GRoup theory In Padova, 2026

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CONTRIBUTED TALKS ABSTRACTS

Jessica Anzanello
Università degli Studi di Milano-Bicocca

Fixed-point-free elements in two-orbit permutation groups

A classical theorem of Jordan states that every non-trivial finite transitive group contains a derangement, that is, an element with no fixed points. A deep result of Fein, Kantor, and Schacher shows that one can even find such an element of prime-power order. In this talk, I will discuss a natural extension of this result to permutation groups G with two orbits on $n > 2$ points. In this setting, we show that either G contains a derangement, or it contains an element of prime-power order with exactly one fixed point. As a corollary, we obtain that if the two orbits have size a and b, with $a + b > 2$ and $(a, b - 1) = (a - 1, b) = 1$, then G has a derangement. This confirms and generalizes a conjecture of Ellis and Harper. This is joint work with Sean Eberhard.

Elena Bogliolo
Università di Pisa

Ulam stability of groups with displacement properties

Stability is the property of obtaining close results when applying small perturbations to the variables. In this talk we present a notion of stability for groups and representations, namely Ulam stability. We show that a large class of groups, that includes groups of piecewise linear homeomorphisms of the interval and piecewise projective homeomorphisms of the line as well as compactly supported homeomorphisms and diffeomorphisms, is Ulam stable. The main technical tool is a cohomology theory (asymptotic cohomology) that is related to bounded cohomology.

Malcolm Hoong Wai Chen
University of Manchester

Abstract regular polytopes associated with finite simple groups

Abstract regular polytopes are combinatorial structures that generalise classical geometric objects such as regular polygons and polyhedra. These objects can be studied algebraically through an elegant correspondence with their automorphism groups together with a distinguished set of generating involutions known as C-strings. This provides a natural framework for investigating the geometric structure of finite simple groups by drawing on the wealth of information known about their involutions. In this talk, we will survey known results on C-strings of finite simple groups, as well as report several interesting examples of C-strings previously unknown to the literature. This is ongoing joint work with my PhD supervisor, Peter Rowley.

Ram Karan Choudhary
Indian Institute of Science Education and Research, Pune

On Matrix Representations of Finite Groups over Q

Let G be a finite group and let $\mathrm{Irr}(G)$ denote the set of irreducible complex characters of G. For $\chi \in \mathrm{Irr}(G)$, define

$$\Omega(\chi) = m_{\mathbb{Q}}(\chi) \sum_{\sigma \in \mathrm{Gal}(\mathbb{Q}(\chi)/\mathbb{Q})} \chi^{\sigma} \, ,$$

where $m_{\mathbb{Q}}(\chi)$ is the Schur index of χ over $\mathbb{Q}$. It is well known that every irreducible representation of G over $\mathbb{Q}$ affords a character of the form $\Omega(\chi)$, and conversely every such character arises from an irreducible rational representation of G. In this talk, we discuss methods for constructing irreducible rational matrix representations of finite p-groups, where p is a prime. We show that constructing a rational matrix representation of a p-group G affording the character $\Omega(\chi)$ can be reduced to finding a suitable pair (H, ψ), where $H \leq G$ and $\phi \in \mathrm{Irr}(H)$ satisfy certain structural conditions. Such a pair, called a required pair, provides a practical framework for constructing explicit irreducible rational matrix representations of G. We then consider the group $G = \mathrm{GL}_2(q)$, where q is a prime power. Motivated by the theory of required pairs for finite p-groups, we construct irreducible matrix representations of $\mathrm{GL}_2(q)$ over $\mathbb{Q}$ affording the characters $\Omega(\chi)$, where $\chi \in \mathrm{Irr}(\mathrm{GL}_2(q))$ arises from parabolic induction. Our construction follows an approach analogous to the required-pair method for finite p-groups, demonstrating that these ideas extend naturally beyond the p-group setting.

