Follow-Up-Workshop to TP
"Logic and Algorithms in Group Theory"

August 18 - August 22, 2025

organized by
Katrin Tent (Universität Münster), Eamonn O'Brien (University of Auckland), André Nies (University of Auckland)

Abstracts

Simon André (IMJ-PRG Sorbonne University)

The Tarski problem for hyperbolic groups with torsion

Abstract:
Sela and Kharlampovich-Myasnikov proved that non-abelian free groups are elementarily equivalent, thus solving a famous problem posed by Tarski around 1945. Then, Sela gave a complete classification of finitely generated groups that are elementarily equivalent to a torsion-free hyperbolic group. However, such a classification remains unknown for hyperbolic groups with torsion. I will present some partial results in this direction, and explain what are some of the new difficulties caused by non-trivial elements of finite order, in particular the fact that morphisms from a surface group to a hyperbolic group with torsion can be very pathological.

Martin Bridson (University of Oxford)

The geometry of the conjugacy problem for finitely presented groups

Abstract: There is a well understood relationship between the word problem for a finitely presented group G and the geometry of discs filling loops in any compact manifold with fundamental group G. This relationship was exploited in the 1990s and 2000s to develop a rather complete understanding of the Dehn Functions of finitely presented groups. The geometry of the conjugacy problem is less robust and less well understood. I shall begin with a brief survey of what is known about this topic. I shall then sketch some highlights from a series of recent (and future) papers concerning the nature of Conjugator Length Functions, which provide optimal bounds on the size of conjugating elements in finitely presented groups. This talk is based on joint work with Tim Riley (Cornell).

Montserrat Casals-Ruiz (University of the Basque Country)

On the elementary theory of graph products of groups

Abstract: When studying the model theory of groups, it is natural to ask which group-theoretic constructions preserve the elementary theory. In 1959, Feferman and Vaught studied the first-order

properties of direct products and showed, in particular, that the direct products of elementarily equivalent groups are elementarily equivalent. In contrast, invariance of the elementary equivalence under free products of groups was a long-standing conjecture which was recently solved by Sela (2017). In this talk, we will first address the converse question: given two elementary equivalent free products of groups (or more generally, graph product of groups), when are the factors elementarily equivalent? We discuss some sufficient conditions and use our results to describe finitely generated groups elementarily equivalent to RAAGs whose underlying graph is a transitive forest.

Rémi Coulon (CNRS - Université de Bourgogne)

Equations in Burnside groups

Abstract: In this talk we will report on work that carried out in part during the 2018 HIM program "Logic and Algorithms in Group Theory". The free Burnside group $B(r, n)$ is the quotient of the free group of rank r by the normal subgroup generated by the n-th power of all its elements. It was introduced in 1902 by Burnside who asked whether $B(r, n)$ is necessarily a finite group or not. In 1968, Novikov and Adian proved that if $r > 1$ and n is a sufficiently large odd exponent, then $B(r, n)$ is infinite. It turns out that $B(r, n)$ has a very rich structure. In this talk we are interested in understanding equations in $B(r, n)$. In particular we want to investigate the following problem. Given a set of equations S, under which conditions does every solution to S in $B(r, n)$ already come from a solution in the free group of rank r. Along the way we will explore other aspects of certain periodic groups (quotients of a free Burnside groups) such as the Hopf / co-Hopf property, the isomorphism problem, their automorphism groups, etc. This is joint work with Z. Sela.

Bettina Eick (Technische Universität Braunschweig)

The frame of the graph associated with the p-groups of maximal class

Abstract: The graph $G(p)$ associated with the p-groups of maximal class is a major tool in the classification of these groups. In this talk we briefly survey some of the cornerstones of the investigation of $G(p)$ so far. We then introduce a new concept: the frame of $G(p)$. This extends the knowledge on the structure of $G(p)$ significantly and may open a new route towards a classification of the p-groups of maximal class. We describe this new feature and its applications. This is joint work with Patali Komma and Subhrajyoti Saha.

