Abstracts of all Talks

Below are all abstracts of the talks delivered at AIAD 2001 which were submitted in time in the version of their original submission.

Isomorphisms Between Matrix Rings over a Fixed Ring of Scalars

Gene Abrams

University of Colorado at Colorado Springs

The ring R is said to have type (n,k) in case there is an isomorphism of free modules ${}_RR^i \simeq {}_RR^j$ if and only if $i,j \geq n$ and $i \equiv j \pmod{k}$. Clearly for such i,j there is a ring isomorphism between the matrix rings $M_i(R)$ and $M_j(R)$. We provide examples which show that for a ring of type (n,k) there can exist isomorphisms $M_i(R) \simeq M_{i'}(R)$ where $i,i' \geq n$ and $i \not\equiv i' \pmod{k}$. We then investigate examples (provided by G. Bergman) of Invariant Basis Number rings R for which there exists an upward-directed set $S \subseteq \mathbf{N}$ with the property that $M_i(R) \simeq M_j(R)$ if and only if $i,j \in S$. We show that these IBN examples in fact arise as subrings of the original class of non-IBN rings.

Joint work with P. N. Anh.

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Some Codes Arising from Group Actions

Ricardo Alfaro

University of Michigan-Flint

This is a preliminary talk on constructing codes using skew group actions of finite groups on a field. I present some examples, comparison with cyclic codes and some questions.

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Interfaces between Noncommutative Ring Theory and Operator Algebras

Pere Ara
Universitat Autònoma de Barcelona

I will present a unified approach to several constructions in operator algebras that are related to the algebraic theory of rings of quotients, showing deep relations between algebraic and analytic concepts. These constructions include the algebra of unbounded operators affiliated to a finite von Neumann algebra, defined by Murray and von Neumann in 1936, and the C^*-algebra of essential multipliers of a C^*-algebra, defined by Elliott in 1976. In both cases, the algebras were defined without any explicit reference to localisation theory, but the fact that they can be obtained as quotient algebras has played a very important role in several applications.

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Exchange Property and the Natural Preorder Between Simple Modules over a Semiartinian Ring

Giuseppe Baccella
Università di L'Aquila

The aim of the talk is to illustrate how, given a right semiartinian ring R, every irredundant set $\mathbf{Simp}_R$ of representatives of simple right R-modules carries a canonical structure of an artinian poset, which is a Morita invariant. We outline some basic features of this order structure; most of them bear on the fact that R satisfies the exchange property, as we proved recently. For a wide class of right semiartinian rings, which we call *nice*, we establish a link between those (two-sided) ideals which are pure as left ideals and some upper subsets of $\mathbf{Simp}_R$.

In case R is an Artin algebra, then R is nice if and only if it is ℓ-hereditary and there is a strict link between the poset $\mathbf{Simp}_R$ and the Gabriel quiver $\Gamma(R)$; moreover there is an anti-isomorphism from the lattice of upper subsets of $\mathbf{Simp}_R$ to the set of all ideals which are pure as left ideals.

Finally we explain how every artinian poset (possibly after adding a suitable maximal element if it is infinite) is order isomorphic to $\mathbf{Simp}_R$ for some nice right semiartinian ring R.

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A Theorem of Martindale Revisited by the Local Approach

Maria Isabel Tocon Barroso
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Algebras satisfying a polynomial identity seem to be the natural generalization of commutative algebras: A is said to *satisfy a polynomial identity over* K, or just to be a *PI algebra*, if there exists a nonzero f in $K\langle x_1, ..., x_n\rangle$, the free algebra over K in the noncommutative variables $x_1, ..., x_n$, for some n, such that $f(a_1, ..., a_n) = 0$ for all $a_1, ..., a_n$ in A.

Classical results on PI algebras are the theorems of Kaplansky and Posner describing primitive and prime PI algebras, respectively. Both theorems can be obtained as a consequence of a theorem of Martindale which characterizes the prime algebras satisfying a "generalized polynomial identity" (GPI) [1].