Deborah Gonçalves Fabri
University of Galway

Ideal zeta functions of Lie rings arising from hyperplane arrangements

An ideal zeta function is a generating function that counts the number of finite-index ideals in a ring, encoding algebraic growth into an analytic object that serves as an invariant to study the asymptotic behavior of an algebraic structure. In this talk, we consider a family of class 2 nilpotent Lie rings whose commutator structure is defined by alternating tensors that explicitly encode the geometry of hyperplane arrangements. This framework blends geometric combinatorics with algebraic counting, where a local analysis introduces arithmetic dependence on prime numbers. We will discuss how the combinatorics, underlying geometry and local arithmetic properties govern the growth of finite-index ideals.

Harish Kishnani
Indian Institute of Science Education and Research Pune

A Unified Approach to Commutator Maps via Balance Equations and Weighted Graphs

In algebra, commutators occur in several contexts. Some of these are–the commutator word $xyx^{-1}y^{-1}$ on a group G, the commutator map $(x, y) \mapsto xy - yx$ on associative rings, and the Lie bracket $[x, y]$ of a Lie algebra. While distinct, these commutators often possess common properties. Thus, one may hope to deal with them together. In this talk, I will discuss one such attempt based on a recent work with Prof. Amit Kulshrestha.

We introduce balance equations over commutative rings R and associate R-weighted graphs to them so that solving balance equations corresponds to a consistent labeling of vertices of the associated graph. We provide explicit solutions of these equations. As an application, letting R to be the ring of p-adic integers, we examine some necessary and sufficient conditions for a p-group of nilpotency class 2 to have its set of commutators coincide with its commutator subgroup. We also apply our results to study the surjectivity of the Lie bracket in Lie algebras, without any restriction on their dimension and the underlying field.

Mario Marcos Losada
University of Oxford

Highest weight modules for Iwasawa algebras

Iwasawa algebras are completed group rings for compact p-adic Lie groups and there is an ongoing programme to classify their prime ideals. In the case where the group has no open normal subgroups, it is conjectured that every non-zero prime ideal has finite codimension, so that every irreducible infinite-dimensional representation is faithful. It turns out that to prove this conjecture it is enough to study the completions of highest weight modules for the corresponding Lie algebra.

Can Wen
University of Cologne

The non-vanishing of the first Hochschild cohomology of the blocks of the sporadic simple groups

Let G be a finite group whose order is divisible by the prime characteristic p of an algebraically closed field k. In 1993, based on the classi- fication of finite simple groups, Fleischmann Janiszczak and Lempken showed that $\mathrm{HH}^1(kG) \neq 0$. The block-wise version of this result is a conjecture posed by Linckelmann: For any p-block B of a finite group algebra kG with a non-trivial defect group we have $\mathrm{HH}^1(B)$. In this talk, I will provide a partial answer to this conjecture. More pre- cisely, we show that this conjecture holds for the blocks of the sporadic simple groups, except for the 3-blocks of J_4 with defect 3 (which is currently under investigation). This is an ongoing joint work with Lleonard Rubio y Degrassi and Matthew Antrobus.

Radosław Żak
University of Oxford

Extensions of smooth mod-p representations of $\mathrm{SL}_2(\mathbb{Q}_p)$

In representation theory of p-adic groups, most attention is understandably given to classifying irreducible representations. Breaking this convention, in this talk we will see how to compute Ext^1 groups and build extensions of mod-p representations of $\mathrm{SL}_2(\mathbb{Q}_p)$, the simplest p-adic group – at least in some cases. This is achieved through diagrams and a spectral sequence coming from the Bruhat decomposition of SL_2. The talk will be based on my ongoing PhD research.

Laura Voggesberger

Semisimple elements in the component group

Let G be a connected reductive algebraic group over an algebraically closed field. Let u in G be a unipotent element and s be a semisimple element in the centralizer of u. It is still an open question what the image and conjugacy class of s in the component group $A_G(u)$ is. In particular, the answer would be helpful in the light of McNinch and Sommers' theorem, stating that there is a bijection of conjugacy classes of $A_G(u)$ and pairs $(L, sZ^\circ(L))$, where $L = C_G(t)^\circ$ for t in $C_G(u)$ semisimple and u distinguished in L, s in $Z(L)$ and $C_{G^\circ}(sZ^\circ(L)) = L$. Joint work with Marie Roth.