Darstellungstheorietage 2016

Bergische Universität Wuppertal

Abstracts

Matthias Klupsch - On cuspidal and supercuspidal representations of finite reductive groups

Let (G, F) be a connected reductive group defined over the finite field $\mathbb{F}_q$ via the Frobenius F. For any field k of characteristic $l \nmid q$, a simple kG^F-module M is called (super-)cuspidal if it is not isomorphic to a submodule (a composition factor) of a non-trivially Harish-Chandra induced module. The goal of this talk is to explain how the problem of classifying supercuspidal simple modules can be reduced to the case where G is simple and simply connected and to give some partial classification results in this case.

Mariano Serrano - On the Zassenhaus Conjecture

H.J. Zassenhaus conjectured that any unit of finite order in the integral group ring $\mathbb{Z}G$ of a finite group G is conjugate in the rational group algebra $\mathbb{Q}G$ to an element of the form $\pm g$ with $g \in G$. The Zassenhaus Conjecture found much attention and was proved for many series of solvable groups, e.g. for nilpotent groups, groups possessing a normal Sylow subgroup with abelian complement or cyclic-by-abelian groups. However, the conjecture has been proved only for thirteen non-abelian simple groups. In this work we prove the Zassenhaus Conjecture for the groups $PSL(2, p)$, where p is a Fermat or Mersenne prime. This increases the list of non-abelian simple groups for which the conjecture is known by probably infinitely many, but at least by 48, groups. Our result is an easy consequence of known results and our main theorem which states that the Zassenhaus Conjecture holds for a unit in $\mathbb{Z}PSL(2, q)$ of order coprime with $2q$, for some prime power q.

References

[1] L. Margolis, Á. del Río and M. Serrano. *Zassenhaus Conjecture on torsion units holds for $PSL(2, p)$ with p a Fermat or Mersenne prime,* http://arxiv.org/abs/1608.05797, 2016.

Gunter Malle - Irreducibility of cuspidal unipotent characters

We exhibit a progenerator for the category of representations of a finite reductive group in good characteristic based on a recent result of Taylor on generalised Gelfand-Graev representations. Using this, we address a conjecture of Geck from 1992 and give some further applications to bounding Harish-Chandra series. This is joint work with Olivier Dudas.

René Reichenbach - The Cartan method and nilpotent extensions of defect groups

Let B be a p-block of a finite group. Given all generalized decomposition numbers of B corresponding to nontrivial subsections up to basis sets it is possible to compute the ordinary decomposition numbers and the Cartan matrix of B up to basis sets. This method was already used by Brauer and Olsson. We present some refinements of the method and use it to calculate *invariants $k(B)$, $k_i(B)$ and $l(B)$ as well as the Cartan matrix of blocks whose defect groups are nilpotent extensions of some families of groups.*

Erzsébet Horváth - Depth of maximal subgroups of Ree groups

This is a joint work with Franciska Petényi and Lászlo Héthelyi. We determined the combinatorial and ordinary depth of all maximal subgroups of the Ree groups ${}^2G_2 = R(q)$ for $q \geq 27$.

Alessandro Paolini - On characters of a Sylow p-subgroup of $G(p^f)$

Let G be a finite group of Lie type defined over $\mathbb{F}_q$, where q is a power of a prime p. We discuss some history and methods about the problem of parametrizing the set $\mathrm{Irr}(U)$ of the irreducible characters of a Sylow p-subgroup U of G. We then mention some joint results with Goodwin, Le and Magaard about the parametrization of $\mathrm{Irr}(U)$ when G is of small rank, including the exceptional types F_4 and E_6.

Gwyn Bellamy - Graded algebras admitting a triangular decomposition.

The goal of this talk is to describe the representation theory of finite dimensional graded algebras A admitting a triangular decomposition (in much the same flavour as the enveloping algebra of a semi-simple Lie algebra admits a triangular decomposition). The examples to keep in mind are restricted rational Cherednik algebras, restricted enveloping algebras and hyperalgebras. We exploit the fact that the category of graded modules for such an algebra is a highest weight category. This allows us to prove two key results. First that the degree zero part A_0 of the algebra is cellular, and secondly a canonical subquotient of our highest weight category provides a highest weight cover of A_0-mod. This is based on joint work with U. Thiel.

Burkhard Külshammer - Loewy lengths of center of blocks

In my talk I will report on bounds for the Loewy lengths of centers of blocks recently obtained by Y. Otokita, B. Sambale and myself.

Niamh Farrell - The rationality of blocks of quasi-simple finite groups

The Morita Frobenius number of an algebra is the number of Morita equivalence classes of its Frobenius twists. Morita Frobenius numbers were introduced by Kessar in 2004 in the context of Donovan's Conjecture in block theory. I will present the latest results of a project in which we aim to calculate the Morita Frobenius numbers of the blocks of quasi-simple finite groups. I will discuss the connection between our methods and a recent result of Bonnafé-Dat-Rouquier, and explain the relationship between Morita Frobenius numbers and Donovan's Conjecture.

Frank Lübeck - Small primitive prime divisors

Let $n \in \mathbb{N}$ and $\Phi_n(X)$ the n-th cyclotomic polynomial.
For any prime power q define $\Phi_n^*(q)$ as the largest divisor of $\Phi_n(q)$ that is prime to all $q^k - 1$

with $1 \leq k < n$. *Zsigmondy (1892) showed that* $\Phi_n^*(q) = 1$ *only for* $(n, q) = (6, 2)$.
Pairs (n, q) *with 'small'* $\Phi_n^*(q)$ *play a role in some group theoretic classification questions and in algorithms for matrix groups over finite fields. Hering (1974) determined for some application all pairs* (n, q) *such that* $\Phi_n^*(q)$ *equals some polynomials in* n *of degree* ≤ 2 *(for example* $\Phi_n^*(q) = (n+1)^2$*).*
We describe an algorithm which for a constant $c > 0$ *and an exponent* k *determines all* (n, q) *with* $\Phi_n^*(q) \leq cn^k$.
This is joint work with Stephen Glasby, Alice Niemeyer and Cheryl Praeger.