The aim of this talk is to obtain the characterization given by Martindale's theorem, looking not at the PI character of the algebra, but at its "local PI structure" (following the ideas of [3]). This local-to-global transition of information will be possible via the "local algebras" associated to elements, which were first introduced by K. Meyberg [2]:

Let A be an algebra. For every element a in A, take $A^{(a)}$ to be the algebra defined by the same linear structure as A and the homotope product $x{\cdot_a}y = xay$. We define the *local algebra of* A *at* a as the quotient:

$$A_a = A^{(a)}/ker(a)$$

where $ker(a) = \{x \in A : axa = 0\}$.

In particular, we will show that the condition on a prime algebra of satisfying a GPI is equivalent to that of containing a nonzero PI element, where an element a in A is said to *be PI* if the local algebra A_a is PI (indeed, both notions are equivalent in practice). Next, we state the main result, which is a local version of Martindale's theorem:

Theorem *Let A be a prime K-algebra and a in A a nonzero PI element. Then:*

(i) *The extended centroid $C(A)$ of A is isomorphic to the field of fractions of the center $Z(A_a)$ of A_a.*

(ii) *The central closure of A is a primitive algebra with nonzero socle, whose associated division algebra D has finite dimension over its center $C(A)$.*

[1] W.S. Martindale, Prime rings satisfying a generalized polynomial identity, J. Algebra **12** (1969), 576–584.
[2] K. Meyberg, Lectures on algebras and triple systems, Lecture Notes, University of Virginia, Charlottesville.
[3] F. Montaner, Local PI theory of Jordan systems, J. Algebra **216** (1999) 302–327.

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M-Injective Modules and Prime M-Ideals

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For a left R-module M we identify certain submodules of M that play a role analogous to that of prime ideals in the ring R. Using this definition, we investigate conditions on the module M which imply that there is a one-to-one correspondence between isomorphism classes of indecomposable M-injective modules and "prime M-ideals".

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Banach Algebras in which any Left Ideal is Countably Generated

Nadia Boudi
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In 1974, Sinclair and Tullo proved that noetherian Banach algebras are finite-dimensional. We give an extension of their result and we prove that if A is a Banach algebra where any left ideal is either finitely or countably generated, then A is finite dimensional. We also study the case of alternative algebras.

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Functional Identities

Matej Brešar
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A functional identity on a ring R is, roughly speaking, an identity involving maps of R. A typical example is the identity

$$\sum_{i=1}^{n} E_i(x_1, \ldots, x_{i-1}, x_{i+1}, \ldots, x_n)x_i + x_i F_i(x_1, \ldots, x_{i-1}, x_{i+1}, \ldots, x_n) = 0$$

for all $x_1, \ldots, x_n \in R$. Here, $E_i, F_i : R^{n-1} \to R$ are arbitrary maps. The usual goal when treating a functional identity on R is either to describe the form of all maps involved in the identity, or, when this is not possible, to describe the structure of R. For example, if R is a prime ring, the maps E_i, F_i satisfying the above identity can be uniquely determined unless R satisfies S_{2n-2}, the standard polynomial identity of degree $2n-2$.
We shall briefly survey the main concepts and results of the theory of functional identities, and discuss some of its applications. In particular, we will present solutions of the long-standing Herstein's problems on Lie homomorphisms of some Lie subrings of associative rings. We shall also outline some other applications, for instance, ring-theoretic generalizations of some results on linear preservers obtained by linear algebraists and operator theorists.

Joint work with K.I. Beidar, M.A. Chebotar and W.S. Martindale.

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Noncommutative Symplectic Geometry

Ken Brown
University of Glasgow

I will describe a large class of (noncommutative noetherian) algebras introduced and studied in a recent preprint of P. Etinghof and V. Ginzburg, (AG/0011114). These algebras are deformations of skew group algebras of finite groups acting on polynomial algebras. They include as special cases skew group algebras over the Weyl algebras and the deformations of Kleinian singularities studied by Crawley-Boevey and Holland (Duke Math. J. 1998). They are expected to have important applications, for example to differential operators, representation theory of Hecke algebras and to symplectic resolution of singularities. Being rather straightforward to define but having nevertheless an extremely rich and beautiful structure, these algebras illustrate in a rather transparent way some of the major themes which are emerging in the subject beginning to be known as "non-commutative algebraic geometry". I'll describe new results of myself and Iain Gordon on the structure of these "symplectic reflection algebras".

