LECTURE SCHEDULE

International Conference

GROUPS, RINGS AND GROUP RINGS

July 11–15, 2011

University of Alberta, Edmonton, Canada

Organizers: Eric Jespers, Wolfgang Kimmerle and Sudarshan Sehgal

Sunday: July 10 - Arrival day

LECTURE ROOMS

Room M (Invited talks): 134
Room N (Invited talks): 150
Room A: 217/219
Room B: 236/238
Room P (poster session): ....

Monday: July 11

8:00-9:15 am	On site registration
9:20-9:30 am	Opening of conference
9:30-10:30 am	*Passman*
Room M	**Invariant ideals of abelian group algebras under the torus action of a field**
10:30-11:00 am	**coffee break**
11:00-12:00 am	*Weiss*
Room M	**TBA**
12:00-02:00 pm	lunch
2:00-3:00 pm	*Bleher*
Room M	**Universal deformation rings: inverse problems and complete intersections**
3:00-3:30 pm	coffee break
3:30-3:50 pm	*Bächle*
Room A:	**On the normalizer property for subgroups**
3:30-3:50 pm	*Quinlan*
Room B:	**Distinguishing covering groups of elementary abelian groups**
3:55-4:15 pm	*Lobao Tierry*
Room A:	**Adjoint and circle groups: their structures and the normalizer property**
3:55-4:15 pm	*Künzer*
Room B:	**A genus question for orders**
4:20-4:40 pm	*Veloso*
Room A:	**On the structure of numerical sparse semigroups**
4:20-4:40 pm	*Usefi*
Room B:	**Lie identities on symmetric elements of restricted enveloping algebras**
7:00 pm	Reception at Faculty Club

Tuesday: July 12

8:00-9:00 am	breakfast
9:00-10:00 am	*Aljadeff*
Room N	**Polynomial identities, graded algebras (and one application to) division algebras**
10:00-11:00 am	*Bahturin*
Room M	**Modules with maximal growth over free group algebras**
11:00-11:30 am	coffee break
11:30-12:10 am	*Gupta*
	On some different topics: primitive elements, test sets polynilpotent series, equationally Noetherian partially commutative metabelian groups
12:10 pm	lunch
2:00-3:00 pm	*Boltje*
Room M	**Bisets, the double Burnside ring and fusion systems**
3:00-3:30 pm	coffee break
3:30-3:50 pm	*Bernal Jose Jaoquin*
Room A:	**Permutation decoding for abelian codes**
3:30-3:50 pm	*Kirschmer*
Room B:	**Maximal finite subgroups of Sp(2n,Q)**
3:55-4:15 pm	*Chalom Gladys*
Room A:	**Idempotents in abelian codes**
3:55-4:15 pm	*Silva*
Room B:	**On Z_2-graded identities of the super tensor product** $U_{k,l}(F)\hat{\otimes}E$
4:20-4:40 pm	*Guerreiro Marines*
Room A:	**Minimal codes in abelian group algebras**
4:20-4:40 pm	*Hermes Castillo Gómez*
Room B:	**Lie properties of symmetric elements under oriented involutions in group algebras**
4:40-5:00 pm	*poster session*
Room P	Lucas Rodrigo, **A radical for baric algebras**
	Tiago da Silva **TBA**
	Renata Rodrigues Marcuz Silva, **Units of** ZC_{2p}
	Massae Kitani, **Units of** $\mathbb{Z}C_{p^n}$
	Diniz de Melo Fernanda, **TBA**

Wednesday: July 13

8:00-9:00 am	breakfast
9:00-10:00 am	*del Rio*
Room N	**Subgroup separability in integral group rings**
10:00-11:00 am	*Goncalves*
Room M	**Some problems in division rings**
11:00-11:30 am	coffee break
11:30-12:10 am	*Kimmerle*
Room M	**On the Gruenberg-Kegel graph of V(ZG)**
12:10 pm	lunch
13:00	free afternoon

Thursday: July 14

8:00-9:00 am	breakfast
9:00-10:00 am	*Nebe*
Room M	**The group ring of $SL_2(p^f)$ over p - adic integers**
10:00-11:00 am	*Okninski*
Room M	**Primitive spectrum and representations of plactic algebras**
11:00-11:30 am	coffee break
Room M 11:30-12:10	*Jespers*
	Generators of the unit group of integral group rings
12:10 pm	lunch
2:00-3:00 pm	*Giambruno*
Room M	**On the exponent of a non commutative polynomial**
3:00-3:30 pm	coffee break
3:30-3:50 pm	*Caicedo*
Room A:	**Some calculations of partial augmentations of torsion units**
3:30-3:50 pm	*Eisele*
Room B:	**Lifting algebras to orders**
3:55-4:15 pm	*Alvaro Perez Raposo*
Room A:	**Symmetric and antisymmetric elements in nonlinear involutions in group rings**
3:55-4:15 pm	*Li*
Room B:	**Morphic groups**
4:20-4:40 pm	*Van Gelder*
Room A:	**Finite group algebras of nilpotent groups: a complete set of orthogonal primitive idempotents**
4:20-4:40 pm	*Margolis*
Room B:	**Dihedral p - critical elements in finite simple groups**
7:00 pm	Banquet at the Faculty Club

Friday: July 15

8:00-9:00 am	breakfast
9:00-10:00 am	*Hurley*
Room M	**Group rings in communications**
10:00-11:00 am	*Bell*
Room M	**Free subalgebras of division algebras**
11:00-11:30 am	coffee break
11:30-11:50 am	*Kiefer*
Room A	**Poincaré Bisectors in Hyperbolic Spaces and Application to Units**
11:55-12:15 am	*Riley*
Room A	**Properties of the Frobenius map in non commutative algebras**
12:10 pm	lunch
2:00-2:20 pm	*Herman*
Room A	**Clifford theory and association schemes**
2:30-3:30 pm	*Polcino Milies*
Room M	**Involutions in group algebras**
3:30-4:00 pm	coffee break
4:00-5:00 pm	*Shirvani*
Room M	**TBA**
5:00 pm	closing ceremony

Saturday: July 16 - Departure day

ABSTRACTS

Aljadeff Eli, Technion-Israel Institute of Technology, Haifa,
email: elialjadeff@gmail.com and aljadeff@tx.technion.ac.il

Title: **Polynomial identities, graded algebras (and one application to) division algebras**

Amitsur showed (in the early 70's) the existence of non crossed products division algebras by means of "generic" constructions. This establishes a clear connection between the classical theory of polynomial identities and division algebras. Later, ($\sim$ in the 90's and onwards) considerable amount of attention has been given to G-graded polynomial identities.

