Groups St Andrews 2017 in Birmingham

5th–13th August 2017

Karl H. Hofmann, 2010

Booklet of Abstracts

Disclaimer: The times and rooms listed in this document are *provisional*. Please consult the **The Daily Group Theorist** for the definitive talk times.

Contents

Principal Speakers

Michael Aschbacher (Caltech)
Finite simple groups and fusion systems
Time/Room: Sunday 2.30pm, Monday 4pm, Tuesday 2.30pm & Wednesday 9.30am, Poynting Building Large Lecture Theatre

Abstract: The goal of these talks is to give some insight into a program to, first, classify a large subclass of the class of simple 2-fusion systems, and then, second, to use the result on fusion systems to simplify the proof of the theorem classifying the finite simple groups. We will begin with an introduction to the theory of fusion systems, and then move on to an overview of the proof of the theorem classifying the finite simple groups of component type. We then discuss how to translate that proof into the category of 2-fusion systems, and the advantages that accrue from the change in category. Finally we describe how the result on fusion systems can be used to derive a corresponding theorem on simple groups.

Pierre-Emmanuel Caprace (Université Catholique de Louvain)
Locally compact groups beyond Lie theory
Time/Room: Sunday 9.30am, Tuesday 4pm, Thursday 4pm & Saturday 2.30pm, Poynting Building Large Lecture Theatre

Abstract: The theory of locally compact groups was initiated at the turn of the 20th century under the impetus of Hilbert's fifth problem. After reviewing the landmarks of its history, we will discuss some key examples, and present an overview of the recent progress made in investigating the local structure of the non-discrete simple locally compact groups that are not Lie groups. We will also describe how non-discrete locally compact groups are relevant to the study of abstract groups, all of whose proper quotients are finite.

Radha Kessar (City, University of London)
On characters and p-blocks of finite simple groups
Time/Room: Tuesday 9.30am, Wednesday 11am, Friday 9.30am & Saturday 4pm, Poynting Building Large Lecture Theatre

Abstract: To each prime number p and to each finite group G is associated a natural partitioning of the set of complex irreducible characters of G called the p-block partition. The aim of these lectures is two-fold: firstly, to give an introduction to p-block theory, and secondly, to describe — as far as we know the answer — the p-block partitions of finite simple groups.

Gunter Malle (TU Kaiserslautern)
Local-global conjectures
Time/Room: Monday 9.30am, Tuesday 1.30pm, Thursday 9.30am & Friday 2.30pm, Poynting Building Large Lecture Theatre

Abstract: The ordinary and modular representation theory of finite groups abounds with open conjectures that relate the representation theory of a group to that of its local subgroups. We will present some of these conjectures as well as recent substantial progress which was obtained by way of reduction to the situation of quasi-simple groups and application of results relying on Lusztig's theory of characters of finite reductive groups.

The first part of this course, providing basics of block theory and of representation theory of finite groups of Lie type will be joint with the one by Radha Kessar.

One-Hour Speakers

Tim Burness (University of Bristol)
Simple groups, generation and probabilistic methods
Time/Room: Sunday 1.30pm, Poynting Building Large Lecture Theatre

ABSTRACT: It is well known that every finite simple group can be generated by two elements and this leads naturally to a wide range of problems that have been the focus of intensive research in recent years, such as random generation, $(2,3)$-generation and so on. In this talk I will discuss some recent progress on similar problems for subgroups of simple groups, with applications to primitive permutation groups and the study of subgroup growth (this is joint work with Liebeck and Shalev). I will also recall the notion of the spread of a finite group and I will explain how probabilistic methods (based on fixed point ratio estimates for simple groups) have been used to shed light on a far reaching conjecture of Breuer, Guralnick and Kantor. Time permitting, I will finish by mentioning some related problems on the generating graph of a finite group.

Vincent Guirardel (Université de Rennes 1)
Boundaries for Out(F_n)
Time/Room: Friday 1.30pm, Poynting Building Large Lecture Theatre

ABSTRACT: We will discuss boundaries for $\mathrm{Out}(F_n)$ and related groups occurring in different contexts and a view towards applications.

Harald Helfgott (University of Göttingen)
The diameter of the symmetric group: ideas and tools
Time/Room: Saturday 1.30pm, Poynting Building Large Lecture Theatre

ABSTRACT: Given a finite group G and a set A of generators, the diameter $\mathrm{diam}(\Gamma(G,A))$ of the Cayley graph $\Gamma(G,A)$ is the smallest ℓ such that every element of G can be expressed as a word of length at most ℓ in $A \cup A^{-1}$. We are concerned with bounding $\mathrm{diam}(G) := \max_A \mathrm{diam}(\Gamma(G,A))$.

It has long been conjectured that the diameter of the symmetric group of degree n is polynomially bounded in n. In 2011, Helfgott and Seress gave a quasipolynomial bound $(\exp((\log n)^{(4+\epsilon)}))$. We will discuss a recent, much simplified version of the proof, emphasising the links in commons with previous work on growth in linear algebraic groups.

Andrei Jaikin-Zapirain (Universidad Autónoma de Madrid)
On ℓ^2-Betti numbers and their analogues in positive characteristic
Time/Room: Saturday 9.30am, Poynting Building Large Lecture Theatre

ABSTRACT: Let G be a group, K a field and A a n by m matrix over the group ring $K[G]$. Let $G = G_1 > G_2 > G_3 \cdots$ be a chain of normal subgroups of G of finite index with trivial intersection. The multiplication on the right side by A induces linear maps

$$\begin{aligned} \phi_i : \quad K[G/G_i]^n \quad &\to \quad K[G/G_i]^m \\ (v_1, \dots, v_n) \quad &\mapsto \quad (v_1, \dots, v_n)A. \end{aligned}$$

We are interested in properties of the sequence $\{\frac{\dim_K \ker \phi_i}{|G:G_i|}\}$. In particular, we would like to answer the following questions.

1. Is there the limit $\lim_{i\to\infty} \frac{\dim_K \ker \phi_i}{|G:G_i|}$?
2. If the limit exists, how does it depend on the chain $\{G_i\}$?
3. What is the range of possible values for $\lim_{i\to\infty} \frac{\dim_K \ker \phi_i}{|G:G_i|}$ for a given group G?

It turns out that the answers on these questions are known for many groups G if K is a number field, less known if K is an arbitrary field of characteristic 0 and almost unknown if K is a field of positive characteristic.

In my talk I will give several motivations to consider these questions, describe the known results and present recent advances in the case where K has characteristic 0.

Donna Testerman (École Polytechnique Fédérale de Lausanne)
Representations and subgroup structure of simple algebraic groups
Time/Room: Thursday 11am, Poynting Building Large Lecture Theatre

ABSTRACT: Building on the fundamental work of Dynkin for the complex semisimple Lie algebras, numerous mathematicians have studied the restrictions of irreducible representations of simple algebraic groups to closed subgroups. We will give an overview of the work carried out since 1985, starting with Seitz's major contribution in the late '80's. In particular, this work illustrates the connection between the study of such restrictions and the determination of the maximal closed connected subgroups of the classical type algebraic groups.

We describe the classification of the irreducible actions of all maximal positive-dimensional closed subgroups of simple algebraic groups and highlight some interesting branching rules for non irreducible actions. This includes work of Burness, Ford, Ghandour, Marion and Cavallin.

Contributed Talks

Cristina Acciarri (University of Brasilia, University of Padua)
Graphs encoding the generating properties of a finite group
Provisional Time/Room: Monday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: The generating graph $\Gamma(G)$ of a finite group G is the graph defined on the non-identity elements of G in such a way that two distinct vertices are connected by an edge if and only if they generate G. The graph $\Gamma(G)$ gives interesting information only if G is 2-generated.

We introduce an alternative definition that works in a more general setting and encodes the generating properties of a d-generated finite group, for any positive integer d. In the talk we will present some results and questions related to the study of these graphs. This is a joint work with Andrea Lucchini.

Faryad Ali (Al-Imam University (IMSIU), Riyadh, Saudi Arabia)
Generating pairs for the Fischer group Fi_{23}
Provisional Time/Room: Sunday afternoon, Physics West Lecture Theatre

ABSTRACT: A group G is called (l, m, n)-generated, if it is a quotient group of the triangle group $T(l, m, n) = \langle x, y, z \mid x^l = y^m = z^n = xyz = 1\rangle$. In some research articles, Moori posed the question of finding all the triples (l, m, n) such that non-abelian finite simple groups are (l, m, n)-generated. In the present article, we answer this question for the Fischer sporadic simple group Fi_{23}. In particular, we establish all the (p, q, r)-generations for the Fischer group Fi_{23}, where p, q and r are prime divisors of $|Fi_{23}|$.

Daniela Amato (University of Brasília)
Descendant-homogeneous digraphs with property Z.
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre A

ABSTRACT: The *descendant set* $\mathrm{desc}(\alpha)$ of a vertex α in a digraph D is the set of vertices which can be reached by a directed path from α. A subdigraph of D is *finitely generated* if it is the union of finitely many descendant sets, and D is *descendant-homogeneous* if it is vertex transitive and any isomorphism between finitely generated subdigraphs extends to an automorphism. A digraph D has *property Z* if there is a homomorphism from D onto the digraph with vertex set $\mathbb{Z}$ and edge set $\{(i, i+1) \mid i \in \mathbb{Z}\}$.

In [1] the authors consider connected descendant-homogeneous digraphs with finite out-valency, specially those which are highly arc-transitive. They show that such digraphs must be imprimitive and, in particular, they consider the ones with property Z. In [2], we show that some of the results from [1] hold for descendant-homogeneous digraphs which are distance transitive, a wider class of digraphs. Moreover, for each $k \geq 1$ and $L \geq 1$, we construct a connected highly arc-transitive digraph $D(k, L)$ with property Z. We show, however, that $D(k, L)$ is descendant-homogeneous only when $k = 1$.

References

[1] Daniela Amato and John K. Truss, Descendant-homogeneous digraphs, *Journal of Combinatorial Theory, Series A* 31 (2011), 247–283.

[2] Daniela Amato, Descendant-homogeneous digraphs with property Z, *Submitted*.

Sevgi Atlihan (Gazi University)
A Note on Biminimal Non-Abelian Groups
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre C

ABSTRACT:

A group G is called *biminimal non-abelian* if all its subgroups are either abelian or minimal non-abelian, but G neither is abelian nor minimal non-abelian. In this work, we prove that if G is a locally graded group with such property, then G is finite and its order is divisible by at most three prime numbers; moreover, under certain conditions, the commutator subgroup $G^{'}$ of G has prime-power order, like in the case of metahamiltonian groups. Recall here that a group is said to be *metahamiltonian* if all its non-abelian subgroups are normal. Of course, any biminimal non-abelian group is either metahamiltonian or minimal non-metahamiltonian, and we also prove that if G is a locally graded group whose non-normal subgroups are either abelian or minimal non-abelian, then the commutator subgroup $G^{'}$ of G is finite and its order is divisible by at most three prime numbers.

Andreas Bächle (Vrije Universiteit Brussel, Belgium)
Rationality of groups and centers of integral group rings
Provisional Time/Room: Sunday morning, Poynting Building Small Lecture Theatre

ABSTRACT: A finite group is called rational if all entries of its character table are rational integers. Being rational has significant implications for the structure of the group, e.g. it is a classical result of R. Gow that the only primes dividing the order of such a group are 2, 3 and 5, if the group is solvable. The concept of rationality was generalized by D. Chillag and S. Dolfi by introducing the term (inverse) semi-rational group 2010. It turned out that being an inverse semi-rational group has quite some impact in the study of integral group rings. We will discuss this connection and recent results by Bakshi, Maheshwary, Passi and myself.

Ayoub Basheer (Department of Mathematical Sciences, North-West University (Mafikeng), P Bag X2046, Mmabatho 2735, South Africa)
On Some Generation Methods of Finite Simple Groups
Provisional Time/Room: Friday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: Generation of finite simple groups by suitable subsets is of great interest and has many applications to groups and their representations. For example, the computations of the genus of simple groups can be reduced to the generations of the relevant simple groups. There are several methods to generate a finite simple group. In this talk we consider and review some of these methods and we focus on the (p, q, r)-generations, ranks of conjugacy classes in a finite simple group and the spread of a simple group. In particular we focus on the contributions of Professor Moori and his research groups including postgraduate and post-doctoral students.

Raimundo Bastos (Universidade de Brasília)
Finiteness conditions for the non-abelian tensor product of groups
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre C

ABSTRACT: Let G, H be groups that act compatibly on each other. We denote by $\eta(G,H)$ a certain extension of the non-abelian tensor product $G \otimes H$ by $G \times H$. We prove that if the set of all tensors $T_{\otimes}(G,H) = \{g \otimes h \,:\, g \in G,\, h \in H\}$ is finite, then the non-abelian tensor product $G \otimes H$ is finite. In the opposite direction we examine certain finiteness conditions of G in terms of similar conditions for the tensor square $G \otimes G$. This is a joint work with Noraí R. Rocco (Universidade de Brasília) and Irene N. Nakaoka (Universidade Estadual de Maringá)

Barbara Baumeister (Bielefeld University)
The smallest quotients of Aut F_n
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre A

ABSTRACT: The non-abelian finite simple group $L_n(2)$ is a quotient of $\mathrm{Aut}(F_n)$ (factor out F_n' and then reduce modulo $Z/2Z$). In the talk I will confirm the conjecture by Mecchia-Zimmermann that this is the smallest non-abelian finite quotient of $\mathrm{Aut}(F_n)$. On the way some other nice and new results will appear.

