

Schedule Asymptotic Algebra 2025

All talks will take place in room M4-122.

Thursday, 9 October 2025

13:30 - 14:00	Registration
14:00 - 15:00	Gustavo Fernandez-Alcober (Bilbao) <i>Grigorchuk-Gupta-Sidki groups</i>
15:10 - 15:35	Mikel Eguzki Garciarena Perez (Düsseldorf) <i>Maximal subgroups in constant spinal groups</i>
15:35 - 16:30	Coffee and Tea
16:30 - 16:55	Alec Schmutz (Bielefeld) <i>Ask zeta functions and hyperplane arrangements</i>
17:00 - 17:25	Felix Zhang (Hagen) <i>The action of the Levi subgroup on the unipotent radical and applications to induced representations</i>
17:30 - 17:55	Noam von Rotberg (Bielefeld) <i>Enumerating representations by extending matrices</i>
19:00	Common dinner <i>Jivino</i>

Friday, 10 October 2025

9:30 - 10:25	Martina Conte (Bielefeld) <i>Definability of the dimension of R-analytic groups</i>
10:30 - 10:55	Jianhao Shen (Bielefeld) <i>Counting Symplectic Lattices with Double Prescribed Invariants</i>
10:55 - 11:30	Coffee and Tea
11:30 - 11:55	Nowras Otmen (Padova) <i>Probabilistic identities, analytic groups and free constructions</i>
12:00 - 12:25	Margherita Piccolo (Hagen) <i>Frames in quasi-semisimple profinite groups</i>

Abstracts

Grigorchuk-Gupta-Sidki groups

Gustavo Fernandez Alcober (University of the Basque Country)

We introduce the family of Grigorchuk-Gupta-Sidki groups (GGS-groups, for short) acting on the p -adic tree for p a prime. These groups generalise some of the first examples of finitely generated infinite periodic groups, that is, groups that provide a negative answer to the General Burnside Problem. We will present the most important properties of GGS-groups and will use this family of groups to illustrate the classes of branch groups and regular branch groups acting on a regular rooted tree.

Maximal subgroups in constant spinal groups

Mikel Eguzki Garciarena Perez (Universität Düsseldorf)

Groups of automorphisms of regular rooted trees are a rich source of examples with interesting properties in group theory, and they have been used to solve important problems. The first Grigorchuk group, defined by Grigorchuk in 1980, is one of the first instances of an infinite finitely generated periodic group, thus providing a negative solution to the General Burnside Problem. It is also the first example of a group with intermediate growth, hence solving the Milnor Problem. Many other groups of automorphisms of rooted trees have since been defined and studied. Important examples are the Gupta-Sidki group and the second Grigorchuk group which belong to the family of the so-called Grigorchuk-Gupta-Sidki groups (GGS-groups, for short). Many generalizations of the GGS-groups have also appeared in the recent years, such as the large family of the so-called constant spinal groups.

A question that seems to appear repeatedly when working with groups of automorphisms of regular rooted trees is whether a group is contained in the class \mathcal{MF} of groups with all maximal subgroups of finite index.

The aim of this talk is to present a criterion that ensures that certain constant spinal groups are contained in the class \mathcal{MF} , and with the use of this criterion present some branch groups within \mathcal{MF} exhibiting novel properties, for example groups that possess non-normal maximal subgroups. Furthermore, we also present some tools that help to find new examples of branch groups outside \mathcal{MF} , with maximal subgroups of infinite index.

This is a joint work with J. Moritz Petschick.

Ask zeta functions and hyperplane arrangements

Alec Schmutz (Universität Bielefeld)

Ask zeta functions are rational generating functions which enumerate average sizes of kernels of matrices of linear forms defined over finite rings. Such zeta functions are of group-theoretic interest, as they relate to the conjugacy class zeta functions of unipotent groups associated with graphs. In this talk, I will outline a connection between ask zeta functions associated with hypergraphs, and certain rational functions attached to hyperplane arrangements. The ask zeta functions we consider are recovered, under suitable substitutions of some variables, by the so-called “flag Hilbert-Poincaré series” of a hyperplane arrangement.