In the main part of the lecture I will recall some fundamental facts on polynomial identities and present some new results in the G-graded context. Then, towards the end of the lecture, I'll present an application of the theory of G-graded polynomial identities to division algebras in the same spirit as Amitsur.

Bächle Andreas, University of Stuttgart, email: baechle@mathematik.uni-stuttgart.de

Title: **On the normalizer property for subgroups**

In Sehgal, "Units in integral group rings", Problem 43 asks whether for all finite groups the 'obvious' units are the only units normalizing the group basis G in the integral group ring, i.e. if $\mathrm{N}_{\mathrm{U}(\mathbb{Z}G)}(G) = G \cdot \mathrm{Z}(\mathbb{Z}G)$? Although this is false in general, it is known to hold for a wide variety of groups, for example for all finite groups with normal Sylow 2-subgroup. It is natural to extend this question to subgroups of G, namely to ask which subgroups are normalized only by the unavoidable units

$$H \leq G: \quad \mathrm{N}_{\mathrm{U}(\mathbb{Z}G)}(H) = \mathrm{N}_G(H) \cdot \mathrm{C}_{\mathrm{U}(\mathbb{Z}G)}(H) \ ?$$

This can be seen as a question on H (for example for a fixed isomorphism type of H) as well as a question on G, i.e. for which groups G does the above property hold for all subgroups $H \leq G$. In this talk, we will discuss how far some methods for the classical problem will take us in the case of the generalized question and where these tools break down and we have to establish new techniques.

Bahturin Yuri, Memorial University of Newfoundland and Moscow State University, email: bahturin@mun.ca

Title: **Modules with maximal growth over free group algebras**

This talk is based on a recent joint paper with Alexander Olshanskii "Actions of Maximal Growth", *Proceedings London Math. Soc. (3)*, **101** (2010), 27 - 72. Some of the results of that paper have consequences for modules over (free) group algebras. A module M over the free group algebra of rank $r > 1$ is said to be of *maximal growth* if it has a cyclic submodule whose growth is the same as the growth of the free cyclic module. For example, any finitely generated module with finitely many relations has maximal growth.

Theorem *Let Φ be a field, F_r a free group of rank $r > 1$, $R = \Phi[F_r]$ the free group algebra. Then any R-module M has a unique submodule N whose growth is not maximal such that the growth of every nonzero submodule of M/N is maximal.*

Although modules of maximal growth are very close to the free modules then can satisfy very strong finiteness conditions. Some of these have close relationship to the Burnside-type problems. As an example, the following is true.

Theorem *Let Φ be a field. Then there is a module M of maximal growth over the free group F_r or, equivalently, over the free group algebra $R = \Phi[F_r]$, $r > 1$, satisfying the following additional properties.*

(a) *The module M is monomial, that is, induced from a trivial 1-dimensional module of a subgroup of F_r;*

(b) *The module M has a simple submodule N of codimension 1 (hence the growth of N is also maximal);*

(c) *The modules M and N are periodic in the sense that for any $a \in M$ and $g \in F_r$ there is a positive $m = m(a, g)$ such that $ag^m = a$. (In other words, the orbits of the action of any cyclic subgroup of F_r on M are finite.)*

Bell Jason, Simon Fraser University, Vancouver, email: jpb@math.sfu.ca

Title: **Free subalgebras of division algebras**

Localization in noncommutative rings behaves much more pathologically than in commutative rings. An example of this phenomenon is given by a famous result of Makar-Limanov, which shows that the first Weyl algebra over the complex numbers has a quotient division ring D that contains a free subalgebra on two generators. Both Makar-Limanov and Stafford have conjectured that unless a division algebra is a direct limit of polynomial identity subalgebras, then it must contain a free algebra on two generators. We show that this conjecture holds for division rings of the form $K(x;\sigma)$ and $K(x;\delta)$, where K is a field and σ and δ are respectively an automorphism and a derivation of K. In addition to this, we show that if A is a finitely generated complex domain of Gelfand-Kirillov dimension less than 3, then either A satisfies a polynomial identity or its quotient division ring contains a free subalgebra on two generators. This is joint work with Daniel Rogalski.

Bernal Jose Joaquín and Simón Juan Jacobo, University of Murcia, Spain, email: josejoaquin.bernal@um.es

Title: **Permutation decoding for abelian codes**

We present some recent work on permutation decoding for abelian codes. Permutation decoding was introduced by F. J. MacWilliams in 1964. This technique uses a special subset of the permutation automorphism group of the code, called PD-set, in order to move the error positions of the received vector out of an information set of the code. The existence of PD-sets depends heavily on the information set fixed.

An abelian code is an ideal of a finite abelian group algebra. We present a new method to construct information sets for every abelian code, in the semisimple case, based on the structure of the set of its roots. By using this information set we have established some conditions which provide a PD-set for an abelian code. As an application of these results we have designed some abelian codes which are permutation decodable. When the length of the codes is not a power of a prime number, we identify the cyclic codes of these lengths with multidimensional abelian codes and we apply our method to construct information sets different from the usual ones for cyclic codes, that is the set formed by consecutive positions. With respect to these new information sets we have found permutation decodable cyclic codes with better parameters than permutation decodable cyclic codes with respect to the usual information sets.

Bleher Frauke M., University of Iowa, Iowa City, USA , email: frauke-bleher@uiowa.edu

Title: **Universal deformation rings: inverse problems and complete intersections**

In the eighties, Mazur, using work of Schlessinger, introduced techniques of deformation theory to the study of p-adic lifts of mod p representations of Galois groups. In this talk I will discuss joint work with T. Chinburg and B. de Smit on the inverse problem for deformation rings. This is to identify which rings can arise as the universal deformation ring of some group representation. One of the main results is a solution to a problem posed by M. Flach in all residue characteristics.

Boltje Robert, University of California Santa Cruz, email: boltje@ucsc.edu

Title: **Bisets, the double Burnside ring, and fusion systems**

A (G, H)-biset is a set with a group G acting from the left and a group H acting from the right such that the two actions commute. This simple mathematical structure has become an important tool in modular representation theory, finite group theory and algebraic topology. The talk will introduce the double Burnside ring (the Grothendieck group of (G, G)-bisets, with a tensor product construction as multiplication), discuss the role it plays in the above mentioned fields, and present some new results.