Giles Gardam (University of Bonn)

SAT for the working mathematician

Abstract: I will discuss solvers for the Boolean satisfiability problem (SAT) as a tool for the working mathematician. SAT is NP-complete which means it is (in theory) broadly applicable but (in theory) very difficult, however modern SAT solvers are able to solve remarkably large problems in practice. An example of this from my own experience is producing a counterexample to the unit conjecture for group rings, which had remained open for 80 years.

Thomas Koberda (University of Virginia)

Differential topology and first order rigidity

Abstract: In this talk, I will discuss recent work with Sang-hyun Kim and J. De la Nuez González, wherein we prove that the first order theory of a diffeomorphism group of a closed manifold recovers the diffeomorphism type of the underlying manifold. The first order theory of the diffeomorphism group also recovers the degree of regularity; thus we are able to strengthen a classical result of F. Takens, which asserts that an isomorphism between two integral regularity diffeomorphism groups is induced by a diffeomorphism between the underlying manifolds.

Chen Meiri (Technion – Israel Institute of Technology)

Width in higher rank arithmetic groups

Abstract: In this talk we will explain how questions about the width of (normal) subsets in higher rank arithmetic groups can be transformed to questions of the type of the Congruence Subgroup Problem with respect to non-standard models of these groups. No prior knowledge on higher rank arithmetic groups or CSP is assumed.

Gianluca Paolini (University of Torino)

Profinite rigidity of crystallographic groups

Abstract: I will survey my work joint with R. Sklinos, S. André and D. Carolillo on profinite rigidity of crystallographic groups, stemming from a model theoretic solution of the problem of profinite rigidity of the affine Coxeter groups. I will also discuss the problem of profinite homogeneity of a given crystallographic group, with particular focus on the profinite homogeneity of the affine Coxeter groups. Finally, in a different direction, I will mention some very recent results on the problem of elementary equivalence on spherical and affine Artin groups (of type $\tilde{A}_n$); this last project is joint with A. Cassella and Giovanni Paolini.

Mima Stanojkovski (Università di Trento)

Groups from elliptic curves: isomorphism testing and the PORC conjecture

Abstract: Let p be a prime number. In this talk I will discuss a particular family of finite groups of class 2 and exponent p that encode smooth cubics in the plane in a precise sense. I will present joint work with Joshua Maglione on isomorphism testing involving groups in this family. Moreover, I will explain how this family comes up in relation to Higman's famous PORC conjecture.

Todor Tsankov (Université Claude Bernard – Lyon 1)

Comeager isomorphism classes in zero-dimensional dynamics

Abstract: It is often possible to parametrize a given class of dynamical systems by elements of a Polish space and then it becomes natural to ask what properties hold "generically", i.e., on a comeager set of systems. The most extreme situation is when there is a single comeager isomorphism class: that is, the generic properties are captured by a single system. This does not usually happen in ergodic theory but is possible in zero-dimensional topological dynamics. For example, it is a result of Kechris and Rosendal that there is a generic action of $\mathbb{Z}$ on the Cantor space and of Kwiatkowska that there is such a generic action of the free group F_n. In this work, we are interested in minimal dynamical systems and show that there is a generic minimal action of F_n and also a generic minimal action of F_n

---

that preserves a probability measure. We also develop a model-theoretic framework to study this and related questions. This is joint work with Michal Doucha and Julien Melleray.

Matteo Vannacci (University of Florence)

Algorithmic randomness in profinite groups

Abstract: I will report on some ongoing work on algorithmic randomness in profinite groups with Willem Fouche and Andre Nies. First, we will compare the property of "generating an open subgroup in a profinite group almost surely" against different notions of algorithmic randomness. Then we will outline some effective algorithmic forms of classical results about absolute Galois groups.

James Wilson (University of Colorado)

Defining and computing characteristic subgroups without automorphisms

Abstract: Characteristic subgroups of a group G are classically defined in terms of invariance under the automorphisms of G. However, characteristic subgroups are a means to establish what automorphisms exist in the first place. If we do not yet know the automorphisms nor the characteristic subgroups, then we are at a standstill. To overcome this circular dependence, we introduce an impredicative definition of characteristic structure as a property of the representation theory of the category of groups and discuss the implications to certified computation. This is joint work with Brooksbank, Dietrich, Maglione, and O'Brien.