This is joint work with Dawid Kielak and Emilio Pierro.

Anton Baykalov (Novosibirsk State University)
On algebraic normalizers of maximal tori in simple groups of Lie type
Provisional Time/Room: Saturday morning, Poynting Building Small Lecture Theatre

ABSTRACT: Consider a simple algebraic group $\overline{G}$ of adjoint type over an algebraic closed field $\overline{F}_p$ of positive characteristic p. Suppose that σ is a Stainberg map (i.e. $|\overline{G}_\sigma| < \infty$). Denote $O^{p'}(\overline{G}_\sigma)'$ by G, it is called a finite group of Lie type. Let $\overline{T}$ be a maximal σ-invariant torus of $\overline{G}$, then $T := \overline{T} \cap G$ is a maximal torus of G and $N(G,T) := N_{\overline{G}}(\overline{T}) \cap G$ is the algebraic normalizer of T in G. In this talk we specify, when $N(G,T)$ is equal to $N_G(T)$.

Imen Belmokhtar (Queen Mary University of London)
The structure of induced simple modules for 0-Hecke algebras
Provisional Time/Room: Monday afternoon, Physics West Lecture Theatre

ABSTRACT: In this talk we shall be concerned with the 0-Hecke algebra; its irreducible representations were classified and shown to be one-dimensional by Norton in 1979. The structure of a finite-dimensional module can be fully described by computing its submodule lattice. We will discuss how this can be encoded in a generally much smaller poset given certain conditions and state new branching rules in types B and D.

Rudradip Biswas (PhD Student, University of Manchester)
Complete Resolutions and Gorenstein Projectives
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre B

ABSTRACT: Constructing complete resolutions for arbitrary groups is a major challenge. Owing to the works of mathematicians like Farrell, Ikenaga, Kropholler, Cornick we know how to construct complete resolutions for groups belonging to different classes. Ikenaga constructed complete resolutions for groups belonging to what he called the class C_∞ which contained the class comprising of groups with finite virtual cohomological dimension for which complete resolutions had already been constructed . Cornick-Kropholler constructed complete resolutions for groups satisfying some set of other conditions. Some relations between Ikenaga's class and the class of groups satisfying Cornick-Kropholler's conditions were pointed out by Olympia Talelli and Guido Mislin and they made some suggestions on some further equivalences between the classes . Talelli and Fotini Dembegioti later proposed few other related conjectures which , if true, are bound to solve the problem of constructing complete resolutions for groups of type Φ which were first introduced by Talelli. It is known and can be proved easily that there are groups for which complete resolutions cannot be constructed. But it is still a challenge to identify the optimum class of groups for which complete resolutions can be constructed. Complete resolutions of a group are useful also to study stable categories of modules of that group as triangulated categories and I wish to shortly explain why. My talk would mainly be a survey over all the complete resolution results that I mentioned here and I shall end with, if possible, the challenge that lies ahead in settling the question as to exactly which kind of groups admit complete resolutions. If time permits I shall also try to say something about the rich reserve of results that lie in the stable category theory of modules of finite groups courtesy the works of David Benson, Srikanth Iyengar, Henning Krause and others, emulating some of which in the context of stable category of modules of infinite groups forms a part of my current project .

Alexander Bors (University of Salzburg)
Fibers of word maps and composition factors
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre A

ABSTRACT: In recent years, various authors have worked on word maps on groups, in particular their images and fibers. In our talk, we discuss some of our recent results concerning the composition factors of finite groups G for which it is assumed that the word map $w_G : G^d \to G$ of some given word w in d distinct variables has a fiber of positive proportion in G^d.

Henry Bradford (Georg-August-Universität Göttingen)
Short Laws for Finite Groups and Residual Finiteness Growth
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre A

ABSTRACT: A law for a group G is a non-trivial equation satisfied by all tuples of elements in G. We produce new short laws holding (a) in finite simple groups of Lie type and (b) simultaneously in all finite groups of small order. As an application of the latter we obtain a new lower bound on the residual finiteness growth of free groups. Our proofs use, among other things, the Classification of Finite Simple Groups and results on random walks in groups. This talk is based on joint work with Andreas Thom.

John N. Bray (Queen Mary, University of London)
Recognising Suzuki groups
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre B

ABSTRACT: In this talk I describe how to recognise the Suzuki groups, both in the natural representation and in a black box context. This is part of the Group Recognition Project. Joint work with Henrik Bäärnhielm.

Thomas Breuer (Lehrstuhl D für Mathematik, RWTH Aachen University, Germany)
On the Verification of ATLAS Information
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre B

ABSTRACT: I will report on details and side-effects of the recent verification of most of the character tables in the ATLAS of Finite Groups.

Mun See Chang (University of St Andrews)
Computing normalisers in permutation groups
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre B

ABSTRACT: At present time, there is no known general polynomial time algorithm for finding the normaliser $N_G(H)$ of subgroup H in a finite permutation group G. The best solution so far is to use backtrack search to look for the normalising elements. However, the current algorithm does not perform well in certain kinds of groups. This includes the groups that have all orbits of size at most 2. By considering these groups as vector spaces, the performance of the algorithm has been greatly improved. Early results of these groups on 20 points have shown speedups by up to 3 orders of magnitude. In this talk I will demonstrate some tests used in this algorithm to reduce the search size.

Boaz Cohen (The Academic College of Tel-Aviv)
A generalization of the Hall-Witt identity
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre A

ABSTRACT: In this talk we present several families of expressions with an increasing number of variables, which generalize the famous Hall-Witt identity:

$$[x_3, x_1^{-1}], x_2]^{x_1}[[x_1, x_2^{-1}], x_3]^{x_2}[[x_2, x_3^{-1}], x_1]^{x_3} = 1$$

In addition, we give several "recipes" of how to construct a "Hall-Witt type" identities. For instance, we obtain the following "Hall-Witt type" identities with 4 variables:

$$[x_2x_3x_4, x_1][x_3x_4x_1, x_2][x_4x_1x_2, x_3][x_1x_2x_3, x_4] = 1$$

and

$$[x_4^{x_3}[x_4, x_1^{-1}], x_2]^{x_1}[x_1^{x_4}[x_1, x_2^{-1}], x_3]^{x_2}[x_2^{x_1}[x_2, x_3^{-1}], x_4]^{x_3}[x_3^{x_2}[x_3, x_4^{-1}], x_1]^{x_4} = 1,$$

in which the last identity can be though as a 4-variables generalization of the original Hall-Witt identity.

Marston Conder (University of Auckland, New Zealand)
Answer to a 1962 question by Zappa on cosets of Sylow subgroups
Provisional Time/Room: Sunday afternoon, Watson Building Lecture Theatre A

ABSTRACT: In a paper in 1962, Guido Zappa asked whether a non-trivial coset of a Sylow p-subgroup of a finite group could contain only elements whose orders are powers of p. Also he asked whether in that case, the coset could contain at least one element of order p. The first question was raised again recently in a 2014 paper by Daniel Goldstein and Robert Guralnick, when generalising an answer by John Thompson in 1967 to a similar question by L.J. Paige (about whether a non-trivial coset of a Sylow 2-subgroup could contain only elements of even order).

In this talk I'll present a positive answer to both questions of Zappa, showing somewhat surprisingly that in a number of non-abelian finite simple groups, some non-trivial coset of a Sylow 5-subgroup (of order 5) contains only elements of order 5. Also I'll explain how various aspects of Zappa's first question can be used to show that several possibilities for the group and its Sylow p-subgroup P can be eliminated, and hence that $|P| \geq 5$ but $|P| \neq 8$. It is an open question as to whether the order of the Sylow p-subgroup can be 7 or 9 or more.

Leo Creedon (Institute of Technology Sligo)
Units of Group Algebras, their Subgroups and Applications to Coding Theory
Provisional Time/Room: Sunday afternoon, Watson Building Lecture Theatre C

ABSTRACT: The unit group of group algebras will be investigated, along with the subgroup of unitary units. These will be used to create error correcting codes. An $[n, k, d]$ code is a code with length n, rank k and minimum distance d. In [1] a new technique for constructing codes from finite group algebras and circulant matrices is given. This was applied in [2] to construct the extended binary Galoy code (the unique $[24, 12, 8]$ linear block code). Subsequently, in [3] a similar technique was used to construct the self-dual, doubly-even and extremal $[48, 24, 12]$ binary linear block code. These code words can be viewed as either elements of a cyclic group algebra or as elements of a dihedral group algebra. The codes are vector subspaces of the group algebra and the code words are elements of these vector spaces. Here these results are generalised by finding the group of unitary units and using this to construct linear block codes of length $n = 3(2^m)$ for positive whole numbers m which had previously been computationally prohibitive.

References:
[1] Paul Hurley and Ted Hurley. Codes From Zero-Divisors and Units in Group Rings. Int. J. Information and Coding Theory, Vol. 1, No. 1, 2009.
[2] Ian McLoughlin and Ted Hurley. A group ring construction of the extended binary Golay code. IEEE Transactions on Information Theory, 54:4381âĂŞ4383, September 2008.
[3] Ian McLoughlin. A group ring construction of the [48,24,12] type II linear block code. Designs, Codes and Cryptography April 2012, Volume 63, Issue 1, pp 29-41.

M. R. Darafsheh (School of Mathematics, Statistics, and Computer Science, College of Science, University of Tehran, Tehran, Iran)
On rational irreducible characters of finite groups
Provisional Time/Room: Sunday afternoon, Watson Building Lecture Theatre B

ABSTRACT: A finite group G is called rational or a $\mathbb{Q}$-group, if $\chi(x) \in \mathbb{Q}$ for all irreducible character χ and every element x of G. Structure of a finite $\mathbb{Q}$-group is complicated and is not completed yet. In this paper we survey recent results on classifying $\mathbb{Q}$-groups.

Ryan Davies (University Of Birmingham)
An Introduction to reduction theorems: Refining Brauer's Induction Theorem
Provisional Time/Room: Monday afternoon, Physics West Lecture Theatre

Abstract:

Brauer's Induction Theorem states that every irreducible character of a finite group G can be expressed as a $\mathbb{Z}$-linear combination of induced generalised characters from elementary subgroups.

Continuing the recent trend of Global-Local Conjectures in Representation Theory, we intend to replace the collection of elementary subgroups in the above theorem by subgroups of index divisible by the p-part of the character degree. In this talk, I will give an introduction to reduction theorems in Representation Theory and the techniques used to prove them and some results.

Emerson Ferreira de Melo (University of Brasília)
Coprime automorphisms acting with nilpotent centralizers
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre C

Abstract: Let p be a prime and P a p-group of exponent p acting by automorphisms on a finite p'-group G. In this talk, we show that if $|P| \geq p^3$ and $C_G(x)$ is nilpotent of class at most c for any $x \in A^{\#}$, then G is nilpotent with class bounded solely in terms of c and p.

Marian Deaconescu (Kuwait University)
Commutators and actions in finite groups
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre A

Abstract:

I will report on recent joint work with Gary Walls. If G is a finite group and if the finite group A acts on G via automorphisms, we define a measure for the subsets of G which depends on the action of A on G. For a subset S of G we define $m(S) = |\{(x, a) \in G \times A \mid [x, a] \in S\}|$.

This simple idea has many important consequences. For example, we have a formula for the number of elements in a normal subgroup of G which are not commutators in G. It also follows that if an element $g \in G$ belongs to the kernels of more than half of the irreducible complex characters of G ,then every element of the normal closure of $\langle g \rangle$ is a commutator in G. Characterizations of the finite abelian groups and of the finite nilpotent groups of class at most two are obtained in terms of numerical invariants.

Alla Detinko (University of St Andrews)
Zariski density and algorithms for infinite linear groups
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre B

Abstract: We present new methods and algorithms for computing with finitely generated linear groups. These rely on the theory of Zariski dense subgroups of linear algebraic groups. Special consideration will be given to applications of algorithms to practical computing and mathematical experiments.

Florian Eisele (City, University of London)
Tame blocks
Provisional Time/Room: Monday morning, Poynting Building Small Lecture Theatre

ABSTRACT: I will give a quick walk-through of old and new results on tame blocks, that is, 2-blocks of finite groups of dihedral, semi-dihedral or quaternion defect. I will cover results determining the structure of such blocks over a discrete valuation ring, and results on their group of derived auto-equivalences which are an application of the fairly recent theory of τ-tilting modules. In the last few minutes I am going to give an overview of some of the problems that are yet to be solved.