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Inducing Subgroups on the Brauer and Picard Groups of a Coalgebra via Strong Equivalences

Juan Cuadra
Universidad de Almería

In this talk we study strong equivalences for two coalgebras C and D. These are Morita equivalences between C^*-Mod and D^*-Mod which induce, by restriction, equivalences between the categories of comodules $\mathcal{M}^C$ and $\mathcal{M}^D$. By considering these equivalences we get a subgroup $Pic^s(C)$ of $Pic(C)$, the Picard group of C. $Pic^s(C)$ is also a subgroup of $Pic(C^*)$, the Picard group of the dual algebra C^*. We give some examples where $Pic^s(C) \neq Pic(C)$ and $Pic^s(C) \neq Pic(C^*)$.
Let $Br(C)$ be the Brauer group of a cocommutative coalgebra C as defined in [5]. Using strong equivalences instead of equivalences in the definition of $Br(C)$ one gets a subgroup $Br^s(C)$. There is a duality morphism from $Br^s(C)$ into $Br(C^*)$, the Brauer group of C^*. We study this morphism solving in a positive way the questions formulated in [5, page 568].

[1] J. Cuadra, J.R. García Rozas, and B. Torrecillas, *Picard Groups and Strongly Graded Coalgebras.* To appear in J. Pure Appl. Algebra.

[2] J. Cuadra, J.R. García Rozas, B. Torrecillas, and F. Van Oystaeyen, *The Brauer Group of Irreducible Coalgebras.* To appear in J. Algebra, 2001.

[3] B. I-Peng Lin, *Morita's Theorem for Coalgebras.* Comm. Algebra **1** (1974), 311-344.

[4] M. Takeuchi, *Morita Theorems for Categories of Comodules.* J. Fac. Sci. Univ. Tokyo Sect. IA Math. **24** (1977), 629-644.

[5] B. Torrecillas, F. Van Oystaeyen, and Y.H. Zhang, *The Brauer Group of a Cocommutative Coalgebra.* J. Algebra **177** (1995), 536-568.

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Cotilting-type Bimodules Without Obvious Reflexive Modules

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We investigate the reflexive modules with respect to the new generalizations of Morita bimodules, i. e. with respect to the "quasi-cotilting" and the "locally quasi-cotilting" bimodules in the sense of Mantese. Almost all the results follow from a characterization of the indecomposable reflexive modules with respect to decomposable bimodules, defined over arbitrary rings. However, in order to construct cotilting-type bimodules admitting few and non obvious reflexive modules, it suffices to deal with representation-finite algebras, defined over an algebraically closed field K, and with modules and/or bimodules of finite dimension over K.

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Krull–Schmidt Theorem: Recent Developments

Alberto Facchini
Università di Padova

Some recent developments of the Krull–Schmidt Theorem will be presented. After a brief historical presentation, I will talk about the Krull–Schmidt Theorem for various algebraic structures. Then I will move on to consider the case of modules over associative rings. The case of serial modules will be presented. (Recall that a module is uniserial if its lattice of submodules is linearly ordered by inclusion, and is serial if it is a direct sum of uniserial modules.) In this context the notions of monogeny classes and epigeny classes appear naturally. I will present some recent results by Puninski, Diracca and myself about the uniqueness of decompositions and the uniqueness of the monogeny/epigeny classes. Finally, I will consider the extension from local endomorphism rings to homogeneous semilocal endomorphism rings, that is, rings that are simple artinian modulo their Jacobson radical.