Caicedo Mauricio J. and del Rio Angel, University of Murcia, Spain, email: mauriciojc02@hotmail.com

Title: **Some calculations of partial augmentation of torsion units**

Let G be a finite group and u a torsion unit of augmentation 1 of the integral group ring ZG. Zassenhaus Conjecture (ZC1) states that u is conjugate in QG of an element of G. It is well known that (ZC1) holds for u if and only if the partial augmentation of the powers of u are all non-negative. We will present some methods to verify this property for some metabelian groups.

Castillo Gómez John Hermes, Universidad de Nariño (Colombia) and Universidade de Sõ Paulo (Brasil), Brasil, email: jhcastillo@gmail.com

Title: **Lie properties of symmetric elements under oriented involutions in group algebras**

We study the Lie nilpotency and Lie n-Engel properties of symmetric elements under oriented involutions. In some cases the results obtained are similar to the ones in the case of the classical involution but interesting new situations arise.

Joint work with César Polcino Milies, IME-USP. Partially supported by CAPES and CNPq Brasil Processo: 141857/2011-00.

Chalom Gladys, University of Sao Paulo, Brasil, email: gladyschalom@gmail.com

Title: **Idempotents in Abelian Codes**

In this work we describe some abelian binary codes, considered as ideals in the group algebra of a finite (abelian) group, by means of its idempotents generators. This point of view has the advantage that the algorithm to calculate the idempotents is much more easy, uses the group elements and allows us to obtain the parameters as weigth and dimension very easily, not only for the known cases but giving very interesting bounds to some unknown cases. This results are a joint work with Raul Ferraz, Marins Guerreiro and César Polcino Milies.

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del Río Ángel , Ruiz Manuel, Zalesskii Pavel, University of Murcia, Spain, email: adelrio@um.es

Title: **Subgroup separability in integral group rings**

A group Γ is said to be subgroup separable if for every finitely generated subgroup H of Γ and every $x \in \Gamma \setminus H$ there is a subgroup N of finite index in Γ such that $x \notin HN$. In other words, the subgroup separability condition control whether membership to a finitely generated subgroup can be decide in finite epimorphic images. We provide a list of finite groups containing all the finite groups G for which, $\mathcal{U}(\mathbb{Z}G)$, the group of units of the integral group ring of G, is subgroup separable. We prove that for most of the groups G of this list $\mathcal{U}(\mathbb{Z}G)$ is indeed subgroup separable.

Diniz de Melo Fernanda, University of Sao Paulo, email: fdmelo@yahoo.com.br

Poster

Eisele Florian , University of Aachen, Germany, email: florian.eisele@rwth-aachen.de

Title: **Lifting Algebras to Orders** I will talk about the problem of lifting a finite-dimensional algebra defined over a field F to an order defined over a discrete valuation ring $\mathcal{O}$ with residue field F. Specifically, I am interested in obtaining an arithmetic description of the (p-adic) integral group ring of a finite group (or a block thereof) from a quiver with relations defined over a field of characteristic p. I will present a new approach to the problem, which may roughly be described as "replacing the algebra with a derived equivalent simpler one". Using this approach I was able to obtain explicit descriptions for blocks of dihedral defect defined over a discrete valuation ring with residue field $\bar{\mathbb{F}}_2$ (starting from the classification of these blocks over $\bar{\mathbb{F}}_2$). In the case of blocks of dihedral defect with two simple modules this also helped narrow down which Morita equivalence classes in the classification can occur at all in group rings. Also, by using that very same approach, I was also able to prove that a conjectural description of the basic algebra of $\mathbb{Z}_p[\zeta_{p^f-1}]\mathrm{S}L_2(p^f)$ is indeed correct.

Giambruno Antonio, University of Palermo, email: a.giambruno@unipa.it

Title: **On the exponent of a non commutative polynomial**

Through the computation of the asymptotics of codimensions we attach to a polynomial a numerical invariant, called exponent, and we prove that the standard polynomial has highest exponent among polynomials of the same degree.

Goncalves Jairo Z., University of Sao Paulo, Brasil, email: jzg@ime.usp.br

Title: **Some problems in division rings**

Let D be a division ring with center k, let $D^{\dagger} = D \setminus \{0\}$ be its multiplicative group and let * be a k-involution on D. We will discuss *Lichtman Conjecture*: there are free groups in $D^{\dagger}$, and also its * version, namely, $D^{\dagger}$

contains free symmetric and unitary pairs.

Guerreiro* Marines, Universidade Federal de Viçosa, Brasil, email: marines@ufv.br

Title: **Minimal codes in abelian group algebras**

We give counterexamples to show that some results regarding equivalence of abelian group codes, that have been in the literature for quite some time, are not correct. Also, we give examples of special families of abelian groups for which these results do hold and show how the structure of the lattice of subgroups of an abelian group can be used to describe the equivalence classes of minimal codes of the group algebra. This is joint work with Raul Antonio Ferraz, Csar Polcino Milies and Gladys Chalom from IME-USP (Brazil).

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Gupta Kanta, University of Manitoba, email: cgupta@cc.umanitoba.ca,

Title: **On some different topics : primitive elements, test sets , polynilpotent series , equationally Noetherian , partially commutative metabelian groups**

Herman Allen, University of Regina, Canada, email: aherman@math.uregina.ca

Title: **Clifford theory and Association Schemes**

In group representation theory, Clifford theory describes the behaviour of a representation of a group when it is restricted to a normal subgroup. An adaptation of Clifford theory for representations of association schemes was recently developed by Akihide Hanaki that is based on Dade's Clifford theory for group graded algebras. Let K be a field. If T is a strongly normal closed subset of a finite association scheme S, the quotient scheme $S/\!\!/T$ has the structure of a finite group, and the adjacency algebra KS is an $S/\!\!/T$-graded algebra over KT. Unlike the group situation, this need not be strongly graded. Nevertheless many of the applications of Clifford theory for group representations can still be established for association schemes. I will consider one such application useful for computing Schur indices.

Hurley Ted, National University of Ireland, Galway, Ireland,
email: ted.hurley@nuigalway.ie

Title: **Group rings in communications**

Group ring structures occur all over the place in the communications areas; often the structures used by engineers/cs people are special cases of group rings structures but are not recognised by them as such. There are some nice theorems involved; the mathematicians who may not like applications should also be happy!