Gülin Ercan (Middle East Technical University)
Groups of automorphisms with TNI-centralizers
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre C

ABSTRACT: A subgroup H of a finite group G is called a TNI-subgroup if $N_G(H) \cap H^g = 1$ for any $g \in G \setminus N_G(H)$. Let A be a group acting on G by automorphisms where $C_G(A)$ is a TNI-subgroup of G. We prove that G is solvable if and only if $C_G(A)$ is solvable, and determine some bounds for the nilpotent length of G in terms of the nilpotent length of $C_G(A)$ under some additional assumptions. We also study the action of a Frobenius group FH of automorphisms on a group G if the set of fixed points $C_G(F)$ of the kernel F forms a TNI-subgroup, and obtain a bound for the nilpotent length of G in terms of the nilpotent lengths of $C_G(F)$ and $C_G(H)$. This is a joint work with İsmail Ş. Güloğlu.

Fuat Erdem (Middle East Technical University)
Hamiltonian cycles in the generating graphs of the alternating and symmetric groups
Provisional Time/Room: Friday morning, Physics West Lecture Theatre

ABSTRACT: The generating graph of a finite group G, denoted by $\Gamma(G)$, is the graph on the non-identity elements of G in which two distinct vertices are joined by an edge if and only if they generate G. An important problem in this area is the following: For which groups G does there exist a Hamiltonian cycle in $\Gamma(G)$? (A Hamiltonian cycle in a graph is a cycle that visits each vertex exactly once.)

The existence of a Hamiltonian cycle in the generating graph has been proven by several authors for solvable groups, sufficiently large finite simple groups, sufficiently large symmetric groups, and the groups $S \wr Cn$, where S is a sufficiently large nonabelian finite simple group and n is a prime power. In this talk, we show that $\Gamma(A_n)$ and $\Gamma(S_n)$ contain a Hamiltonian cycle with an explicit lower bound on n.

This is joint work with Attila Maróti.

Ben Fairbairn (Birkbeck, University of London)
Beauville groups: they're bigger thank you think!
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre A

ABSTRACT: We discuss a number of conjectures relating to the question of which finite groups are Beauville groups. In particular we correct a spectacularly incorrect error published by the speaker and use the alternating group Alt(7) to quantify the extent to which he's been an idiot.

Joanna B. Fawcett (University of Cambridge)
Partial linear spaces with a primitive rank 3 automorphism group of affine type
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre A

Abstract: Partial linear spaces are incidence geometries that generalise both linear spaces and graphs. If G is the automorphism group of a partial linear space that is not a linear space, then G is transitive on pairs of collinear points as well as pairs of non-collinear points precisely when G is transitive of rank 3; if G is also primitive and finite, then G is of almost simple, grid or affine type. In this talk, we will discuss some recent progress on classifying such partial linear spaces in the affine case. This is joint work with John Bamberg, Alice Devillers and Cheryl Praeger.

Benjamin Fine (Fairfield University, Fairfield, CT 06824)
One-Relator Groups:An Overview
In honor of Gilbert Baumslag
Provisional Time/Room: Monday afternoon, Poynting Building Large Lecture Theatre

Abstract: One relator groups have always played a fundamental role in combinatorial group theory. This is true for a variety of reasons. From the viewpoint of presentations they are the simplest groups after free groups which they tend to resemble in structure. Secondly as a class of groups they have proved to be somewhat amenable to study. However most importantly is that they arise naturally in the study of low-dimensional topology, specifically as fundamental groups of two-dimensional surfaces. In 1985 Gilbert Baumslag gave a short course on one-relator groups which provided a look at the subject up to that point. In this talk we update the massive amount of work done over the past three decades. we look at the important connections with surface groups and elementary theory, and describe the surface group conjecture and the Gromov conjecture on surface subgroups. We look at the solution by D. Wise of Baumslag's residual finiteness conjecture and discuss a new Baumslag conjecture on virtually free-by-cylic groups. We examine various amalgam decompositions of one-relator groups and what are called the Baumsag-Shalen conjectures. We then look at a series of open problems in one-relator group theory and their status. Finally we introduce a concept called planarity based on the Magnus breakdown of a one-relator group which might provide a systematic approach to the solution of problems in one-relator groups.

Eric M Freden (Southern Utah University)
Aspects of growth in Baumslag-Solitar groups
Provisional Time/Room: Monday afternoon, Watson Building Lecture Theatre A

Abstract: We show that the asymptotic growth rate for the standard presentation of $BS(2,4)$ is the same as that of its Bass-Serre tree. We provide estimates for this number and consider generalizations to $BS(p,q)$, $1 < p < q$.

Alexey Galt (Novosibirsk State University, Sobolev Institute of Mathematics)
On splitting of the normalizer of a maximal torus in groups of Lie type
Provisional Time/Room: Monday afternoon, Watson Building Lecture Theatre C

ABSTRACT: The problem of splitting of the normalizer of a maximal torus was stated by J.Tits. Let $\overline{G}$ be a simple connected linear algebraic group over an algebraically closed field $\overline{\mathbb{F}}_p$ of positive characteristic p. Let σ be a Steinberg endomorphism and $\overline{T}$ a maximal σ-invariant torus of $\overline{G}$. It's well known that all maximal tori are conjugate in $\overline{G}$ and a quotient $N_{\overline{G}}(\overline{T})/\overline{T}$ is isomorphic to the Weyl group of $\overline{G}$. The natural question is to describe all groups $\overline{G}$, in which $N_{\overline{G}}(\overline{T})$ splits over $\overline{T}$. The similar question arises in finite simple groups of Lie type. We will discuss the progress in these questions.

Oihana Garaialde Ocaña (Heinrich-Heine Universität Düsseldorf)
Cohomology of finite p-groups and the coclass theory
Provisional Time/Room: Friday morning, Poynting Building Small Lecture Theatre

ABSTRACT: This talk deals with the cohomology algebras of the finite p-groups. The first explicit computations of such cohomology algebras were those of the finite abelian p-groups. Later computations, however, exhibited the complexity of such algebras and in many cases, computational calculations are the only indications we have.

Motivated by the classification of the finite p-groups by means of their coclass (recall that a p-group of size p^n and nilpotency class r has coclass $n-r$), J.F. Carlson proved the following result: Let c be an integer. Then, there are only finitely many isomorphism types of cohomology algebras for the finite 2-groups of coclass c.

In the same paper, he conjectures that the analogous result should hold for the p odd case. In this talk, we shall mention the main ingeredients to give a (partial) proof of the above conjecture. This is a joint work with A. Díaz Ramos and J. González-Sánchez.

Martino Garonzi (University of Brasília (UnB))
Factorizing finite primitive groups with point stabilizers
Provisional Time/Room: Tuesday morning, Poynting Building Small Lecture Theatre

ABSTRACT: A permutation group G acting faithfully on a set Ω with n points ($|\Omega| = n$ is called the "degree" of G) is said to be "primitive" if there is no non-trivial partition of Ω stabilized by G, in other words if B is a subset of Ω with the property that $B^g = B$ or $B^g \cap B = \emptyset$ for all $g \in G$ (making the union $\bigcup_{g\in G} B^g$ a partition of Ω stabilized by G) then either $|B| = 1$ or $B = \Omega$ (B stands for "block"). A "point stabilizer" of this action is $M = \{g \in G \ : \ \alpha^g = \alpha\}$ where $\alpha \in \Omega$ is a fixed element. Such M is a maximal subgroup of G with trivial core (the intersection of the conjugates of M is trivial).

In a joint work with D. Levy, A. Maróti and I. Simion we proved that there exists a universal constant c such that any finite primitive permutation group of degree n with a non-trivial point stabilizer is a product of no more than $c \log n$ point stabilizers.

An equivalent (and more "abstract") formulation of this result is the following: for every finite group G and every maximal subgroup M of G, G is a product of at most $c \log |G : M|$ conjugates of M.

In this talk I will explain the main ideas of the proof of this result.

Alejandra Garrido (University of Düsseldorf)
Primitive groups of intermediate word growth
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre A

ABSTRACT: Studying the permutation actions of a group is a fundamental way to gain insight into the group. Since primitive actions form the basic building blocks of permutation actions, these should arguably be the starting point. In the case where the group is countably infinite, one can ask whether there are any primitive actions on infinite sets; that is, whether there are any maximal subgroups of infinite index. The study of maximal subgroups of countably infinite finitely generated groups has so far mainly concerned classes of groups which are either "small" or "big" in the sense that their word growth is either polynomial (and in this case all maximal subgroups are of finite index) or exponential (and in this case there are uncountably many maximal subgroups of infinite index). It is natural to investigate this question for groups of intermediate word growth, for instance, some groups of automorphisms of rooted trees.

I will report on some joint work with Dominik Francoeur (University of Geneva) where we show that some such groups of intermediate word growth have exactly countably many maximal subgroups of infinite index. In particular, we show that they are primitive groups of intermediate word growth.

Michael Giudici (The University of Western Australia)
2-arc-transitive digraphs
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre A

ABSTRACT: An s-arc in a digraph Γ is a sequence $v_0, v_1, \ldots, v_s$ of vertices such that for each i the pair (v_i, v_{i+1}) is an arc of Γ. There are several important differences between the study of s-arc-transitive graphs and s-arc transitive digraphs. For example, there are no 8-arc-transitive graphs of valency at least 8, while for every positive integer s there are infinitely many digraphs of valency at least three that are s-arc-transitive but not $(s+1)$-arc transitive. In this talk I will discuss recent work with Cai Heng Li and Binzhou Xia on characterising vertex-primitive 2-arc-transitive digraphs.

Stephen Glasby (Center for the Mathematics of Symmetry and Computation, University of Western Australia)
How many composition factors of order p are there in a completely reducible subgroup of $\mathbf{GL}(d, p^f)$?
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre B

ABSTRACT: Let $q = p^f$, and let G be a completely reducible subgroup of $\mathrm{GL}(d, q)$ with r irreducible constituents. The number, $c_p(G)$, of composition factors of G of prime order p, satisfies

$$c_p(G) \leqslant \frac{\varepsilon_q d - r}{p - 1}$$

where ε_q is a function of q with $1 \leqslant \varepsilon_q \leqslant \frac{3}{2}$. For every choice of $q = p^f$ and r, we give infinitely many completely reducible groups $G_1, G_2, \ldots$, where $G_i \leqslant \mathrm{GL}(d_i, q)$ for each $i \geqslant 1$, for which this bound is an equality. This is joint work with Michael Giudici, Cai Heng Li and Gabriel Verret.

Valentina Grazian (University of Aberdeen)
Fusion systems containing pearls
Provisional Time/Room: Monday morning, Poynting Building Small Lecture Theatre

ABSTRACT: In finite group theory, the word *fusion* refers to the study of conjugacy maps between subgroups of a group. The modern way to solve problems involving fusion is via the theory of fusion systems. A saturated fusion system on a p-group S is a category whose objects are the subgroups of S and whose morphisms are monomorphisms between subgroups which satisfy certain axioms. To classify saturated fusion systems $\mathcal{F}$ on S, we first need to determine the so-called $\mathcal{F}$-essential subgroups of S. These are self-centralizing subgroups of S whose automorphism group has a restricted structure.

If p is an odd prime and $\mathcal{F}$ is a saturated fusion system on the p-group S, we call *pearls* the $\mathcal{F}$-essential subgroups of S that are isomorphic either to the abelian group $\mathrm{C}_p \times \mathrm{C}_p$ or to the extraspecial group of order p^3 and exponent p. In this talk we present new results about fusion systems containing pearls.

Scott Harper (University of Bristol)
$\frac{3}{2}$-Generation of Finite Groups
Provisional Time/Room: Monday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: It is well-known that every finite simple group can be generated by two elements. Moreover, two arbitrary elements are very likely to generate the whole group. For example, every non-identity element of a finite simple group belongs to a generating pair. Groups with the latter property are said to be $\frac{3}{2}$-generated. It is natural to ask which other finite groups are $\frac{3}{2}$-generated. In 2008, Breuer, Guralnick and Kantor conjectured that a finite group is $\frac{3}{2}$-generated if and only if every proper quotient of the group is cyclic. In this talk we will discuss recent progress towards establishing this conjecture, where probabilistic techniques play a key role.

Sumana Hatui (Harish-Chandra Research Institute, Allahabad, India)
Schur multiplier of central product of groups
Provisional Time/Room: Sunday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: Let G be a central product of two groups H and K. We study second cohomology group of G, having coefficients in a divisible abelian group D with trivial G-action, in terms of the second cohomology groups of certain quotients of H and K. In particular, for $D = \mathbb{C}^*$, some of our results provide a refinement of results from [Wiegold, J., Some groups with non-trivial multiplicators, Math. Z. **120** (1971), 307-308] and [Eckmann, B., Hilton, P. J. and Stammbach, U., On the Schur multiplicator of a central quotient of a direct product of groups, J. Pure Appl. Algebra **3** (1973), 73-82].
This is a joint work with Manoj K. Yadav and L.R. Vermani.