The action of the Levi subgroup on the unipotent radical and applications to induced representations

Felix Zhang (FernUniversität in Hagen)

For a prime p , the ring \mathbb{Z}_p of p -adic integers and the ring $\mathbb{F}_p[[t]]$ of formal power series over the field of size p are discrete valuation rings with the same residue field. Despite of this similarity, they are not isomorphic. Surprisingly, the representation theory of algebraic matrix groups over discrete valuation rings seems to depend on the residue field only. In my talk, I explain this for representations induced from maximal parabolic subgroups and discuss how this leads to analyzing unipotent radicals with the action of the Levi subgroup. This allows understand the decomposition of representation induced from (certain) maximal parabolic subgroups in all Cartan-Killing types only excluding G_2 , F_4 and E_8 .

Enumerating representations by extending matrices

Noam von Rotberg (Universität Bielefeld)

Representation zeta functions of groups enumerate a groups' irreducible complex representations of each finite degree. Computing these zeta functions for nilpotent groups can be achieved by enumerating skew-symmetric matrices over finite Artinian rings with given elementary divisor type. We are interested in understanding how the representation zeta function changes under taking relative-free products with \mathbb{Z}^n . On the level of matrices this corresponds to counting how a skew symmetric matrix can be extended by a generic row and column to obtain a prescribed elementary divisor type. We discuss a formula for this.

Definability of the dimension of R -analytic groups

Martina Conte (Universität Bielefeld)

In joint work with Benjamin Klopsch we showed that the dimension of p -adic analytic pro- p groups is definable by one sentence in the language of groups. While for these groups one can rely on a completely group-theoretic characterisation, such a description is not at present known for more general R -analytic groups, where R is any pro- p domain. It is therefore interesting to examine in which cases invariants of such groups can be axiomatized in the language of groups and which natural extensions of this language allow for definability in general R -analytic groups. In joint work in progress with Andoni Zozaya we consider this more general setting of R -analytic groups and investigate the definability of their dimension. In this talk I will introduce the groups under consideration and give an overview of this problem.

Counting Symplectic Lattices with Double Prescribed Invariants

Jianhao Shen (Universität Bielefeld)

For a lattice L inside the standard symplectic space $(\mathbb{Z}_p^{2n}, \langle \cdot, \cdot \rangle)$, one can attach two natural invariants: the partition λ describing the finite quotient \mathbb{Z}_p^{2n}/L , and the partition μ describing the isometry type of the bilinear form induced by $\langle \cdot, \cdot \rangle$ on L . We enumerate lattices with both invariants prescribed, defining the numbers $N_{n,p}(\lambda, \mu)$.

Several approaches are explored: relations with Hecke and Hall algebras via Satake transforms, and translations of the problem into the language of groups and buildings. Complete formulas are obtained in the case $n = 2$, together with explicit computations for $n = 3$.

Probabilistic identities, analytic groups and free constructions

Nowras Otmen (University of Padova)

Profinite groups can be endowed with a probability measure, which allows one to investigate probabilistic questions in this class of topological groups. A particularly interesting instance is that of a group with a probabilistic identity, that is, when a group satisfies a word with positive probability. In this presentation, I will talk about the structural implications of satisfying a probabilistic identity in two classes of groups: analytic groups and fundamental groups of graphs of pro- p groups. This is joint work with Steffen Kionke, Tommaso Toti, Matteo Vannacci and Thomas Weigel.

Frames in quasi-semisimple profinite groups

Margherita Piccolo (FernUniversität in Hagen)

Given a profinite group, it is generally a difficult question to determine if it is, in fact, isomorphic to a profinite completion of an abstract group. A profinite group is called *quasi-semisimple* if it is perfect and the quotient with its centre is a semisimple profinite group, which is a Cartesian product of non-abelian finite simple groups. Kassabov and Nikolov introduced the concept of a *frame* to provide a criteria for a semisimple profinite group to be a profinite completion.

In this talk, I will give an overview of the main tools and ingredients in this area and I will report on recent work in progress with Steffen Kionke aimed at generalising Kassabov and Nikolov's criteria to quasi-semisimple profinite groups.