Areas where the group ring ideas have proved or are proving useful include:

- Coding Theory. In particular;
    1. Linear zero-divisor and unit-derived codes.
    2. LDPC (Low Density parity check) codes. Short cycled codes.
    3. Convolutional Codes. (e.g. QLI (Quick Look In) codes are particular examples of group ring convolutional codes).
    4. Construction of self-dual; dual-containing codes and infinite series of 'good' such codes.
- Filterbanks & Signal Processing.
- Cryptography
- Hadamard matrices

I will discuss some of these as time allows.

Jespers Eric, Vrije Universiteit Brussel, Belgium, email: efjesper@vub.ac.be

Title **Generators of the unit group of integral group rings**

The unit group of an order in a finite dimensional semisimple rational algebra A is an important example of an arithmetic group. Hence it forms a fundamental topic of interest. Recall that a subring Γ of A is said to be an order if Γ is a finitely generated $\mathbb{Z}$-module that contains a $\mathbb{Q}$-basis of A. Prominent examples of orders are group rings RG of finite groups G over the ring of integers R of an algebraic number field. The unit group $\mathcal{U}(RG)$ of RG has received a lot of attention and most of it has been given to the case $R = \mathbb{Z}$. It is well known that the unit group $\mathcal{U}(\Gamma)$ of an order Γ is a finitely presented group. However, only for very few finite non abelian groups G the unit group $\mathcal{U}(\mathbb{Z}G)$ has been described, and even for fewer groups G a presentation of $\mathcal{U}(\mathbb{Z}G)$ has been obtained. Nevertheless, for many finite groups G a specific finite set B of generators of a subgroup of finite index in $\mathcal{U}(\mathbb{Z}G)$ has been given. The only groups G excluded in this result are those for which the rational group algebra $\mathbb{Q}G$ has a simple component that is either a non-commutative division algebra different from a totally definite quaternion algebra or a 2×2 matrix ring $M_2(F)$, where F is either $\mathbb{Q}$, a quadratic imaginary extension of $\mathbb{Q}$ or a non-commutative division algebra. These results are mainly due to Ritter- Sehgal and Jespers-Leal.

It remains a challenge to give finitely many explicit generators for the central units of $\mathbb{Z}G$, with G a finite group. In recent joint work with del Rio and Van Gelder we discovered a K-theory free proof showing that the Bass cyclic units generate a subgroup of finite index, a result originally due to Bass and Milnor. Also jointly with Parmenter we discovered new constructions of central units generating a subgroup of finite index in $Z(\mathcal{U}(\mathbb{Z}G))$ for finite abelian-by-supersolvable groups G. Thirdly, joint with Olteanu and Del Río, for many finite nilpotent groups G we show that $\mathcal{U}(\mathbb{Z}G)$ has a subgroup of finite index that is generated by three nilpotent groups for which we have an explicit description of their generators. Finally joint with Dooms and Konvalov, we discovered a method on how to deal with simple components of the type $M_2(\mathbb{Q})$. This is done by introducing new additional generators using Farey symbols, which are in one to one correspondence with fundamental polygons of congruence subgroups of $PSL_2(\mathbb{Z})$. Furthermore, for each simple Wedderburn component $M_2(\mathbb{Q})$ of $\mathbb{Q}G$, the new generators give a free subgroup that is embedded in $M_2(\mathbb{Z})$.

In this lecture we report on all these results.

Kiefer Ann, Vrije Universiteit Brussel, Belgium, email: akiefer@vub.ac.be

Title **Poincaré Bisectors in Hyperbolic Spaces and Application to Units** (joint work with E. Jespers, S. O. Juriaans, A. De A. E Silva, A. C. Souza Filho)

Describing generators and relations of groups acting on hyperbolic spaces was started in the nineteenth century. The big difficulty one encounters is the construction of a fundamental domain. This problem was considered by

Ford, Poincaré, Serre, Swan, Thurston and many others. But only in the case of a Ford domain explicit formulas are known.

Another non-trivial problem is that of describing units in an order of a non-commutative non-split division algebra. This problem is related to the construction of units in the integral group ring $\mathbb{Z}G$ of a finite group G. Only for very few finite non abelian groups G the unit group $\mathcal{U}(\mathbb{Z}G)$ has been described, and even for fewer groups G a presentation of $\mathcal{U}(\mathbb{Z}G)$ has been obtained. Nevertheless, for many finite groups G a specific finite set B of generators of a subgroup of finite index in $\mathcal{U}(\mathbb{Z}G)$ has been given. The only groups G excluded in this result are those for which the rational group algebra $\mathbb{Q}G$ has a simple component that is either a non-commutative division algebra different from a totally definite quaternion algebra or a 2×2 matrix ring $M_2(D)$, where D is either $\mathbb{Q}$, a quadratic imaginary extension of $\mathbb{Q}$ or a rational division algebra $\mathcal{H}(a, b, \mathbb{Q})$.

Our objectives are two fold. The first one is purely theoretical. Making use of the existing theory, we give explicit descriptions of the bisectors in the Poincaré Theory in $\mathbb{H}^n, n \in \{2, 3\}$, the novelty being the case $n = 3$. We give an algorithm to obtain generators for a subgroup of finite index of a group Γ acting on a hyperbolic 2 or 3-space and having finite covolume (coarea).

Our next objective is applications to units. We show how this algorithm may be used to compute the unit group of an order in a non-split classical quaternion algebra $\mathcal{H}(K)$ over an imaginary quadratic field extension K of the rationals. The same method works for non cocompact discrete groups and we apply it to the construction of generators of a subgroup of finite index in $\mathcal{U}(\mathbb{Z}G)$, with G nilpotent.

Kimmerle Wolfgang, University of Stuttgart , Germany ,
email: kimmerle@mathematik.uni-stuttgart.de

Title: **On the Gruenberg-Kegel graph of $V(\mathbb{Z}G)$**

Let G be a group. The Gruenberg - Kegel graph $\pi(G)$ of a group G is defined as follows. The vertices of $\pi(G)$ are the primes p for which G has an element of order p. Two different vertices p and q are joined by an edge provided there is a group element of G of order pq. The integral group ring of G is denoted by $\mathbb{Z}G$ and $V(\mathbb{Z}G)$ denotes the subgroup of the unit group $U(\mathbb{Z}G)$ consisting of all units with augmentation 1. The object of the talk is the prime graph of $V(\mathbb{Z}G)$ in the case when G is a finite group. The question is whether the prime graph of $V(\mathbb{Z}G)$ coincides with that of G.