Marcel Herzog (Tel-Aviv University, Tel-Aviv, Israel)
Sums of element orders in finite groups
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre A

ABSTRACT: Let G denote a finite group and let $\psi(G)$ denote the sum of element orders of G. This talk deals with recent results of Patrizia Longobardi, Mercede Maj and myself concerning the maximal value of $\psi(G)$ for non-cyclic groups G of order n. We proved, in particular, the following two main theorems. Theorem 1: If $|G| = n$, G is non-cyclic and C_n denotes the cyclic group or order n, then $psi(G) \leq \frac{7}{11}\psi(C_n)$. This result is best possible, since for all integers n satisfying $n = 4k$ for some odd integer k, there exists a non-cyclic group G of order n, satisfying $\psi(G) = \frac{7}{11}\psi(C_n)$. Theorem 2: If $|G| = n$, G is non-cyclic and q is the minimal prime divisor of n, then $\psi(G) < \frac{1}{q-1}\psi(C_n)$. In particular, if G is of odd order, then $\psi(G) < \frac{1}{2}\psi(C_n)$. Our results improve the results of Habib Amiri, S, M, Jafarian Amiri and Martin Isaacs from 2009, where they proved that if G is a non-cyclic group of order n, then $\psi(G) < \psi(C_n)$.

Waldemar Hołubowski (Silesian University of Technology, Gliwice, Poland)
Groups and Lie algebras of infinite matrices
Provisional Time/Room: Sunday morning, Poynting Building Small Lecture Theatre

ABSTRACT: In our talk we will give a survey of recent results and Lie algebras of infinite matrices. We will focus on normal subgroups, direct and inverse limints, ideals and derivations. Our aim is to show which results for finite matrices can be extended to infinite ones. We also give examples showing connections between group theory and Lie algebra theory for infinite matrices.

Erzsébet Horváth (Budapest University of Technology and Economics)
Depth in finite groups
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre C

ABSTRACT: The notion of depth is coming from von-Neumann algebras. The depth in semisimple algebras, in particular, ordinary depth in group algebras was first investigated in papers by Burciu, Kadison, Külshammer, Boltje and Danz. Fritzsche was investigating the depth of subgroups of $PSL(2, q)$. In two joint papers with L. Héthelyi and F. Petényi we determined the depth of maximal subgroups of Suzuki groups and Ree groups. Now we investigate some examples when even depth can occur.

Alexander Hulpke (Colorado State University)
Calculations with Matrix Groups over Rings and Applications to Arithmetic Groups
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre B

ABSTRACT: I will describe how to extend the framework of matrix group recognition to allow for calculations with matrix groups over residue class rings Z/mZ for composite m. Using this framework we then study subgroups of integral matrices that have finite index in $SL_n(Z)$ or $SP_n(Z)$ through their finite congruence quotients. Structural information about these quotients allows for computation of the index in characteristic zero.

This is joint work with Alla Detinko (St. Andrews) and Dane Flannery (Galway).

Stephen Humphries (Department of Mathematics, Brigham Young University, Provo, UT 84602, U.S.A.)
Difference sets disjoint from a subgroup
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre A

ABSTRACT: We study finite groups G having a subgroup H and $D \subset G \setminus H$ such that the multiset $\{xy^{-1} : x, y \in D\}$ has every non-identity element occur the same number of times (such a D is called a *difference set*). We show that H has to be normal, that $|G| = |H|^2$, and that $|D \cap Hg| = |H|/2$ for all $g \notin H$. We show that H is contained in every normal subgroup of prime index, and other properties. We give a 2-parameter family of examples of such groups. We show that such groups have Schur rings with four principal sets.

Michael A. Jackson (Grove City College, USA)
The strong symmetric genus of almost all D-type generalized symmetric groups
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre C

ABSTRACT: The strong symmetric genus of a finite group G is the smallest genus of a closed orientable topological surface on which G acts faithfully as a group of orientation preserving symmetries. A generalized symmetric group is a wreath product of a cyclic group of m elements by the symmetric group on n letters, $G(n, m) = C_m \wr S_n$. The D-type generalized symmetric groups are the index m subgroups of $G(n, m)$ given by $D(n, m) = (C_m)^{n-1} \rtimes S_n$. The strong symmetric genus for the alternating and symmetric groups was found by Marston Conder. The author has previously found the strong symmetric genus of the generalized symmetric groups of type $G(n, 2)$, also known as the hyperoctahedral groups, and the D-type generalized symmetric groups $D(n, 2)$, which are the D_n-type finite Coxeter groups. In this talk we will give the strong symmetric genus all but finitely many $D(n, m)$ for each $m > 2$. These results are achieved using coset diagrams of Marston Conder and Brent Everitt.

Luise-Charlotte Kappe (Binghamton University)
A GAP-conjecture and its solution: isomorphism classes of capable special p-groups of rank 2
Provisional Time/Room: Friday morning, Poynting Building Small Lecture Theatre

ABSTRACT: A group is said to be capable if it is a central quotient group, and a p-group is special of rank 2 if its center is elementary abelian of rank 2 and equal to its commutator subgroup. In 1990, Heineken showed that if G is a capable special p-group of rank 2, then $p^5 \leqslant |G| \leqslant p^7$. Over a decade ago, we asked GAP to determine the number of isomorphism classes of capable special p-groups of rank 2 for small primes p. GAP told us that, in these cases, the number of isomorphism classes of special p-groups of rank 2 grows with p. However, for the capable among them, the number of isomorphism classes is independent of the prime p. Finally, we were able to show that what GAP conjectured is true for all primes p. This is joint work with H. Heineken and R.F. Morse.

Thomas Michael Keller (Texas State University)
Small quotients of finite groups
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre B

ABSTRACT: Let G be a finite group and V a finite faithful irreducible G-module. In joint work with Yong Yang we examined upper bounds for the size of the abelian quotient $|G/G'|$ in terms of the action on $|V|$. It had been known that $|G/G'|$ is bounded above by $|V|$, and we strengthened this by proving that $|G/G'|$ is bounded above by the largest orbit size of G on $|V|$. We also looked at the next step and considered what might be said for the class 2 quotient of the group, i.e., the largest factor group of G which is of nilpotence class 2. Do similar results hold for this larger quotient?

Nayab Khalid (University of St Andrews)
Rearrangement Groups of Connected Spaces
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre C

ABSTRACT: We define groups of homeomorphisms of self-similar topological spaces - 'rearrangement groups'. We study which properties these groups inherit from the topological space they act on. In particular, we discuss how we can find a generating set for such groups that stems from the basic open sets of the topological space.

Ann Kiefer (Universität Bielefeld)
Generators for discrete subgroups of 2-by-2 matrices over rational quaternion algebras
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre B

ABSTRACT: In [1], we developed an algorithm to determine generators for discrete subgroups of quaternion division algebras over quadratic imaginary extensions of $\mathbb{Q}$ or discrete subgroups of 2-by-2 matrices over quadratic extensions of $\mathbb{Q}$. These groups act discontinuously on hyperbolic 3-space and the algorithm constructs a fundamental domain to find a set of generators.

In this work we generalize this algorithm to 2-by-2 matrices over the group of invertible elements of a Clifford algebra. The group of such matrices acts discontinuously on an n-dimensional hyperbolic space.

Via an exceptional isomorphism, we obtain generators of an order in 2-by-2 matrices over the rational quaternion algebra.

References

[1] E. Jespers, S.O. Juriaans, A. Kiefer, A. De A. E Silva, A.C. Souza Filho, *From the Poincaré Theorem to generators of the unit group of integral group rings of finite groups*, Math. Comp. **84(293)** (2015), 1489âĂŞ1520.

Carlisle King (Imperial College London)
Generation of finite simple groups
Provisional Time/Room: Saturday morning, Poynting Building Small Lecture Theatre

ABSTRACT: Given a finite simple group G, it is natural to ask how many elements are needed to generate G. It has been shown that all finite simple groups are generated by a pair elements. A natural refinement is then to ask whether the orders of the generating elements may be restricted: given a pair of integers (a,b), does there exist a pair of elements (x,y) generating G with x of order a and y of order b? If such a pair exists, we say G is (a,b)-generated. I will explore some past results regarding (2,3)-generation as well as a new result.

Dessislava Kochloukova (State University of Campinas)
Growth of homology in soluble groups
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre A

ABSTRACT: Let G be a finitely generated nilpotent-by-abelian group. We are interested under which conditions, the j-th homology $H_j(M, \mathbb{Q})$ of a subgroup of finite index M in G, is finite dimensional and whether $vb_j(G) = \sup_M \dim_{\mathbb{Q}} H_j(M, \mathbb{Q})$ is finite for all $j \leq m$. One natural condition is to require that G is of homological type FP_n and this forces all homology groups $H_j(M, \mathbb{Q})$ to be finite dimensional for $j \leq n$. By definition a group G has a homological type FP_n if the trivial $\mathbb{Z}G$-module $\mathbb{Z}$ has projective resolution with projectives finitely generated in dimension $\leq n$.

We will discuss some recent results of the speaker with Martin Bridson, Fatemeh Mokari and Aline Pinto that describe some cases when $vb_j(G)$ is finite. This includes some results on pro-p version of the problem.

BRIDSON, M. ; KOCHLOUKOVA, D. H. . The torsion-free rank of homology in towers of soluble pro-p groups. Israel Journal of Mathematics, v. 219, p. 817-834, 2017

BRIDSON, M. ; KOCHLOUKOVA, D. H. . The virtual first Betti number of soluble groups. Pacific Journal of Mathematics, v. 274, p. 497-510, 2015

KOCHLOUKOVA, D. H.; MOKARI, F. Y. . Virtual rational Betti numbers of abelian-by-polycyclic groups. Journal of Algebra, v. 443, p. 75-98, 2015.

KOCHLOUKOVA, D.H.; PINTO, A., submitted preprint

Anatoly S. Kondrat'ev (N.N. Krasovskii Institute of Mathematics and Mechanics of UB RAS and Ural Federal University, Ekaterinburg, Russia)

Stabilizers of vertices of graphs with primitive automorphism groups and a strong version of the Sims conjecture

Provisional Time/Room: Monday morning, Watson Building Lecture Theatre A

Abstract: This talk is based on joint works with Vladimir I. Trofimov.

In the mid 1960s, Ch. Sims stated the following conjecture: There exists a function $\varphi : \mathbb{N} \longrightarrow \mathbb{N}$ such that, if G is a primitive permutation group on a finite set X, G_x is the stabilizer in G of a point x from X, and d is the length of any G_x-orbit on $X \setminus \{x\}$, then $|G_x| \leq \varphi(d)$.

Some progress toward to prove this conjecture had been obtained in papers of Sims (1967)), Thompson (1970), Wielandt (1971), Knapp (1973, 1981)), Fomin (1980). But only with the use of the classification of finite simple groups, the validity of the conjecture was proved by Cameron, Praeger, Saxl and Seitz (1983).

The Sims conjecture can be formulated using graphs as follows. For an undirected connected graph Γ (without loops or multiple edges) with vertex set $V(\Gamma)$, $G \leq Aut(\Gamma)$, $x \in V(\Gamma)$, and $i \in \mathbb{N} \cup \{0\}$, denote by $G_x^{[i]}$ the elementwise stabilizer in G of the (closed) ball of radius i of the graph Γ centered at x in the natural metric d_Γ on $V(\Gamma)$. Then the Sims conjecture is equivalent to the following statement: There exists a function $\psi : \mathbb{N} \cup \{0\} \longrightarrow \mathbb{N}$ such that, if Γ is an undirected connected finite graph and G is its automorphism group acting primitively on $V(\Gamma)$, then $G_x^{[\psi(d)]} = 1$ for $x \in V(\Gamma)$, where d is the valency of the graph Γ.

The speaker jointly with Trofimov in 1999 obtained the following strengthened version of the Sims conjecture: If Γ is an undirected connected finite graph and G its automorphism group acting primitively on $V(\Gamma)$, then $G_x^{[6]} = 1$ for $x \in V(\Gamma)$.

New we investigate the more general problem of describing all pairs (Γ, G), where Γ is an undirected connected finite graph, G is its automorphism group acting primitively on $V(\Gamma)$ and $G_x^{[2]} \neq 1$ for $x \in V(\Gamma)$.

The aim of the talk is to discuss obtained results.

Acknowledgement. The work was supported by Russian Science Foundation (Grant 14-11-00061-P).

R. Kwashira (University of the Witwatersrand, Johannesburg, DST-NRF Centre of Excellence in Mathematical and Statistical Sciences (CoE-MaSS))

Non-cancellation group of a direct product

Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre C

Abstract: Consider the semidirect product $G_i = \mathbb{Z}_{n_i} \rtimes_{\omega_i} \mathbb{Z}$. In literature, we find methods for computation of the non-cancellation groups $\chi(G_1 \times G_2)$ and $\chi(G_i^k)$, $k \in \mathbb{N}$. In this talk, we are going to develop a general method of computing $\chi(G_1 \times G_2, h)$, where $h : F \hookrightarrow G_1 \subseteq G_1 \times G_2$ and F a finite group.