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Permutation Groups and Coverings of Curves

Robert Guralnick
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We will discuss several results about arithmetic and geometric properties of coverings of curves including properties of polynomials and rational functions. The general framework for these problems will be to translate them into group theory. We then use group theory — typically results about primitive permutation groups, many of which depend upon the classification of finite simple groups, to find all group theoretic solutions. One then needs to determine which group theoretic solutions actually correspond to the original problem and more generally find all the arithmetic/geometric solutions corresponding to a given group theoretic solution.
In particular, we will discuss covers with a fixed genus and polynomial covers with nice arithmetic properties (particularly over finite fields). Exceptional polynomials and polynomials with the same value set on rational points will be discussed. We hope to emphasize the connection between the arithmetic geometry and the group theory. Properties of permutation groups such as fixed point ratios and fixed point free elements and their connection to the geometry will be mentioned.

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Generalization of Contact Elements Bundles and Relevant Properties of Weil Algebras

Miroslav Kureš
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The Weil algebra A is a local $\mathbb{R}$-algebra, the nilpotent ideal $\mathfrak{n}$ of which has finite dimension as a vector space and $A/\mathfrak{n} = \mathbb{R}$. One can assume that Weil algebras are finite dimensional factor $\mathbb{R}$-algebras

of the algebra $\mathbb{R}[t^1, \dots, t^k]$ of real polynomials in several indeterminates. It means, the Weil algebra A has a form $\mathbb{R}[t^1, \dots, t^k]/\mathfrak{i}$, where $\mathfrak{m}^{r+1} \subset \mathfrak{i} \subset \mathfrak{m}$ for some r, $\mathfrak{m} = \langle t^1, \dots, t^k \rangle$ being the maximal ideal of $\mathbb{R}[t^1, \dots, t^k]$ ($\mathfrak{i}$ with this property is called the *Weil ideal*).
Weil algebras play a very important role in differential geometry. Classical higher order contact elements are generalized to contact elements of Weil algebra type. The set of such elements has a fibered manifold structure. It is necessary to study relevant properties of Weil algebras for the description of natural operations on these bundles. New results in this area are in the center of this contribution, especially, we study the subalgebra $SA = \{a \in A; \phi(a) = a$ for all $\phi \in \operatorname{Aut} A\}$ of a Weil algebra A and we demonstrate the role of SA in the classification of the natural operators lifting vector fields to bundles of contact elements of Weil algebra type (the result was obtained quite recently by W.M. Mikulski).
Let A be a Weil algebra with width $k \geq 1$. If there is an expression of A as $A = \mathbb{R}[t^1, \dots, t^k]/\mathfrak{i}$, where $\mathfrak{i}$ is a homogeneous Weil ideal, we call A the *homogeneous Weil algebra*. If A is a homogeneous Weil algebra, then SA is the trivial subalgebra $\mathbb{R} \cdot 1$. We prove that Weil algebras of k-dimensional velocities functors of order r as well as their nonholonomic, semiholonomic and some other generalizations are homogeneous. (Such bundles are important in analytical mechanics.) Apart from that, we present that there are Weil algebras the subalgebra of fixed elements of which is nontrivial.

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Group Algebras of Simple Locally Finite Groups

Felix Leinen
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This talk is concerned with an old question raised by I. Kaplansky, namely for which simple groups G and for which fields F the group algebra FG has just the trivial two-sided ideals $\{0\}$, FG, and augmentation ideal. I will report about recent joint work with O. Puglisi which continues a research programme begun by A.E. Zalesskii to determine the ideal lattices of complex group algebras of infinite simple locally finite groups G. Due to S. Delcroix, every infinite simple locally finite group can be sorted into one of the following classes: linear groups, finitary groups, groups of 1-type, groups of p-type (for every fixed prime p), and groups of ∞-type. It is known that complex group algebras of linear infinite simple locally finite groups and of groups of p-type or ∞-type always have trivial ideal lattices. Our work provides further evidence that group algebras of finitary groups over finite fields have a fairly rich but well-structured ideal lattice, while the ideal lattice of groups of 1-type is merely a descending chain of length $\omega + 1$.

Joint work with Orazio Puglisi, Università di Firenze.