In the first part of the talk it is shown that the prime graph question for $\mathbb{Z}G$ may be reduced to the examination of simple groups and their automorphism groups which occur as composition factors of G. This is used to prove that the prime graph question has a positive solution if G is a finite group whose order is divisible by three primes (except possibly the case that the Mathieu group M_{10} is a section of G). This reports on joint work with A.Konovalov.

Let H be a subgroup of G considered as group basis in $V(\mathbb{Z}G)$. The second part of the talk deals with torsion units of the centralizer ring of H in $\mathbb{Z}G$. This reports on joint work with A.B"achle.

Kirschmer Markus, University of Aachen, Germany,
email: Markus.Kirschmer@math.rwth-aachen.de,

Title: **Maximal finite subgroups of Sp(2n, Q)** short lecture

The maximal finite subgroups of Sp(2n, Q) have been recently classified for all n ¡= 11. These groups show up as the full automorphism groups of Z-lattices fixing not only a positive definite but also some non-degenerate symplectic form.

We discuss the general outline of the classification as well as several useful tools.

Künzer, University of Aachen, email: kuenzer@mathematik.uni-stuttgart.de

Title: **A genus question for orders**

Let R be a principal ideal domain and $p \in R$ be a prime. Let $\Lambda \subseteq R \times \cdots \times R =: \Gamma$ be an R-order such that $\Lambda_{(p)}$ is local. Suppose Γ/Λ to be annihilated by a power of p. Let $\mathrm{Cl}(\Lambda) := \Gamma^*_{(p)}/\Lambda^*_{(p)}\Gamma^*$ denote the idèle class group of Λ. To a normalized idèle (α), there is a projective Λ-lattice $\Lambda(\alpha)$ in the genus of Λ attached.

An R-order is Morita equivalent to Λ iff it is isomorphic to

$$\Xi_{\alpha_1,\ldots,\alpha_t} := \mathrm{End}_\Lambda(\Lambda(\alpha_1) \oplus \cdots \oplus \Lambda(\alpha_t))$$

for some $t \geqslant 1$ and some normalized idèles $(\alpha_1), \ldots, (\alpha_t)$.

Proposition. We have

$$\Xi_{\alpha_1,\ldots,\alpha_t} \simeq \Xi_{\tilde\alpha_1,\ldots,\tilde\alpha_t} \text{ as } \Lambda\text{-algebras} \iff \prod_{i=1}^t(\alpha_i/\tilde\alpha_i) \in \mathrm{Cl}(\Lambda)^t \ (\leqslant \mathrm{Cl}(\Lambda)) .$$

So we partition the Morita equivalence class of Λ into isoclasses.

Motivating example. Suppose given a finite group G, a principal ideal domain R large enough for G and a prime $p \in R$. Let $RG \subseteq \Phi \simeq \prod_i R^{n_i \times n_i}$ be a Wedderburn embedding. Let $RG_{[p]} := \Phi \cap RG_{(p)}$ be the naive localisation. Then Λ can be taken to be the endomorphism ring of an indecomposable projective $RG_{[p]}$-module P, provided its decomposition numbers are all in $\{0,1\}$, and Ξ to be the endomorphism ring of the direct sum of several indecomposable projectives in the genus of P, as occurring in the Pierce decomposition of $RG_{[p]}$.

Toy example. Let $\Lambda := \{ (z,z') \in \mathbf{Z} \times \mathbf{Z} \,:\, z \equiv_5 z' \}$ and

$$\Xi := \{ \left(\begin{smallmatrix} a & b \\ c & d \end{smallmatrix}\right) \times \left(\begin{smallmatrix} a' & b' \\ c' & d' \end{smallmatrix}\right) \in \mathbf{Z}^{2\times 2} \times \mathbf{Z}^{2\times 2} \,:\, a \equiv_5 a',\ 2b \equiv_5 b',\ -2c \equiv_5 c',\ d \equiv_5 d' \} .$$

Let $\tilde{\Xi}$ be defined in the same way, but without the factors 2 and -2.

Then $\Xi \not\simeq \tilde{\Xi}$, but $\Xi \overset{\text{Morita}}{\sim} \tilde{\Xi}$ and $\Xi_{(p)} \simeq \tilde{\Xi}_{(p)}$ for all primes p, including $p = 5$.

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Title: **Morphic Groups**

A group G is called morphic if every endomorphism $\alpha : G \to G$ for which $G\alpha$ is normal in G satisfies $G/G\alpha \cong ker(\alpha)$.

This concept originated in a 1976 paper of Gertrude Ehrlich characterizing when the endomorphism ring of a module is unit regular. The concept has been extensively studied in module and ring theory, and this talk investigates the idea in the category of groups. After developing their basic properties, we characterize the morphic groups among the dihedral groups and the groups whose normal subgroups form a finite chain. We investigate when a direct product of morphic groups is again morphic, prove that a finite nilpotent group is morphic if and only if its Sylow subgroups are morphic, and present some results about when a p-group is morphic.

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Title: **Dihedral p-critical elements in finite simple groups**

Approaching the construction of a non-abelian free group using Bass-cyclic units Angel del Rio and Jairo Goncalves defined a dihedral p-critical element g of a group G to be an element of prime order p, which is not only conjugate to g and g-1 in G, but is so in every subgroup and quotient group of G. Del Rio and Goncalves classiffied the solvable groups possessing dihedral p-critical elements. The non-solvable groups possessing such elements are simple and were classified using the CFSG by Robert Guralnick to be groups of the type $\mathrm{PSL}(2, q)$. We show how this result in some special cases can be achieved without the CFSG.

Massae Kitani* Patrícia and Ferraz Raul, Universidade de Saõ Paulo, Brasil, pmassae@gmail.com

Title: **Units of $\mathbb{Z}C_{p^n}$**

Let C_p be a cyclic group of order p, where p is a prime integer such that $S = \{-1,\ \theta,\ 1+\theta,\ 1+\theta+\theta^2,\ \cdots, 1+\theta+\cdots+\theta^{\frac{p-3}{2}}\}$ generates the group of units of $\mathbb{Z}[\theta]$ and θ is a primitive p^{th} root of 1 over $\mathbb{Q}$. In the article "Units of $\mathbb{Z}C_p$ ", Ferraz gave an easy way to find a set of multiplicatively independent generators of the group of units of the integral group ring $\mathbb{Z}C_p$. We extended this result for $\mathbb{Z}C_{p^n}$, provided that a set similar to S generates the group of units of $\mathbb{Z}[\theta]$. This occurs, for example, when $\phi(p^n) \leq 66$.