Melissa Lee (Imperial College London)
Bases, Pyber's conjecture and quasisimple groups.
Provisional Time/Room: Tuesday morning, Poynting Building Small Lecture Theatre

ABSTRACT: A *base* B for a permutation group acting faithfully on a set Ω is a subset of Ω with the property that the only permutation to fix every element of B is the identity. We are often interested in the smallest possible size of a base, called the *base size* and denoted $b(G)$. Pyber conjectured in 1993 that there exists an absolute constant c, such that for a primitive permutation group G, $b(G)$ is bounded above by $c \log |G| / \log n$, where n is the degree of the action. In this talk, I will discuss the proof of Pyber's conjecture, which was recently completed by Duyan, Halasi and Maróti, and describe some improvements on the bounds given in this proof, especially in the context of quasisimple groups.

Xianhua Li (Soochow University)
A characterization of finite simple groups by the order and graph
Provisional Time/Room: Monday afternoon, Watson Building Lecture Theatre C

ABSTRACT: The characterization of finite simple groups are given by their orders and graphs.

Paula Lins (Universität Bielefeld)
Bivariate zeta functions of groups associated to unipotent group schemes
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre A

ABSTRACT: Zeta functions of groups are important tools in asymptotic group theory. We introduce two zeta functions on two variables, namely the bivariate conjugacy class and the representation zeta functions of groups of rational points of unipotent group schemes over rings of integers of number fields. We will discuss about some properties of these zeta functions such as Euler product decomposition, rationality and functional equation.

Patrizia Longobardi (Università degli Studi di Salerno - Italy)
Small doubling properties in orderable groups
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre B

ABSTRACT: A finite subset S of a group G is said to satisfy the *small doubling property* if $|S^2| \leq \alpha|S| + \beta$, where α and β denote real numbers, $\alpha > 1$ and $S^2 = \{s_1 s_2 \mid s_1, s_2 \in S\}$.

Our aim in this talk is to investigate the structure of finite subsets S of *orderable groups* satisfying the small doubling property with $\alpha = 3$ and small $|\beta|$'s, and also the structure of the subgroup generated by S. This is a step in a program to extend the classical Freiman's inverse theorems (see [1]) to nonabelian groups.

References

[1] G.A. Freiman, *Foundations of a structural theory of set addition*, Translations of mathematical monographs, **37**, Amer. Math. Soc., Providence, Rhode Island, 1973.

[2] G.A. Freiman, M. Herzog, P. Longobardi, M. Maj, Small doubling in ordered groups, *J. Austral. Math. Soc.*, **96** (2014), no. 3, 316-325.

[3] G.A. Freiman, M. Herzog, P. Longobardi, M. Maj, Y.V. Stanchescu, Direct and inverse problems in Additive Number Theory and in non-abelian group theory, *European J. Combin.*, **40** (2014), 42-54.

[4] G.A. Freiman, M. Herzog, P. Longobardi, M. Maj, Y.V. Stanchescu, A small doubling structure theorem in a Baumslag-Solitar group, *European J. Combin.*, **44** (2015), 106-124.

[5] G.A. Freiman, M. Herzog, P. Longobardi, M. Maj, A. Plagne, D.J.S. Robinson, Y.V. Stanchescu, On the structure of subsets of an orderable group with some small doubling properties, *J. Algebra*, **445** (2016), 307-326.

[6] G.A. Freiman, M. Herzog, P. Longobardi, M. Maj, A. Plagne, Y.V. Stanchescu, Small doubling in ordered groups: generators and structure, *Groups, Geometry, and Dynamics*, to appear.

[7] G.A. Freiman, M. Herzog, P. Longobardi, M. Maj, Y.V. Stanchescu, Small doubling in ordered nilpotent groups of class 2, *European Journal of Combinatorics*, to appear.

K. Magaard (University of Birmingham)
Maximal Subgroups of Finite Classical Groups
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre B

Abstract: The maximal subgroup problem is central to finite group theory and has wide ranging applications in number theory and geometry. Evidently the general maximal subgroup problem for finite groups requires the classification of the maximal subgroups of the finite almost simple groups and the determination of the cohomology groups $H^1(G, V)$ for all quasisimple G and all irreducible $\mathbb{F}_pG$-modules V and all primes p. The converse; i.e. that the solution of these two problems is also sufficent for solving the general maximal subgroup problem, is due to Aschbacher O'Nan Scott.

The primary open problem in the classification of the maximal subgroups of the finite almost simple groups is the determination of the overgroups of finite quasisimple groups which act irreducibly on the natural module of a finite classical group. Recent advances in the representation theory of the finite quasisimple groups have opened up pathways to settling these. I will illustrate this with a series of examples.

Arturo Magidin (University of Louisiana at Lafayette)
When is the lattice of closure operators on a subgroup lattice again a subgroup lattice?
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre A

Abstract: (Joint work with Martha L.H. Kilpack) It is known that every complete algebraic lattice can be realized as either a sublattice of the lattice of subgroups of a group G, or as an interval in such a lattice. On the other hand, not all can be realized as the subgroup lattice of a group. Given a class of lattices, we may ask which of those lattices are isomorphic to the subgroup lattice of a group, and also what types of groups may so occur.

Given the lattice L of subgroups of a group G, we consider the lattice of (algebraic) closure operators on L, and ask whether this lattice is isomorphic to the lattice of subgroups of some group. For groups with torsion (including all finite groups) we completely settle the question: the lattice of (algebraic) closure operators on the subgroups of G form a subgroup lattice if and only if G is either cyclic of prime power order, or isomorphic to the Püfer p-group.

Mercede Maj (Università degli Studi di Salerno - Italy)
On a finiteness conditions on non-abelian subgroups
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre C

Abstract: Many authors have considered the problem to get information about a group G assuming that some family of its subgroups satisfies a given property $\mathcal{P}$; in particular when $\mathcal{P}$ is a finiteness condition (see for instance $[1]-[4]$ and $[6]-[9]$).

Our aim in this talk is to discuss some new results, jointly obtained in [5] with Leonid Kurdachenko, Patrizia Longobardi and Igor Subbotin, concerning classes of groups G which have finitely many non-isomorphic non-abelian subgroups.

References

[1] S.N. Černikov, *Infinite groups with prescribed properties of their systems of infinite subgroups*, Dokl. Akad. Nauk SSSR, **159** (1964) 759-760 (Russian), Soviet Math. Dokl., **5** (1964) 1610-1611.

[2] S.N. Černikov, *Groups with given properties of systems of infinite subgroups*, Ukrain. Mat. Ž, **19** (1967) 111-131 (Russian), Ukrainian Math. J., **19** (1967) 715-731.

[3] M.R. Dixon, L.A. Kurdachenko, *Groups with the maximum condition on non-nilpotent subgroups*, J. Group Theory **4** (2001), 75-87.

[4] M.R. Dixon, L.A. Kurdachenko *Locally nilpotent groups with the maximum condition on non-nilpotent subgroups*, Glasgow Math. J. **43** (2001), 85-102.

[5] L.A. Kurdachenko, P. Longobardi, M. Maj, I.Ya Subbotin, *Groups with finitely many types of non-isomorphic non-abelian subgroups*, in preparation.

[6] L.A. Kurdachenko, D.I. Zaicev, *Groups with the maximum condition for non-abelian subgroups*, Ukrain. Mat. Zh. **43** (1991), 925-930 (Russian), English transl., Ukrainian Math. J. **43** (1991), 863-868.

[7] A.I. Mal'cev, *On certain classes of infinite soluble groups*, Mat. Sb. **28** (1951), 567-588 (Russian), Amer. Math. Soc. Transl. (2) **2** (1956), 1-21.

[8] O.J. Schmidt, *Infinite soluble groups*, Mat. Sb., **17(59)** (1945), 145-162 (Russian).

[9] H. Smith, J. Wiegold, *Groups which are isomorphic to their non-abelian subgroups*, Rend. Math. Univ. Padova **97** (1997), 7-16.

Philani Rodney Majozi (University of Zululand)
Extending Huppert's Conjecture from Non-Abelian Simple Groups to Quasi-Simple Groups
Provisional Time/Room: Saturday morning, Physics West Lecture Theatre

Abstract: We propose to extend a conjecture of Bertram Huppert in Illinois J. Math. **44** (2000) from finite non-abelian simple groups to finite quasi-simple groups. Specifically, we conjecture that if a finite group G and a finite quasi-simple group H with $Mult(H/Z(H))$ cyclic have the same set of irreducible character degrees (not counting multiplicity), then G is isomorphic to a central product of H and an abelian group. We present a pattern to approach this extended conjecture and, as a demonstration, we confirm it for the special linear groups in dimensions 2 and 3.

Co-authors: N. H. Nguyen, H.P. Tong-Viet and T.P. Wakefield

Andrey Mamontov (Novosibirsk State University, Sobolev Institute of Mathematics)
On recognizing finite simple groups by element orders in the class of all groups
Provisional Time/Room: Friday morning, Physics West Lecture Theatre

Abstract:

Denote by $\omega(G)$ the set of element orders of G, assuming that G is periodic. There is a natural question: if we know the set of numbers $\omega = \omega(G)$ then can we recover G? Restrict it to the case when $\omega(G) = \omega(H)$ for some finite simple group H. It is well studied if G is assumed to be finite apriori, and related to the corresponding Burnside problem in general case. Precisely, the following groups are known to be recognizable by their set of element orders in the class of all groups: $L_2(2^m)$, $L_2(7) \simeq L_3(2)$, $L_3(4)$. In the talk we discuss current progress and techniques.

Leo Margolis (University of Murcia)
Zassenhaus Conjecture for small groups
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre C

Abstract: Zassenhaus conjectured in 1974 that for a finite group G any unit of finite order in the integral group ring $\mathbb{Z}G$ is conjugate in the rational group algebra of G to an element in $\pm G$ - the maximal triviality one can expect of these units. Though proven for some special classes of groups, as e.g. nilpotent groups, the conjecture remains open in general. I will report on some work determining the smallest possible counterexamples to Zassenhaus' conjecture by combining computer algebra and the known methods to attack the conjecture, one result being that the smallest group for which the Zassenhaus Conjecture can not be settled yet is of order 192.

I will also sketch some of the methods used which mostly rely on ordinary and modular representation theory. This is joint work with A. Bächle, F. Eisele, A. Herman, A. Konovalov and G. Singh.

Natalia V. Maslova (Ural Federal University and Krasovskii Institute of Mathematics and Mechanics UB RAS)

On the pronormality of subgroups of odd indices in finite simple groups

Provisional Time/Room: Friday afternoon, Poynting Building Small Lecture Theatre

Abstract: This talk is based on joint works with Anatoly S. Kondrat'ev and Danila O. Revin.

According to Ph. Hall, a subgroup H of a group G is said to be *pronormal* in G if H and H^g are conjugate in $\langle H, H^g \rangle$ for every $g \in G$.

Some problems in combinatorics and permutation group theory were solved in terms of the pronormality.

Well-known examples of pronormal subgroups are normal subgroups, maximal subgroups, and Sylow subgroups of finite groups; Sylow subgroups of proper normal subgroups of finite groups; Hall subgroups of finite solvable groups.

In 2012 Vdovin and Revin proved that all Hall subgroups are pronormal in all finite simple groups and, basing on the analysis of the proof they conjectured that subgroups of odd indices are pronormal in all finite simple groups.

In 2015 this conjecture was verified by Kondrat'ev, Maslova, and Revin for many families of finite simple groups. However in 2016 it was proved by the same authors that the conjecture fails.

In this talk we discuss some recent progress in the classification of finite simple groups in which all subgroups of odd indices are pronormal.

Acknowledgement. The work was supported by the President of the Russian Federation (Grant MKŰ6118.2016.1), the State Maintenance Program for the Leading Universities of the Russian Federation (Agreement 02.A03.21.0006 of 27.08.2013), and the CAS PresidentŠs International Fellowship Initiative (Grant 2016VMA078).

Jules Clement Mba (University of Johannesburg, Department of Pure and Applied Mathematics)

Homomorphisms between restricted genus groups

Provisional Time/Room: Friday morning, Watson Building Lecture Theatre C

Abstract: For two finitely generated groups with finite commutator subgroup G_1 and G_2, homomorphisms between genera of groups $\mathcal{G}(G_1)$ and $\mathcal{G}G_2$ have been established in the literature, especially when G_2 is some quotient group obtained from G_1 or when G_2 is some power of G_1. For a certain class of groups under a given finite group F, we prove the existence of a homomorphism between the restricted genera.

Justin McInroy (Heilbronn Institute for Mathematical Research, University of Bristol)
Code algebras, axial algebras and VOAs
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre A

Abstract: We introduce a new class of non-associative algebras coming from binary linear codes, called code algebras. This is inspired by the link between binary codes and vertex operator algebras (VOAs), where the code governs the representation theory of the VOA. We show that, except for one example, our code algebras are always simple algebras. There are some obvious idempotents, but we also give a construction for finding other idempotents. This leads to the result that for a certain class of code, code algebras are axial algebras, but not necessarily for the expected fusion rules.

In this talk, we will introduce some of the concepts and provide motivation for the definition of code algebras. We will outline some of the main results and point to some open questions. We do not assume a background knowledge of VOAs.

