n . On the other hand, every acylindrically hyperbolic group satisfies $PP(2)$; furthermore, finitely generated $PP(2)$ -groups admit a geometric characterization: they are precisely the groups containing strongly quasi-convex, non-cyclic, free subgroups. In particular, we obtain that every countable acylindrically hyperbolic group is properly proximal. Finally, for every $n \in \mathbb{N}$, we provide examples of finitely generated properly proximal groups that do not satisfy $PP(n)$, thus showing that our hierarchy is indeed infinite. The talk is based on joint work with K. Toyosawa and Z. Yang.

Sven Raum

University of Potsdam, Germany

**K -THEORY AND DELOCALISED TRACES OF RIGHT-ANGLED HECKE
 C^* -ALGEBRAS**

Thursday, 1 October / 14:00–14:45

For every Coxeter group, a classical construction provides a continuous family of complex C^* -algebras deforming its group algebra. These are called Iwahori–Hecke algebras. At certain parameters, they arise as double-coset Hecke algebras of totally disconnected groups. Their completions to Hecke C^* -algebras form an interesting class of examples for developing structure and classification results for non-amenable C^* -algebras. For right-angled Coxeter types, there have been significant advances on this problem.

In this talk, I will focus on the classification aspect, reporting on K -theory calculations and on a computation of the pairing with delocalised traces for right-angled Hecke C^* -algebras. This yields partial classification results. As an important intermediate step, we obtain Schwartz subalgebras inside Hecke C^* -algebras of hyperbolic, right-angled type.

This talk is based on joint works with Piotr Nowak, Sanaz Pooya, and Adam Skalski.

Yehuda Shalom

Tel Aviv University, Israel

PROGRESS ON THE MARGULIS-ZIMMER CONJECTURE

Tuesday, 29 September / 14:00–14:45

The Margulis-Zimmer conjecture predicts that the only subgroups commensurated by S-arithmetic groups are the “obvious ones”, arising from sub-arithmetic subgroups.

In the talk we will describe the precise conjecture, and its place in a much more general conjectural framework, aiming to unify numerous deep rigidity results for S-arithmetic groups, including the M-Z conjecture, the congruence subgroup property, the normal subgroup theorem and Margulis Super-rigidity.

We shall discuss also some new results, proving the full M-Z conjecture for all higher rank non-uniform lattices, as well first proof over positive characteristic in the case of Chevalley groups (e.g., SL_n).

Based on joint work with Willis and Venkataramana.

Itamar Vigdorovich

University of Oxford, UK

SELFLESS REDUCED GROUP C^* -ALGEBRAS

Thursday, 1 October / 15:15–16:00

The notion of a selfless C^* -algebra has attracted considerable attention over the past two years. This elegant and somewhat categorical notion implies key regularity properties in the study of C^* -algebras. In this talk, I will focus mainly on reduced group C^* -algebras. While simplicity of such algebras is by now quite well understood, whether simplicity implies selflessness remains an important open problem. I will introduce the topic, discuss some of the techniques that have been used, and present results by myself and others toward understanding this question, including a joint work with Leibtag and Le Bars.

Tianyi Zheng

UC San Diego, US

COMMENSURATING ACTIONS AND THE SIERPIŃSKI CARPET GROUP

Tuesday, 29 September / 11:15–12:00

The Sierpiński carpet is a classical fractal, and there is an iterated monodromy group associated with its subdivision rule, which we call the carpet group. It is an infinite, finitely generated, amenable group, its amenability coming from a criterion in terms of the conformal dimension of the limit space. We show that it has Property FW: every Schreier graph of it is one-ended. Since Kazhdan's Property (T) implies FW, this is a case where a weak form of rigidity holds in a setting opposite to (T) itself. It answers a question of Cornuier on the existence of such amenable groups. The proof is centered on a classification of commensurating actions for finitely generated contracting self-similar branch groups, a class of groups acting on rooted trees. A second consequence is that regular branch groups in this class never have Property PW; in particular, the first Grigorchuk group admits no proper action on CAT(0) cube complex. Joint with Nicolás Matte Bon and Volodymyr Nekrashevych.