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Simplicity in Jordan Superalgebras and Relations with Lie Structures

Consuelo Martínez López
Universidad de Oviedo

Our aim is to present the current knowledge on Jordan superalgebras, with special emphasis on structure theory. Some recent results about simple finite-dimensional Jordan superalgebras in prime characteristic will be discussed, with reference to the inspiration sources and by comparing with the associative, Lie, and zero-characteristic cases. Some applications, relations between Jordan and Lie structures and links to representation theory will be included.

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On two-graded L^*-Algebras and L^*-Triple Systems

Antonio Jesus Calderón Martín
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In [1], Lister introduced the concept of Lie triple system and classified the finite-dimensional simple Lie triple systems over an algebraically closed field of characteristic zero. In order to study infinite-dimensional Lie triple systems, we introduce the notion of L^*-triple, as a mixture between a Lie triple system and a Hilbert space, and obtain a classification of L^*-triples admitting a two-graded L^*-algebra envelope. However, the problem on the existence of L^*-algebra envelopes is still open. We study several classes of L^*-triples that admit two-graded L^*-algebra envelopes and then we classify them.

[1] W.G. Lister, A structure theory of Lie triple systems, Trans. Amer. Math. Soc. 72 (1952) 217-242.

Joint work with C. Martín González (Universidad de Málaga).

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Exterior Powers for Quadratic Forms and Annihilating Polynomials in the Witt Ring

Sean McGarraghy
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Let K be a field of characteristic not equal to 2. We may define, for each non-negative integer k and each quadratic form φ over K, the k-fold exterior power of φ, denoted by $\Lambda^k(\varphi)$. We obtain formulae for the classical invariants of $\Lambda^k(\varphi)$ in terms of those of φ.
Λ^k is a functor on the category whose objects are finite-dimensional K-quadratic forms and whose morphisms are isometries. The exterior powers Λ^k define a λ-ring structure on $\widehat{W}(K)$, the Witt–Grothendieck ring of isometry classes of quadratic forms over K.
While the Witt ring $W(K)$ is not itself a λ-ring under the same operations, results in the λ-ring $\widehat{W}(K)$ may be used to recover the result of D. W. Lewis that for any positive integer n, the polynomial

$$p_n(t) := (t-n)(t-n+2)\cdots(t+n) \in \mathbf{Z}[t]$$

annihilates every quadratic form of dimension n in $W(K)$.

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On the Number of Generators of a Finite Group

Federico Menegazzo
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An interesting method to compute the minimal number of generators of a finite group has recently been introduced by F. Dalla Volta and A. Lucchini (1998). In this lecture we shall briefly comment on this method, and then show how it can be used in different areas of group theory. The applications will include some questions on (finite) permutation and linear groups, and the 'profinite Grushko–Neumann theorem'.

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The Probability of Generating a Permutation Group

Fiorenza Morini
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It is well known that a permutation group of degree n can be generated by $n-1$ elements. A deeper result follows from the classification of finite simple groups: any subgroup G of $Sym(n)$ can be generated by $[n+1/2]$ elements. This motivates the following question: given a constant b how many $[bn]$-tuples of elements of G generate G itself? Does the proportion of the $[bn]$-bases of G increase with n? We answer the question from an asymptotic point of view. If n is large enough, then the probability of generating G with $[n/2]$ elements is at least $1/4$. On the other hand if $b > 1/2$ and n is large enough, then $[bn]$ randomly chosen elements of G almost certainly generate G.
Lucchini, Menegazzo, Morigi (2000) proved that a transitive group G of degree n can be generated by $cn/(logn)^{1/2}$ for a suitable constant c. A stronger result is true: if $d > c$ then the probability of generating G with $[dn/(\log n)^{1/2}]$ elements tends to 1 as n tends to infinity.
Similar results are proved for completely irreducible linear groups over a finite field.

Joint work with Andrea Lucchini (Università di Brescia)

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Statistical Studies of Standard Structures

Peter M Neumann
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The standard structures that are the subject of this lecture are matrix algebras and classical groups over finite fields. The studies use both geometric and combinatorial methods to elicit statistical information about them. In particular, I propose to focus on semisimple matrices and the possibility of 'missing' identities of Rogers–Ramanujan type.