This is joint work with Alonso Castillo-Ramirez and Felix Rehren.

Carmen Melchor (Universitat Jaume I (Spain), Department of Mathematics)
New progress in products of conjugacy classes in finite groups
Provisional Time/Room: Thursday afternoon, Poynting Building Small Lecture Theatre

Abstract: There exist many researches about the structure of a finite group focused on the product of its conjugacy classes. One of the most relevant problems was posed in 1985 by Z. Arad and M. Herzog who conjectured that in a non-abelian simple group, the product of two non-trivial classes can never be a single conjugacy class. The conjecture has been solved for several families of simple groups. We will show new results about the product of conjugacy classes regarding the non-simplicity and solvability of a finite group G.

Suppose that K is a conjugacy class of G. We focus our attention on the product of K by its inverse. We know that KK^{-1} is always a G-invariant set, so we can write $KK^{-1} = 1 \cup A$, where A is the join of conjugacy classes of G. When $KK^{-1} = 1 \cup D$ or $KK^{-1} = 1 \cup D \cup D^{-1}$, where D is a conjugacy class, we prove that G is not a non-abelian simple group by means of the Classification of the Finite Simple Groups (CFSG). When K is real, we also study the extreme case in which A is a single class and we prove, without using the CFSG, that $\langle K \rangle$ is a solvable proper normal subgroup of G of Fitting length at most 2. We completely determine the structure of $\langle K \rangle$ depending on the size of K and the order of its elements.

Joint work with Antonio Beltrán and María José Felipe

Adnan Melekoğlu (Adnan Menderes University)
Mirror automorphisms of chiral regular maps
Provisional Time/Room: Monday afternoon, Watson Building Lecture Theatre B

ABSTRACT: A regular map $\mathcal{M}$ is an embedding of a graph in a compact surface S such that its automorphism group $\mathrm{Aut}^+(\mathcal{M})$ acts transitively on the directed edges. If $\mathcal{M}$ is reflexible, each reflection of $\mathcal{M}$ fixes a number of simple closed geodesics on S, which are called mirrors. For every mirror M on S, there exist one or two conformal automorphisms of $\mathcal{M}$, each of which fixes M setwise and rotates M in opposite directions. These automorphisms are inverses of each other and they are called the mirror automorphisms of M. If $\mathcal{M}$ is chiral, then $\mathcal{M}$ admits no reflections and the surface S does not carry mirrors. Nevertheless, some conformal automorphisms of $\mathcal{M}$ can still be considered as mirror automorphisms. In this talk I will describe these automorphisms and discuss their applications to some combinatorial problems.

G.I. Moghaddam (Department of Mathematics, University of Manitoba, Canada)
Cancellative Semigroups Admitting Conjugates
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre B

ABSTRACT: We prove that a cancellative semigroup admitting conjugates is embeddable in a nilpotent group of class 2 if and only if it satisfies the conjugacy law $x^{y^z} = x^y$. Also adapting Ore's techniques we describe an exact procedure for embedding a cancellative semigroup admitting conjugates into a group. Moreover we characterize semigroups embeddable in nilpotent groups of class n by means of conjugacy laws involving semigroup laws described by Mal'cev, Neumann and Taylor.

Rögnvaldur G. Möller (Science Institute, University of Iceland)
Cayley–Abels graphs for totally disconnected locally compact groups
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre C

ABSTRACT: Let G be a compactly generated totally disconnected locally compact group. An Abels–Cayley graph for G is a locally finite connected graph that G acts transitively on such that the stabilisers of vertices are compact open subgroups. Many results for finitely generated groups connecting Cayley graphs and group structure have analogues involving Abels–Cayley graphs.

Some years ago George A. Willis asked me about the connections between the minimal valency of an Abels–Cayley graph for G and properties of the topological group G. In this talk I will describe some thoughts on this question, e.g. show lower bounds for the minimal valency based on the modular function and the scale function on G, characterize those groups where the minimal valency is 2 and describe special properties of groups where the minimal valency is 3.

Some of these results are contained in the master thesis of Arnbjörg Soffía Árnadóttir at the University of Iceland.

Carmine Monetta (University of Salerno)
The Conjugacy Search Problem for Supersoluble Groups
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre C

ABSTRACT: In cryptography key exchange methods are usually based on one-way functions, that is functions which are easy to compute but whose inverses are difficult to determine. There are several ways in which group theory can be used to construct one-way functions. For instance, in 1999, I. Anshel, M. Anshel and D. Goldfeld introduced a key exchange protocol whose security relies in part on the Conjugacy Search Problem: *given two conjugate elements u and v of a group G, find an element x in G such that $u^x = v$.*

In 2004, B. Eick and D. Kahrobaei considered polycyclic groups as platform groups for this method (see [1]). However, not every class of polycyclic groups is useful as a basis for their cryptosystem. In fact, for finitely generated nilpotent groups, the conjugacy search problem can be solved by efficient methods.

Inspired by [2], in this talk we show an efficient conjugacy algorithm for supersoluble groups.

References

[1] B. Eick and D. Kahrobaei, *Polycyclic groups: a new platform for cryptography*, preprint arxiv: math.gr/0411077. Technical report, 2004.

[2] C. C. Sims, *Computation with finitely presented groups*, Enciclopedia of mathematics and its application.

Raul Moragues Moncho (University of Birmingham)
Saturated fusion systems over p-groups with extraspecial subgroups of index p
Provisional Time/Room: Tuesday morning, Physics West Lecture Theatre

ABSTRACT: Saturated fusion systems are constructions on p-groups which generalise the action of a finite group acting on its Sylow p-subgroups via conjugation. We introduce them and new exotic fusion systems that appear and then focus on p-groups S with extraspecial subgroups of index p. We compare the situation in finite simple groups containing S as a Sylow p-subgroup and in saturated fusion systems over S which have no normal p-subgroups, and how this heavily restricts the structure of S.

Adán Mordcovich (University of St Andrews)
On probabilistic generation of $\mathrm{PSL}_n(q)$
Provisional Time/Room: Saturday morning, Poynting Building Small Lecture Theatre

ABSTRACT: It is a fact that a simple group G can be generated by two elements, a natural question then follows: if we pick two elements uniformly at random from G (allowing repetition) what is the probability $P_2(G)$ that such elements generate the whole of G? It is also true that a pair of elements of G do not generate the whole group if and only if there is a maximal subgroup of G containing both of these elements.

From the above one might suspect that there is a strong relation between the maximal subgroups of G and the probability $P_2(G)$; indeed, this is the case. Let $m(G)$ be the index of the largest (maximal) subgroup of G. In 1996, Liebeck and Shalev showed that there exist absolute constants α and β such that

$$1 - \frac{\alpha}{m(G)} \leq P_2(G) \leq 1 - \frac{\beta}{m(G)}$$

holds for all finite simple groups G.

We aim to discuss the values of α and β in the cases where $G = \mathrm{PSL}_n(q)$ and analogous results for where G is an almost simple group satisfying $\mathrm{PSL}_n(q) \leq G \leq \mathrm{Aut}(\mathrm{PSL}_n(q))$.

Luke Morgan (The University of Western Australia)
On p-groups with automorphism groups of prescribed properties
Provisional Time/Room: Friday morning, Poynting Building Small Lecture Theatre

ABSTRACT: Let p be a prime. We will introduce the notion of a *maximally symmetric* p-group. This is a p-group P such that the automorphism group $\mathrm{Aut}(P)$ induces on the Frattini quotient $P/\Phi(P)$ a maximal subgroup of $\mathrm{GL}(P/\Phi(P)) = \mathrm{GL}(d, p)$, where d is the rank of p. Maximally symmetric p-groups are known to exist by a seminal result of Bryant and Kovács, however, those which are minimal with regards to exponent, nilpotence class and order are extremely mysterious. I will report on joint work with John Bamberg, Stephen Glasby and Alice Niemeyer in which we have explicitly constructed (for most Aschbacher classes of the linear groups) these p-groups. In particular, we found that in most cases the minimal such group has exponent p, class two and order bounded by $p^{d^4/2}$.

Tushar Kanta Naik (Harish-Chandra Research Institute, Allahabad, India)
On p-groups of conjugate rank 1 and nilpotency class 3
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre C

Abstract: In 1953, N. Ito stared investigating the finite groups of conjugate type $\{1, n\}$. He proved that if G is of conjugate type $\{1, n\}$, then n is power of some prime p and G is direct product of a non-abelian Sylow p-subgroup and an abelian p'-subgroup; in particular G is nilpotent. Hence to understand such groups, it is sufficient to study finite p-groups of conjugate type $\{1, p^n\}$ for $n \geq 1$. Around half a century later, K. Ishikawa proved that finite p-groups of conjugate type $\{1, p^n\}$ can have nilpotency class at most 3, for odd primes p and is exactly 2 when $p = 2$. He again proved that there exists unique(up to isoclinism) p-groups of conjugate type $\{1, p^2\}$ and of nilpotency class 3, for odd primes p; where all p-groups of conjugate type $\{1, p\}$ are isoclinic to extra-special p-groups; in particular of nilpotency class 2.
In 1996, Dark and Scoppola constucted examples of p-group of conjugate type $\{1, p^n\}$ and nilpotency class 3, for even integer n. Recently, Naik and Yadav proved that there does not exist p-groups of conjugate type $\{1, p^3\}$ and nilpotency class 3 and raise the following natural questions.

> "Does there exist a finite p-group of nilpotency class 3 and conjugate type $\{1, p^n\}$, for odd prime p and odd integer $n > 4$?"

In this talk, we will first prove that, there does not exist p-group of conjugate type $\{1, p^n\}$ and nilpotency class 3; for odd integer n. Then we will prove some structural properties of such p-groups, for even integer n.

Timur Nasybullov (University of Leuven, Belgium)
Groups where the twisted conjugacy class of the unit element is a subgroup
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre C

Abstract: Let G be a group and φ be an automorphism of G. Elements x, y from G are called *(twisted) φ-conjugated* if there exists an element $z \in G$ such that $x = zy\varphi(z)^{-1}$. The relation of φ-conjugation is an equivalence relation and it divides G into *φ-conjugacy classes*. The φ-conjugacy class of the element x is denoted by $[x]_\varphi$. The number $R(\varphi)$ of these classes is called *the Reidemeister number of the endomorphism φ*.

Twisted conjugacy classes appear naturaly in Nielsen-Reidemeister fixed point theory. Let X be a compact topological space, $f : X \to X$ be a homeomorphism and φ be the automorphism of $\pi_1(X)$ induced by the homeomorphism f. Then the number $R(\varphi)$ is closely connected with the Nielsen number $N(f)$ and the Reidemeister number $R(f)$ which are the main objects of Nielsen theory.

During the talk we are going to discuss connections between properties of twisted conjugacy classes in a group and the properties of a group itself. In particular, we will discuss groups where the class $[e]_\varphi$ is a subgroup for every automorphism φ and show that such groups have very restrictive structure: for example, the members of the lower central series of such groups must have finite verbal width.

Daniela Nikolova (Florida Atlantic University)
On the Covering Number of Small Symmetric and Alternating Groups and Some Sporadic Simple Groups
Provisional Time/Room: Saturday morning, Physics West Lecture Theatre

ABSTRACT: We say that a group G has a finite covering if G is a set theoretical union of finitely many proper subgroups. The minimal number of subgroups needed for such a covering is called the covering number of G denoted by $\sigma(G)$. Let S_n be the symmetric group on n letters. For odd n Maroti determined $\sigma(S_n)$ with the exception of $n = 9$, and gave estimates for n even showing that $\sigma(S_n) \leq 2n-2$. We show that $\sigma(S_8) = 64$, $\sigma(S_{10}) = 221$, $\sigma(S_{12}) = 761$. We also show that Maroti's result for odd n holds without exception proving that $\sigma(S_9) = 256$. We establish in addition that the Mathieu group M_{12} has covering number 208, and improve the estimate for the Janko group J_1 given by P.E. Holmes.

In another paper, we establish the covering number of A_9, and A_{11}. As of now, the smallest values of n for which the covering numbers of S_n, and A_n are not known are $n = 14$, and $n = 12$ respectively. The methods we use involve GAP calculations, incidence matrices and linear programming.

The coverings turn out to be dependent on the arithmetic nature of n. Some results for larger classes of S_n have been established.

Tsunekazu Nishinaka (University of Hyogo, Japan)
On primitivity of group algebras of non-noetherian groups
Provisional Time/Room: Sunday morning, Poynting Building Small Lecture Theatre

ABSTRACT: A ring R is said to be (right) primitive if it contains a faithful irreducible (right) R-module, or equivalently, if there exists a maximal (right) ideal in R which includes no non-trivial ideal of R. The study of the primitivity of general group algebras has been a topic of much interest over the last few decades.

In my talk, we introduce a certain condition satisfied many non-noetherian groups and show that the group algebra KG of a group G satisfying the condition is primitive for any field K. We also talk about SR-graph theory which is the main method of the proof.