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Title: **The group ring of $SL_2(p^f)$ over p-adic integers.**

In my habilitation thesis I gave a description of the integral p-adic group ring of $G = SL_2(p^f)$ for arbitrary f. For $p = 2$ one finds for instance

Theorem.

Let $3 \leq f \in \mathbf{N}$, R be the ring of integers in the unramified extension K of degree f of $\mathbf{Q}_2$ and $k := R/2R \cong \mathbf{F}_{2^f}$ the residue class field. Let $G := SL_2(2^f)$ denote the group of 2×2-matrices over k of determinant 1. Then (K, R, k) is a 2-modular splitting system for G.

The simple kG-modules S_I are indexed with the subsets I of $N := \{1, \ldots, f\}$, such that $dim(S_I) = 2^{|I|}$.

Let V be a simple KG-module of dimension n with corresponding representation Δ_V and $C_V := \{I_1, \ldots, I_r\}$ be the set of indices of the 2-modular constituents of V and put $n_j := 2^{|I_j|}$, $1 \leq j \leq r$. Then there is a basis of V

such that

$$\Delta_V(RG) = \{(X_{ij})_{1\leq i,j\leq r} \in R^{n\times n} \mid X_{ij} \in 2^{|I_i\setminus I_j|}R^{n_i\times n_j}\}.$$

The endomorphism rings and homomorphism spaces of the projective indecomposable RG-lattices can be described explicitly. For example the endomorphism ring of the projective cover of the trivial RG-module is isomorphic to the group ring of the Sylow 2-subgroup of G.

The new methods developed by Florian Eisele in his Thesis allow to prove that the conjectured symmetric order B that maps onto kG is indeed isomorphic to the group ring RG.

In the talk I want to present this description, since this gives explicit examples of a series of group rings.

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Title **Primitive spectrum and representations of plactic algebras**

For any integer $n \geq 1$, the finitely presented monoid $M_n = \langle a_1, \ldots, a_n \rangle$ defined by the relations

$$a_i a_k a_j = a_k a_i a_j \qquad \text{for} \quad i \leq j < k,$$
$$a_j a_i a_k = a_j a_k a_i \qquad \text{for} \quad i < j \leq k$$

is called the plactic monoid of rank n. It is known that the elements of M_n are in a one-to-one correspondence with Young tableaux of certain type. Because of its strong relations to Young tableaux, the plactic monoid has already become a classical tool in several areas of representation theory and algebraic combinatorics (cf. (2,3)). The combinatorics of M_n has been extensively studied but there are only a few preliminary results on the algebraic structure of the monoid algebra $K[M_n]$ of M_n over a field K (cf. (1)). In particular, if $n < 3$ then $K[M_n]$ the structure of $K[M_n]$ is pretty well understood.

Our aim is to present recent results on the structure and representations of the algebra $K[M_n]$. In the talk we focus on the case where $n = 3$. The minimal prime ideals of $K[M_3]$ are described. Moreover, in case K is uncountable and algebraically closed, the left and right primitive spectrum and the corresponding irreducible representations of the algebra $K[M_3]$ are described.

This is a joint work with L.Kubat.

References:

(1) F. Cedó, J. Okniński, *Plactic algebras*, Journal of Algebra **274** (2004), 97–117.

(2) W. Fulton, *Young Tableaux*, London Mathematical Society Student Texts 35, Cambridge University Press, New York, 1997.

(3) A. Lascoux, B. Leclerc, J.-Y. Thibon, *The plactic monoid*, in: *Algebraic Combinatorics on Words*, pp. 164–196, Cambridge University Press, Cambridge, 2002.

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Title **Invariant ideals of abelian group algebras under the torus action of a field**

Let $V = V_1 \oplus V_2$ be a finite-dimensional vector space over an infinite locally-finite field F. Then V admits the torus action of $G = F^\bullet$ by defining $(v_1 \oplus v_2)^g = v_1 g^{-1} \oplus v_2 g$. If K is a field of characteristic different from that of F, then G acts on the group algebra $K[V]$ and it is an interesting problem to determine all G-stable ideals of this algebra. Indeed, this is related to the problem of classifying the ideal lattice of certain group algebras of particular locally finite groups. In a recent paper, we showed that, for almost all fields F, the G-stable ideals of $K[V]$ are uniquely writable as finite irredundant intersections of augmentation ideals of subspaces $W_1 \oplus W_2$, with $W_1 \subseteq V_1$ and $W_2 \subseteq V_2$. As a consequence, the set of all such G-stable ideals is Noetherian.

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Title: **Symmetric and antisymmetric elements in nonlinear involutions in group rings**

Let φ be a given involution in a group G, which is extended to an involution ψ in the group ring RG. Necessary and sufficient conditions are given on the group G and its involution, φ, as well as on the ring R and the extension ψ of the involution for the set of symmetric elements to be commutative, in a first part, and for the set of antisymmetric elements to be commutative, in a second part.

These results generalize those in which the extension of involution φ to the group ring RG is made linearly.

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Title: **Adjoint and Circle Groups: their structures and the Normalizer Property**

An element a, in a ring R, is called *right quasi-regular* if there exists an element b in R such that $a \circ b = a + b + ab$; in this case, b is called a *right quasi-inverse* of a. Similarly, one defines a *left quasi-inverse* element. If an element is both left and right quasi-regular, it is called *quasi-regular*, its left and right quasi-inverses coincide, and the set of all quasi-regular elements in R forms a group G under the operation $\circ$, called the *adjoint group* of R. If the adjoint group G is equal to R, this ring is called a (quasi-regular) radical ring and the adjoint group, a *circle group*, as we learn in Polcino Milies and Sehgal [1]. According to the well known R. Sandling results, adjoint and circle groups of finite rings are determined by its integral group rings [2]. Hence, they are solutions to the Isomorphism Problem (*ISO*). Closely related to *ISO* is the so-called Normalizer Property, which asks if the normalizer of a given finite group in the group of units of its integral group ring is, in some sense, minimal. In this work, we exhibit the internal structures of finite adjoint and circle groups, by means of a very nice semidirect product, and explore these structures in order to investigate the normalizer property and obtain solutions to this issue.

[1] C. Polcino Milies and S. K. Sehgal, *An Introduction to Group Rings*, Kluwer, Academic Publishers, Dordrecht 2002.

[2] R. Sandling, Group rings of circle and unit groups, Math. Z. **140** (1974) 195-202.