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K_0 of Purely Infinite Simple Regular Rings

Enrique Pardo
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We generalize the notion of purely infinite simple C^*-algebra to the context of unital rings, and we include a large supply of examples that lie in this class. We state some basic properties of purely infinite simple rings, specially those related to their K-theory. Then we introduce some new techniques for constructing purely infinite simple (von Neumann) regular rings, obtaining some examples with universal properties. We also show that some known examples are particular cases of our construction, and we compute its K-theoretical invariants.

Joint work with P. Ara (Universitat Autònoma de Barcelona, Spain) and K. R. Goodearl (University of California at Santa Barbara, USA).

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Lower Triangular Matrices with Lower Triangular Moore–Penrose Inverses

Pedro Patricio
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In this talk, R is a ring with involution $^-$ and $M(R)$ is the set of matrices over R with involution $^+ : [x_{ij}] \to [\bar{x}_{ji}]$. One can show that all lower triangular invertible matrices have lower triangular inverses if and only if the ring R is *Dedekind-finite*, i.e., $ab = 1$ implies $ba = 1$. Using the same reasoning, we may pose the following question: when does the Moore–Penrose inverse with respect to $^+$ of a lower triangular matrix exist and is again lower triangular? We will discuss the following result:

Theorem Given $A = [a_{i,j}]_{i,j=1,\ldots,n} \in M(R)$ with $a_{i,j} = 0$ if $i < j$, the following are equivalent:

(1) $A^\dagger$ exists w.r.t. $^+$ and is a lower triangular matrix;

(2) $a_{i,i}^\dagger$ exist w.r.t. $^-$ and $a_{i,j} \in a_{i,i} R a_{j,j}$, for all $i, j \in \{1, \ldots, n\}$.

In that case,

$$A^\dagger = [\gamma_{j,k}]_{j,k=1,\ldots,n},$$

where $\gamma_{j,k} = 0$ if $j < k$, $\gamma_{j,j} = a^{\dagger}_{j,j}$, and, if $j > k$,

$$\gamma_{j,k} = \sum_{\substack{s=0,\ldots,j-k-1,\\ j=j_0>j_1>\cdots>j_s>k}} (-1)^{s+1}\, a^{\dagger}_{j,j} a_{j,j_1} a^{\dagger}_{j_1,j_1} a_{j_1,j_2} \ldots a^{\dagger}_{j_s,j_s} a_{j_s,k} a^{\dagger}_{k,k}.$$

Joint work with Roland Puystjens (University of Gent) and Robert E. Hartwig (N.C.S.U., Raleigh).

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Stable Finiteness of Group Rings in Arbitrary Characteristic

Francesc Perera
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In the late 1960's, Kaplansky showed that the group algebra of a group G over a field with characteristic zero is directly finite. Even though different proofs were given shortly after, the general problem of deciding the direct finiteness of $K[G]$ in characteristic $p > 0$ has remained open, and virtually no progress has been made for the last 30 years. The purpose of the talk is to outline a technique that involves the study of translation rings associated to Cayley graphs of amenable groups, and the Sylvester rank functions one can define on them. As a consequence, we obtain that every group ring $D[G]$ of a free-by-amenable group G over a division ring D of arbitrary characteristic is stably finite, thereby settling the above problem in the positive for this wide class of groups.

Joint work with Pere Ara (Universitat Autònoma de Barcelona) and Kevin C. O'Meara (University of Canterbury).

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Adjacency Preserving Maps on Matrices and Operators