Víctor M. Ortiz-Sotomayor (Universitat Politècnica de València)
Structural criteria in factorised groups via conjugacy class sizes
Provisional Time/Room: Thursday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: The connection between the structure of a finite group and the set of its conjugacy class sizes has been thoroughly investigated by a good number of authors. Alongside this research, the study of groups factorised as the product of two subgroups has been gaining an increasing interest, in particular when the factors are linked by certain permutability properties. The aim of this talk is to report about new progress on the structure of a factorised group when arithmetical properties are imposed on the class sizes of certain elements in the factors. More concretely, we deal with square-free and prime power conditions.
Coauthors: M. J. Felipe and A. Martínez-Pastor (Universitat Politècnica de València).

Alessandro Paolini (Technische Universität Kaiserslautern)
The block graph of a finite group
Provisional Time/Room: Monday morning, Poynting Building Small Lecture Theatre

ABSTRACT: Let G be a finite group. We define the block graph of G as follows. The vertices are the prime divisors of $|G|$, and there is an edge between two vertices $p \neq q$ if and only if $\mathrm{Irr}(B_0(G)_p) \cap \mathrm{Irr}(B_0(G)_q) \neq \{id_G\}$; here $\mathrm{Irr}(B_0(G)_r)$ denotes the set of complex irreducible characters of G contained in the principal r-block $B_0(G)_r$.

Motivated by the work of Bessenrodt and Zhang, who proved that block graphs of alternating groups are complete, we investigate block separations of characters in terms of block graphs. We show that block graphs of all finite nonabelian simple groups are complete, except for the sporadic groups J_1 and J_4. Moreover, we determine a criterion of solvability for a group in terms of triangles contained in its block graph. This is a joint work with Brough and Liu.

Götz Pfeiffer (National University of Ireland, Galway, Ireland)
Bisets, Double Burnside Rings, and the Subgroups of a Direct Product.
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre C

ABSTRACT: The double Burnside group $B(G, H)$ of two finite groups G, H is the Grothendieck group of the category of finite (G, H)-bisets. As additive group, $B(G, H)$ is isomorphic to the (ordinary) Burnside ring $B(G \times H)$. In the case $G = H$, the tensor product of bisets yields a multiplication in $B(G, G)$, the double Burnside ring of G. The rational double Burnside algebra $\mathbb{Q}B(G, G)$ is semisimple if and only of G is cyclic. In general, little more is known about the structure of this algebra. In contrast, the Burnside ring $B(G)$ is a commutative ring and its structure is encoded in its table of marks $M(G)$.

We describe a decomposition of the table of marks of the direct product $G \times H$ as a matrix product, based on the first general and systematic study of the subgroup lattice of a direct product of finite groups beyond Goursat's Lemma. On the one hand, this decomposition facilitates the explicit computation of $M(G \times H)$ from information on the groups G and H, like their tables of marks $M(G)$ and $M(H)$. On the other hand, a modification of this matrix product yields a mark homomorphism for the double Burnside ring, exhibiting the structure of $\mathbb{Q}B(G, G)$, at least for some small examples G. This is joint work with B. Masterson.

Markus Pfeiffer (University of St Andrews)
Computing Minimal and Canonical Images
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre B

ABSTRACT: Deciding whether two objects are in the same orbit of a permutation group action is a computationally difficult problem; a commonly used algorithm is to compute the *minimal image* of an object under the group action – then two objects are in the same orbit if and only if they have the same minimal image.

This raises an obvious question – What ordering of objects should be chosen?

We show that the choice of ordering can greatly affect the performance of the minimal image algorithm, and how to choose a good ordering given a group and an object.

This is joint work with Chris Jefferson (University of St Andrews) and Rebecca Waldecker (Martin-Luther-Universität Halle-Wittenberg).

Casey Pinckney (Colorado State University)
Independence Complexes of Finite Groups
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre C

ABSTRACT: Let G be a finite group. We define an independent set of G to be a set S of group elements having the property that any proper subset of S generates a smaller subgroup than the subgroup generated by S. These independent sets form a simplicial complex whose vertices are elements of G and whose faces correspond to independent sets. For certain classes of finite groups, we describe combinatorial properties of the resulting simplicial complex.

Tomasz Popiel (Queen Mary University of London)
Primitive permutation groups and generalised quadrangles
Provisional Time/Room: Tuesday morning, Poynting Building Small Lecture Theatre

ABSTRACT: The classification of flag-transitive generalised quadrangles is a long-standing open problem at the interface of finite geometry and permutation group theory. Given that all of the known flag-transitive generalised quadrangles are also point-primitive (up to point–line duality), it is likewise natural to seek a classification of the point-primitive examples. I will summarise some recent joint work with John Bamberg and Cheryl Praeger in this direction, and outline how some remaining difficulties lead to questions about fixities of certain primitive permutation groups.

Rameez Raja (School of Mathematics, Harish-Chandra Research Institute, HBNI, Chhatnag Road, Jhunsi, Allahabad-211019, India
rameezraja@hri.res.in, rameeznaqash@gmail.com)
On combinatorial aspects arising from abelian groups
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre C

ABSTRACT: Let R be a commutative ring, M be a non-simple unitary R-module and Γ be a simple graph. In this talk we discuss an interplay of combinatorial and algebraic properties of an abelian group G viewed as a module over $\mathbb{Z}$. We classify elements of G into three objects called as full-annihilators $A_f(G)$, semi-annihilators $A_s(G)$ and star-annihilators $A_t(G)$. We show a combinatorial object completely determines an algebraic object. Furthermore, we study the correspondence of subgroups of G and ideals of $\mathbb{Z}$ and of the subgroups of G with the vertices of graphs arising from G. We combinatorially characterize all abelian groups and show that if G is a finitely generated abelian group with Betti number ≥ 2, then the combinatorial structure $\Gamma(G)$ of G is complete.

Colin Reid (University of Newcastle Australia)
Chief series in locally compact groups
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre A

ABSTRACT: I will be talking about joint work with Phillip Wesolek. A chief factor of a topological group G is a factor K/L, where K and L are closed normal subgroups such that no closed normal subgroup of G lies strictly between K and L. We show that a compactly generated locally compact group admits an 'essentially chief series', that is, a finite normal series in which each of the factors is compact, discrete or a chief factor. However, in contrast to the situation for finite groups and Lie groups, general chief factors of locally compact groups can have a complicated normal subgroup structure as groups in their own right.

Noraí Rocco (University of Brasília)
q-Tensor Squares of Polycyclic Groups, $q \geq 0$.
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre C

Abstract: In this talk we address the extension of some known results concerning the non-abelian tensor square $G \otimes G$ and the group $\nu(G)$ $(q = 0)$ to the $q-$tensor square $G \otimes^q G$ of a group G, and also to $\nu^q(G)$ - a group extension of $G \otimes^q G$ by $G \times G$, q a non-negative integer, for polycyclic groups G. These results are applied, for instance, to the computation of $G \otimes^q G$, for a finitely generated nilpotent group G, q odd. Some details of the computation of the $q-$tensor square of the free $n-$generator nilpotent group of class 2 will be presented. Computational aspects for finding a polycyclic presentation of $\nu^q(G)$, when G is given by a polycyclic presentation, will also be addressed.

Bernardo Rodrigues (University of KwaZulu-Natal, Durban, South Africa)
A classification of self-dual codes admitting a rank 3 automorphism group of almost simple type
Provisional Time/Room: Sunday afternoon, Watson Building Lecture Theatre C

Abstract: One of the questions of current interest in coding theory is the following: given a finite non-solvable permutation group G acting transitively on a set Ω, under what conditions on G are self-dual codes invariant under G existent or nonexistent? This problem is investigated under the hypothesis that the group is rank 3 of almost simple type. It is proven that if a self-dual code C admits a rank 3 group G of almost simple type acting transitively on its coordinate positions then G is one of Hall-Janko group, Rudvalis group, M_{11}, $\mathrm{Aut}(\mathrm{M}_{12})$, $\mathrm{PSL}(4,9), \mathrm{P\Gamma L}(3,4)$ or $\mathrm{PSL}(3,2)$.

Lleonard Rubio y Degrassi (City, University of London)
Hochschild cohomology and modular representation theory
Provisional Time/Room: Tuesday morning, Physics West Lecture Theatre

Abstract: In this talk I will discuss the interplay between the local and the global invariants in modular representation theory with a focus on the first Hochschild cohomology $\mathrm{HH}^1(B)$ of a block algebra B. In particular, I will show the compatibility between r-integrable derivations and stable equivalences of Morita type. I will also show that if $\mathrm{HH}^1(B)$ is a simple Lie algebra such that B has a unique isomorphism class of simple modules, then B is nilpotent with an elementary abelian defect group P of order at least 3. The second part is joint work with M. Linckelmann.

Amin Saeidi (North-West University)
Constructing some designs invariant under some families of finite sumple groups
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre B

Abstract: In this note, we use Key-Moori Methods 1 and 2 to construct some designs from the maximal subgroups and conjugacy classes of some families of finite simple groups, such as $PSL_2(q)$ and Suzuki groups. These methods are due to J. Key and J. Moori. In the first method, they consider the primitive permutation representation of simple groups to construct symmetric 1-designs. In the Method 2, they construct 1-designs from a maximal subgroup M and a conjugacy class of some element $x \in M$. We show that the parameters of the designs may be obtained by studying the structure of the maximal sugroups.

Nicola Sambonet (Universidade de São Paulo, Brazil)
Another Schur-Hopf formula
Provisional Time/Room: Sunday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: The Schur-Hopf formula provides a description for the multiplier in terms of a free presentation of the underlying group. It is possible to introduce a new term depending on the generators order without altering the result. In details, suppose that a group G admits a presentation F/R where F is free over X and denote $\Omega = \langle x^{o(xR)} \mid x \in X \rangle$. Then the multiplier can be computed as $M(G) \simeq [F,F]\Omega \cap R/[F,R]\Omega$. Noteworthy, the cover $F/[F,R]\Omega$ inherits finiteness from the group, and it realizes the minimal exponent among all the possible covers.

Yuri Santos Rego (Universität Bielefeld)
Detecting finite presentability of parabolics in Chevalley-Demazure groups
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre B

ABSTRACT: Understanding generators and relations in linear groups constitutes an old topic in mathematics, with particular success witnessed in the case of S-arithmetic subgroups of reductive linear algebraic groups and of Borel subgroups. The follow-up question is: What happens in between, i.e. what can be said about parabolic subgroups? We shall discuss criteria under which the finite presentability of a parabolic subgroup of a universal elementary Chevalley-Demazure group is equivalent to finite presentability of a suitable subgroup.

Jason Semeraro (University of Leicester, Heilbronn Institute)
The number of simple modules associated to Sol(q)
Provisional Time/Room: Tuesday morning, Physics West Lecture Theatre

ABSTRACT: Alperin's Weight Conjecture predicts that the number of simple modules of the principal p-block of a finite group G is completely determined by the p-fusion system of G. What can we say about the corresponding numbers for exotic fusion systems? Motivated by recent work of Malle–Robinson, we conjecture a bound, and verify that it holds in the case of the Benson–Solomon fusion systems via an explicit computation.

This is joint work with Justin Lynd.

Thekiso Seretlo (School of Mathematical and Computer Sciences, University of Limpopo (Turfloop), P Bag X1106, Sovenga 0727, South Africa)
The (p,q,r)-generations of the Mathieu group M_{22}
Provisional Time/Room: Sunday afternoon, Physics West Lecture Theatre

ABSTRACT: Generation of finite groups by suitable subsets is of great interest and has many applications to groups and their representations.In this talk we establish all the (p,q,r)-generations of the Mathieu group M_{22}. GAP and the ATLAS of finite group representatives are used in our computations.

Robert Shwartz (Ariel University, ISRAEL)
Quotiemts of Coxeter groups associated to signed line graphs
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre B

ABSTRACT: Let G be a graph with n vertices and with k edges , and let Γ be the associated line graph. Let f be a function from the set of the edges of Γ to $\{-1, 1\}$, and let Γ_f be a signed graph, which we get from Γ by signing every edge e of Γ by $f(e)$. Let $C(\Gamma)$ be the simply laced Coxeter group associated to Γ. In this talk, we define sign geometric representations, and then we define the signed Coxeter group $C(\Gamma_f)$, which is a quotient of $C(\Gamma)$. We prove that under certain conditions on the signs $f(e)$, the group $C(\Gamma_f)$ is isomorphic to a semidirect product of either the symmetric group S_n or the D-type Coxeter group D_n by $\mathbb{Z}^t$, where t depends only on the number of vertices, and on the number of edges in the graph G.

Rachel Skipper (Binghamton University)
The congruence subgroup problem for a family of branch groups
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre A

ABSTRACT: A group acting on a spherically homogeneous rooted tree has the congruence subgroup property if every subgroup of finite index contains a level stabilizer. The congruence subgroup problem then asks to quantitatively describe the kernel of the surjection from the profinite completion to the topological closure as a subgroup of the automorphism group of the tree.

We will study the congruence subgroup property for a family of branch groups whose construction generalizes that of the Hanoi Towers group, which models the game "The Towers of Hanoi".