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Title **Involutions in group algebras**

Let RG denote the group ring of a group G over a commutative ring with unity R and let * denote an involution on RG, One might ask when the sets $(RG)^+$ or $(RG)^-$ are subrings of RG. These questions are equivalent, respectively, to asking when the elements which are symmetric commute and when the elements that are skew-symmetric anticommute. Observing that $(RG)^+$ is a Jordan algebra under the Jordan operation $\alpha \circ \beta = \alpha\beta + \beta\alpha$ and that $(RG)^-$ is a Lie algebra under the Lie bracket $[\alpha, \beta] = \alpha\beta - \beta\alpha]$, it is also natural to ask when these operations are trivial. These questions are equivalent, respectively, to asking when the elements of $(RG)^+$ anticommute and when the elements of $(RG)^-$ commute.

We shall first discuss the question of anticommutativity of these sets. Then, we shall consider oriented involutions in a general way and discuss all four problem in this more general setting.

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Title **Distinguishing covering groups of elementary abelian groups**

A *covering group* (or *Schur cover*) of an elementary abelian group A of order p^n is a group G with the following properties

- $|G| = p^{n+\binom{n}{2}}$.

- $G' = Z(G)$ is elementary abelian of order $p^{\binom{n}{2}}$.

- $G/Z(G) \cong A$.

If G is a covering group of A, then a minimal generating set for G has n elements, and if $G = \langle x_1, x_2, \ldots, x_n \rangle$ then G' is the elementary abelian group generated by the $\binom{n}{2}$ commutators $[x_i, x_j]$, $i < j$. In this situation each x_i^p can be expressed in terms of these simple commutators in a unique way.

On the other hand, a covering group of A can be determined by identifying a set of generators $\{x_1, \ldots, x_n\}$ and freely choosing an expression in the commutators $[x_i, x_j]$ as the pth power of each generator. The total number of choices available for this operation is $p^{n\binom{n}{2}}$. A natural (but difficult) question asks when two choices for this pth power function on the generators determine isomorphic covering groups. We will discuss how non-isomorphic covering groups can be distinguished and classified in some selected cases. The problem can be expressed in terms of linear algebra if p is odd, but is essentially a combinatorial one in the case $p = 2$.

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Title: **On $\mathbb{Z}_2$-graded identities of the super tensor product $UT_{k,l}(F)\,\widehat{\otimes}\,E$**

Let F be a field of characteristic zero and E be the unitary Grassmann algebra generated over an infinite-dimensional F-vector space L. Denote by $\mathcal{E} = \mathcal{E}^{(0)} \oplus \mathcal{E}^{(1)}$ an arbitrary $\mathbb{Z}_2$-grading of E such that the subspace L is homogeneous. Given $k \geqslant 1$, $l \geqslant 0$, denote by $UT_{k,l}(F)$ the algebra of $(k+l) \times (k+l)$ upper triangular matrices over F with the $\mathbb{Z}_2$-grading $UT_{k+l}(F) = \begin{pmatrix} UT_k(F) & 0 \\ 0 & UT_l(F) \end{pmatrix} \oplus \begin{pmatrix} 0 & M_{k\times l}(F) \\ 0 & 0 \end{pmatrix}$. Given a superalgebra $A = A^{(0)} \oplus A^{(1)}$, define the superalgebra $A\,\widehat{\otimes}\,\mathcal{E}$ by $A\,\widehat{\otimes}\,\mathcal{E} = (A^{(0)} \otimes \mathcal{E}^{(0)}) \oplus (A^{(1)} \otimes \mathcal{E}^{(1)})$. Note that when $\mathcal{E}$ is the canonical grading of E then $A\,\widehat{\otimes}\,\mathcal{E}$ is the Grassmann envelope of A. In this talk we will show some recent results about the $\mathbb{Z}_2$-graded identities of the superalgebras $UT_{k,l}(F)\,\widehat{\otimes}\,\mathcal{E}$. This is a joint work with Prof. Onofrio Mario Di Vincenzo (University of Basilicata).

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Title **Properties of the Froebenius map in noncommutative algebras**

While it is obvious that exponentiation by a given power of p respects both addition and multiplication in every commutative algebra of prime characteristic $p > 0$, it is not clear when either of these properties holds in a noncommutative algebra. It turns out that each is separately equivalent to the associated Lie algebra satisfying a polynomial identity of Engel type. Consequently, the algebra must be locally Lie nilpotent in a certain very strong sense. Other properties of the Froebenius map to be considered include its surjectivity. Clearly, saying that the Froebenius map is surjective on a field is precisely the same as saying the field is perfect. But exactly when are more general algebras also perfect in this same sense?

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Title: **Units of Integral Group Ring $\mathbb{Z}C_{2p}$, poster session**

Let p be a prime integer, θ a p^{th} primitive root of unity, C_{2p} be the cyclic group of order $2p$ and $\mathbb{Z}C_{2p}$ the Integral Group Ring. Consider $u_i := 1+\theta+\theta^2+\ldots+\theta^{i-1}$ for $2 \leq i \leq \dfrac{p+1}{2}$.

In our study we described explicitly the gerenator set of $\mathcal{U}(\mathbb{Z}C_{2p})$, where p satisfies the following: $S_\theta := \{-1, \theta, u_2, \ldots, u_{\frac{p-1}{2}}\}$ generates $\mathcal{U}(\mathbf{Z}[\theta])$ and $\mathcal{U}(\mathbb{Z}_p) = \langle \bar{2} \rangle$, which occur for $p = 11, 13, 19, 29, 37$.

* Supported by CAPES, Brazil

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Title **A radical for baric algebras poster session**

A baric algebra is a pair (A, ω), where A is an algebra over a field F, not necessarialy associative, neither commutative nor finite dimensional, and $\omega\colon A \to F$ is a nonzero homomorphism of algebras, which have been called weight function of the algebra. The kernel of ω is denoted by $bar(A)$.

Let G be a group (not necessarialy finite). The group algebra of F is a baric algebra, where ω is given by the augmentation mapping of FG.

In a baric algebra (A, ω), we denote by $\Delta(S)$ the set of subalgebras B in A (not necessarialy barics) such that $S \subseteq B$ and $bar(B)$ is an ideal of A; and by $A(S)$ the intersection of B such that B is in $\Delta(S)$. An element $x \in A$ is called nondegenerator element if for all $S \subseteq A$ such that $A(S \cup \{x\}) = A$, the equality $A(S) = A$ is valid.

In this work, we define a radical for baric algebras, called bar-radical and we prove that the bar-radical is the set of all nongenerator elements. Furthermore, we note that for some baric algebras, the zero socle and the socle are the same.