Ilir Snopche (Federal University of Rio de Janeiro)
Asymptotic density of test elements in free groups and surface groups
Provisional Time/Room: Monday afternoon, Watson Building Lecture Theatre A

ABSTRACT: An element g of a group G is called a test element if for any endomorphism φ of G , $\varphi(g) = g$ implies that φ is an automorphism. The first non-trivial example of a test element was given by Nielsen in 1918, when he proved that every endomorphism of a free group of rank 2 that fixes the commutator $[x_1, x_2]$ of a pair of generators must be an automorphism.

Let G be a finitely generated group with a finite generating set X, d_X the word metric on G with respect to X and $B_X(r)$ the ball of radius $r \geq 0$ centered at the identity in the metric space (G, d_X). Given $S \subseteq G$, the *asymptotic density* of S in G with respect to X is defined as

$$\overline{\rho}_X(S) = \limsup_{k\to\infty} \frac{|S \cap B_X(k)|}{|B_X(k)|}.$$

In this talk I will discuss the asymptotic density of test elements in free groups and surface groups. This is a joint work with Slobodan Tanushevski.

Layla Sorkatti (University of Khartoum)
Nilpotent Symplectic Alternating Algebras
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre C

ABSTRACT: We first give some general overview of symplectic alternating algebras and then focus in particular on the structure and classification of nilpotent symplectic alternating algebras.

Alexey Staroletov (Sobolev Institute of Mathematics)
On almost recognizability by spectrum of simple classical groups
Provisional Time/Room: Friday morning, Physics West Lecture Theatre

ABSTRACT: The set of element orders of a finite group G is called the *spectrum*. Groups with coinciding spectra are said to be *isospectral*. It is known that if G has a nontrivial normal soluble subgroup then there exist infinitely many pairwise non-isomorphic groups isospectral to G. The situation is quite different if G is a nonabelain simple group. In this talk we discuss finite groups isospectral to simple classical groups. Recently it was proved that if L is a simple classical group of dimension at least 62 and G is a finite group isospectral to L then up to isomorphism $L \leq G \leq \mathrm{Aut}\, L$. We show that the assertion remains true if 62 is replaced by 38.

Yegor Stepanov (Queen Mary University of London)
On some of the subgroups of $E_6(q)$ and ${}^2E_6(q)$.
Provisional Time/Room: Friday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: In this talk, we utilize an octonionic construction of $E_6(q)$ and ${}^2E_6(q)$ to illuminate some of the subgroup structure of these groups.

David Stewart (Newcastle University)
A taste of pseudo-reductive groups
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre B

ABSTRACT: The structure of (connected) reductive algebraic groups over algebraically closed fields is well-known and there is a classification due to Chevalley by root data. Things are less well-behaved over arbitrary fields but semisimple algebraic groups can still be classified by a more complicated invariant called the Tits index. In any case, much of the structure theory of reductive groups is not lost by passing to arbitrary fields: the connected centre is always a torus, the quotient by which gives a semisimple group. But over non-perfect fields k, the unipotent radical over $\bar{k}$ may not be defined over k; asking for the k-defined unipotent radical to be trivial leads to the definition of a *pseudo-reductive group*—such groups arise naturally in certain number-theoretic questions. Major work of Conrad, Gabber and Prasad has shed new light on pseudo-reductive groups. With Bate, Martin and Roerhle, I have proved some theorems about them, but I'll probably be satisfied with giving a brief overview of the 'standard construction' of CGP.

Eric Swartz (College of William and Mary)
Covering numbers of finite groups: a computational approach
Provisional Time/Room: Thursday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: A set of proper subgroups is a *cover* for a group if its union is the whole group, and the minimal number of subgroups needed to cover a group is called its *covering number*. In this talk, I will discuss the application of the software GAP and Gurobi to this problem. The results discussed in this talk are joint work (in different projects) with Luise-Charlotte Kappe and Daniela Nikolova-Popova; Ryan Oppenheim; and Luise-Charlotte Kappe and Martino Garonzi.

Rick Thomas (University of Leicester)
Cayley-automatic groups and semigroups
Provisional Time/Room: Sunday afternoon, Watson Building Lecture Theatre A

ABSTRACT: The notion of FA-presentability is motivated by an interest in possible approaches for understanding computability in algebraic structures (where a structure consists of a set together with a finite collection of relations). A natural definition would be to take some general model of computation such as a Turing machine; a structure would then be said to be "computable" if its domain could represented by a set which can be recognized by a Turing machine and if there were decision-making Turing machines for each of its relations. Notwithstanding this, there have been various ideas put forward to restrict the model of computation used; whilst the range of possible structures would decrease, the computation could become more efficient and certain properties of the structures might become decidable.

One interesting approach was introduced by Khoussainov and Nerode who considered structures whose domain and relations can be checked by finite automata (as opposed to Turing machines); such a structure is said to be "FA-presentable". This was inspired, in part, by the theory of automatic groups introduced by Epstein et al; however, the definitions are somewhat different. Whilst the notion of automaticity in the sense of Epstein et al can be naturally generalized to semigroups, it does not easily extend to arbitrary algebraic structures, whereas the notion of FA-presentability does apply to all such structures.

We will survey some of what is known about FA-presentable structures, focussing on groups and semigroups. In particular, we will report on some recent joint work with Alan Cain, Rachael Carey and Nik Ruškuc on Cayley-automatic semigroups. The talk is intended to be self-contained, in that no prior knowledge of FA-presentability is assumed.

Imke Toborg (Martin-Luther-Universität Halle-Wittenberg)
What's new on Z_3^*?
Provisional Time/Room: Sunday morning, Watson Building Lecture Theatre A

ABSTRACT: In 1966 Glauberman proved his famous Z^*-Theorem and asked whether it is possible to generalise the statement to odd primes. His question remained unanswered until the Classification of the Finite Simple Group was completed. But there is still no proof of the so-called Z_p^*-Theorem that gives insight why the theorem is true and hence provides a better understanding of finite groups in general.

In this talk I present the strategy and first result of Rebecca Waldecker's and my approach towards a local proof of the Z_3^*-Theorem.

Antonio Tortora (Università di Salerno, Italy)
Groups with finite verbal conjugacy classes
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre A

ABSTRACT: Let w be a group-word. Given a group G, let G_w denote the set of all w-values in G and $w(G)$ the verbal subgroup of G corresponding to w. The group G is an $FC(w)$-group if the set of conjugates x^{G_w} is finite for all $x \in G$. In this talk we will survey some results on $FC(w)$-groups where w is assumed to be a concise word. Furthermore, for an arbitrary word w and an $FC(w)$-group G, we will present a recent joint work with C. Delizia and P. Shumyatsky concerning the commutator subgroup of $w(G)$.

Maria Tota (Dipartimento di Matematica, Università di Salerno)
Some finiteness conditions on centralizers or normalizers in groups
Provisional Time/Room: Tuesday morning, Watson Building Lecture Theatre C

ABSTRACT: We consider the following two finiteness conditions on centralizers and normalizers in a group G: (i) $|C_G(x) : \langle x \rangle| < \infty$ for every $\langle x \rangle \not\trianglelefteq G$ and (ii) $|N_G(H) : H| < \infty$ for every $H \not\trianglelefteq G$. We show that (i) and (ii) are equivalent in the classes of locally finite groups and locally nilpotent groups. In both cases, the groups satisfying these conditions are a special kind of cyclic extensions of Dedekind groups. We also study a variation of (i) and (ii), where the requirement of finiteness is replaced with a bound. In this setting, we extend our analysis to the classes of periodic locally graded groups and non-periodic groups. While the two conditions are still equivalent in the former case, in the latter the condition about normalizers is stronger than that about centralizers.

Gunnar Traustason (University of Bath)
Unipotent automorphisms of solvable groups
Provisional Time/Room: Monday morning, Watson Building Lecture Theatre B

ABSTRACT: Let G be a group and $a \in \operatorname{Aut} G$. We say that a is a n-unipotent autmorphisms if $[g,_n a] = 1$ for all $g \in G$. We consider the setting when G is solvable and H a solvable subgroup of $\operatorname{Aut} G$ consisting of n-unipotent automorphisms. In this talk I will present some recent joint results with Orazio Puglizi that show that under some further criteria H must be nilpotent.

Motiejus Valiunas (University of Southampton)
Degree of commutativity of infinite groups
Provisional Time/Room: Friday morning, Watson Building Lecture Theatre C

ABSTRACT: For a finite group F, its degree of commutativity is defined to be the probability that two elements of F chosen at random commute. This concept has been recently generalised to finitely generated infinite groups G, and it seems to be closely related to growth of G. In particular, it has been conjectured that all groups of exponential growth have degree of commutativity zero. In the talk I will outline the construction and proofs of why degree of commutativity has to be zero for two particular classes of groups of exponential growth. Methods used in the proofs give further insight into combinatorial properties of these groups.

Athar Ahmad Warraich (University of Birmingham)
Realizing saturated fusion systems
Provisional Time/Room: Saturday morning, Watson Building Lecture Theatre B

ABSTRACT: Given a finite group G and a finite p-subgroup T, a fusion category $\mathcal{F}_T(G)$, is a category whose objects are subgroups of T and whose morphisms are conjugation maps induced by elements in G. A saturated fusion system $\mathcal{F}$, over a finite p-group T, is a category whose objects are subgroups of T and whose morphisms are injective group homomorphisms satisfying certain properties. A fusion system $\mathcal{F}$ is exotic if there is no finite group G such that $T \in \mathrm{Syl}_p(G)$ and $\mathcal{F} = \mathcal{F}_T(G)$. However, by a theorem of Park, every saturated fusion system is a fusion category for some T and finite G. In this talk we discuss how to construct G for certain exotic fusion systems.

Madeleine Whybrow (Imperial College London)
Constructing Majorana representations
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre B

ABSTRACT: Majorana theory is an axiomatic framework in which to study objects related to the Monster group and its 196,884 dimensional representation, the Griess algebra. The objects at the centre of the theory are known as Majorana algebras and can be studied either in their own right, or as Majorana representations of certain groups. I will discuss my work developing an algorithm in GAP to construct the Majorana representations of a given group. This work is based on a paper of Á. Seress and is joint with M. Pfeiffer.

Gerald Williams (University of Essex)
Generalized Fibonacci groups $H(r, n, s)$ as knot groups
Provisional Time/Room: Friday afternoon, Watson Building Lecture Theatre A

ABSTRACT: Many authors have addressed the problem as to when a cyclically presented group is a 3-manifold group. A refinement of this problem is to determine when a cyclically presented group is a knot group (ie the fundamental group of the complement of a knot in S^3) and since knot groups belong to the class of connected Labelled Oriented Graph (LOG) groups the question arises as to when a cyclically presented group is a connected LOG group. I will discuss this for the class of cyclically presented groups $H(r, n, s)$, introduced by Campbell and Robertson, that generalizes the class of Fibonacci groups $F(2, n)$. It turns out that all torus knot groups and the unknot group $\mathbb{Z}$ arise and it seems likely that these are the only cases.

Binzhou Xia (The University of Western Australia)
Factorisations of almost simple groups
Provisional Time/Room: Thursday afternoon, Poynting Building Small Lecture Theatre

ABSTRACT: A group factorisation is an expression of a group into a product of two subgroups. Group factorisations arise in many contexts including permutation group theory, algebraic graph theory, number theory, etc. As simple groups are of fundamental importance in group theory, it is at the heart of studying group factorisations to understand the factorisations of nonabelian simple groups, or their generalisation, almost simple groups. In this talk I will give some new results on factorisations of almost simple groups. This is joint work with Cai Heng Li.

Qinhai Zhang (Shanxi Normal University, China)
From minimal non-abelian subgroups to finite non-abelian p-groups
Provisional Time/Room: Monday afternoon, Watson Building Lecture Theatre B

ABSTRACT: A p-group G is said to be minimal non-abelian(in brief, $\mathcal{A}_1$-group) if G is non-abelian but all its proper subgroups are abelian. In this talk, we will introduce some results about finite p-groups determined by its $\mathcal{A}_1$-subgroups, which were obtained by the members of the p-group team of Shanxi Normal University. In particular, we present a classification of finite p-groups all of whose $\mathcal{A}_1$-subgroups are isomorphic to non-metacyclic groups of order p^3.

Maria Zvezdina (Novosibirsk State University)
On the orders of elements in almost simple groups with exceptional socle
Provisional Time/Room: Thursday afternoon, Watson Building Lecture Theatre B

ABSTRACT: Finite groups are called *isospectral* if their sets of element orders coincide. It was established a few years ago that if S is a finite simple exceptional group of Lie type, $S \neq {}^3D_4(2)$, and G is a finite group isospectral to S, then G is an almost simple group with socle S. Moreover, if S is not one of the groups $F_4(q)$ (where q is odd), ${}^3D_4(q)$, $E_6(q)$, ${}^2E_6(q)$ or $E_7(q)$, then G is isomorphic to S. We describe the structure of G in all remaining cases. In particular, we show that in some cases G is not necessarily isomorphic to S. This result completes the study of finite groups isospectral to simple exceptional groups of Lie type.