References:

[1] H. Guzzo Jr, The bar-radical of baric algebras, *Arch. Math. (Basel)* **67** (1996), no. 2, 106–118.

[2] H. Guzzo Jr., Some properties of bar-radical of baric algebras, *Comm. Algebra* **30** (2010), no. 10, 4827–4835.

[3] H. Guzzo Jr., The structure of baric algebras, *Groups, rings, and Group rings, Lec. Notes Pure Appl. Math. Chapman and Hall/CRC, Boca Raton, FL* (2006), 233–242.

[4] C. P. Milies and S. K. Sehgal, An Introduction to Group Rings, *Kluwer Academic Publishers* (2002).

[5] R. L. Rodrigues, Álgebras báricas e aplicações, *IME-USP* (2008) - Dissertação de Mestrado.

keywords: baric algebra, nondegenerator element, bar-radical.

AMS classification: MSC17A65, MSC17D05, MSC17D92.

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Poster

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Title: **Lie identities on symmetric elements of restricted enveloping algebras** HAMID USEFI Abstract. Let L be a restricted Lie algebra over a field of charac- teristic $p > 2$ and denote by u(L) its restricted enveloping algebra. We determine the conditions under which the set of symmetric elements of u(L) with respect to the principal involution is Lie solvable, Lie nilpotent, or bounded Lie Engel.

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Title **Finite group algebras of nilpotent groups: a complete set of orthogonal primitive idempotents** (joint work with Gabriela Olteanu)

The group algebra $\mathbb{F}G$ of a finite group G over a field $\mathbb{F}$ is the ring theoretical tool that links finite group theory and ring theory. If the order of G is invertible in $\mathbb{F}$, then $\mathbb{F}G$ is a semisimple algebra and hence is a direct sum of matrices over division rings, called the Wedderburn decomposition of $\mathbb{F}G$.

We will present some recent results on the computation of the Wedderburn decomposition of the finite group algebra $\mathbb{F}G$. The first step is to determine the primitive central idempotents of $\mathbb{F}G$. Recently, [1] gave a character-free method to compute the primitive central idempotents of the rational group algebra $\mathbb{Q}G$ for a finite nilpotent group. Later, [2] and [3] extended and improved this method for more classes of groups over both the rationals and finite fields. Furthermore, the Wedderburn component associated to a primitive central idempotent is described for a large class of groups, including the nilpotent groups, which is a second step toward the description of the simple components of $\mathbb{F}G$. [4] describes a complete set of matrix units (in particular, a complete set of orthogonal primitive idempotents) of each Wedderburn component of the rational group algebra $\mathbb{Q}G$ of a nilpotent group G, a third step in the description of $\mathbb{Q}G$. Finally, we will show such a result for the finite group algebra $\mathbb{F}G$, as proved in [5]. This result allows a straightforward implementation in a programming language, for example in GAP.

References

1. E. Jespers, G. Leal and A. Paques, *Central idempotents in the rational group algebra of a finite nilpotent group*, Journal of Algebra and its Applications 2 (2003), no. 1, 57 - 62.

2. A. Olivieri, Á. del Río and J. J. Simón, *On monomial characters and central idempotents of rational group algebras*, Communications in Algebra 32 (2004), no. 4, 1531 - 1550.

3. O. Broche and Á. del Río, *Wedderburn decomposition of finite group algebras*, Finite Fields and Their Applications 13 (2007), no. 1, 71 - 79.

4. E. Jespers, G. Olteanu and Á. del Río, *Rational group algebras of finite groups: from idempotents to units of integral group rings*, To appear in Algebras and Representation Theory (2011).

5. I. Van Gelder and G. Olteanu, *Finite group algebras of nilpotent groups: a complete set of orthogonal primitive idempotents*, Finite Fields and Their Applications 17 (2011), no. 2, 157 - 165.

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Title: **On the structure of numerical sparse semigroups**, In collaboration with Prof. André Contiero, UFAL

Let $\mathbb{N}$ be the set of non-negative integers and $H = \{0 = \rho_1 < \rho_2 < \ldots\} \subseteq \mathbb{N}$ be a *numerical (additive) semigroup of finite genus* g, i.e., the complement $\mathbb{N} \setminus H$ has g elements called *gaps*, $\mathrm{Gaps(H)} = \{\mathrm{l_1}, \ldots, \mathrm{l_g}\}$. For any numerical semigroup H, we define the parameter $m := \rho_2 - 1$.

Weierstrass semigroups in algebraic curves are examples of numerical semigroups. It is known, however, that a numerical semigroup may not always be realized as Weierstrass semigroup of a point on an algebraic curve.

A semigroup $H = \{0 = \rho_1 < \rho_2 < \cdots\} \subseteq \mathbb{N}$ is said to be *sparse* [1] if its set of gaps $\mathrm{Gaps(H)} = \{\mathrm{l_1}, \ldots, \mathrm{l_g}\}$ satisfies $l_i - l_{i-1} \leq 2, \quad \text{for} \quad i = 2, \ldots, g$ (equivalently, $\rho_{i+1} - \rho_i \geq 2,\ i = 1, \ldots, c - g$, where $c = l_g + 1$).

Thus, each pair of gaps in a sparse semigroup differ by 1 or 2. We present a count of how many gaps are consecutive and how many differ by 2.

It is well known that $l_g \leq 2g - 1$ [2, Theorem 1.1]. In case l_g is even, we write $l_g = 2g - 2k$. Munuera, Torres and Villanueva presented an upper bound for the genus of such semigroups:

Theorem[1, Theorem 3.1] Let H be a sparse semigroup of genus g with $l_g = 2g - 2k$. If $g \geq 4k - 1$, then $g \leq 6k - m - 1$.

It is only natural for one to ask about the existence of sparse semigroups of genus $g \geq 4k - 1$ and greatest gap $l_g = 2g - 2k$. A preliminary analysis of examples suggests that there are no such semigroups if $g > 4k - 1$, which would yield a new upper bound for their genus. We show that looking for such semigroups reduces to looking for sparse semigroups of genus $g = 4k$ and $l_g = 6k$.

References

[1]C. Munuera, F. Torres, J. Villanueva, *Sparse Numerical Semigroups*, Lecture Notes in Computer Science **5527** (2009), 23 – 31.

[2] G. Oliveira, *Weierstrass semigroups and the canonical ideal of non-trigonal curves*, Manuscripta Math., **71** (1991), 431–450.