Tatjana Petek
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The study of the geometry of matrices was initiated by Hua. In this geometry, the points of the space are certain kind of matrices of a given size. With each such space of matrices we associate a group of

motions. The main problem is to characterize this group by as few invariants as possible.
We will be interested in the space of rectangular matrices $M_{m\times n}(\mathbb{F})$ with entries from $\mathbb{F}$, where $\mathbb{F}$ denotes either the field of real numbers $\mathbb{R}$ or the field of complex numbers $\mathbb{C}$. The matrices X_1 and X_2 are said to be adjacent if the rank of $X_1 - X_2$ is equal to 1. The map $T : M_{m\times n}(\mathbb{F}) \to M_{m\times n}(\mathbb{F})$ preserves adjacent pairs of matrices if $T(X_1)$ and $T(X_2)$ are adjacent whenever X_1 and X_2 are adjacent. Let $T : M_{m\times n}(\mathbb{F}) \to M_{m\times n}(\mathbb{F})$, m, $n \geq 2$, be an injective continuous map preserving adjacent pairs of matrices. We prove that when m is not equal to n, T is of the form

$$T([x_{ij}]) = P[f(x_{ij})]Q + R, \qquad ([x_{ij}] \in M_{m\times n}(\mathbb{F})),$$

where f is either identity or conjugation (in $\mathbb{C}$ only), P and Q are invertible matrices of appropriate sizes, and R is any $m \times n$ matrix. When $m = n$, in addition to these two forms we have also

$$T([x_{ij}]) = P[f(x_{ij})]^{\mathrm{tr}} Q + R, \qquad ([x_{ij}] \in M_{m\times n}(\mathbb{F})),$$

where A^{tr} stands for the transpose of A.
Let us note that Hua (see [Wan]) obtained a similar result assuming adjacency preserving in both directions, bijectivity and $\mathbb{F}$ being a division ring. In his result, f is any automorphism of $\mathbb{F}$. The main tool in his proof is a fundamental theorem of projective geometry.
As a consequence of our main result we prove that every 2-local automorphism of $M_{n\times n}(\mathbb{F})$ is an automorphism. The extension to the infinite dimensional case will also be given.

[Wan] Z. Wan, Geometry of matrices, World Scientific, Singapore-New Jersey-London-Hong Kong, 1996.

Joint work with Peter Semrl.

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On Compact Banach–Lie Algebras

Manuel Forero Piulestán
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We say that a Banach–Lie algebra L is compact if the operators $\mathrm{ad}(x)$ are compact for every x in L. In this way we obtain a structure theory for infinite dimensional topologically simple compact Banach–Lie algebras.

Joint work with A.J. Calderón Martín (Universidad de Cádiz, Spain).

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Semisimple Strongly Graded Rings

Ángel del Río
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We give necessary and sufficient conditions for a strongly graded ring (over a finite group) to be semisimple in terms of the group, the coefficient ring and the grading. As a consequence we obtain necessary conditions for a semisimple strongly graded ring with given homogeneous components to exists and show that if the group is cyclic the necessary conditions are sufficient.

Joint work with Eli Aljadeff (Technion-Israel Institute of Technology) and Yuval Ginosar (Ben Gurion, Israel).

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Higher Power Residue Codes and the Leech Lattice

Mehrdad Ahmadzadeh Raji
University of Exeter

We shall consider higher power residue codes over the ring $\mathbf{Z}_4$. We will briefly introduce these codes over $\mathbf{Z}_4$ and then we will find a new construction for the Leech lattice. A similar construction is used to construct some of the other lattices of rank 24 as well.

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Some Aspects of the Koethe Problem

Arthur Sands
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In 1930 Koethe obseved that a ring contains a largest nil ideal and asked whether all one-sided nil ideals were contained in it.This question remains open, but many equivalent questions have been found. In this talk certain classes of rings are defined and relationships between them are considered. Each of these classes would coincide with the class of all nil rings if the Koethe question has a positive answer.

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Invariance Properties of Automorphism Groups of Algebras

Manuel Saorín
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In the talk we shall analyze the invariance of the group of automorphisms, $Aut(A)$, and the group of outer automorphisms,

$$Out(A) = Aut(A)/Inn(A),$$

under transformations of categorical nature. We will be mainly concerned with their invariance under Morita equivalences, tilting-cotilting equivalences or derived equivalences.
We shall state and outline the proof of the following result:

Theorem. *If A and B are two derived equivalent finite dimensional algebras over an algebraically closed field, then the identity components of their (algebraic) groups of outer automorphisms are isomorphic.*
The statement says that the identity component of $Out(A)$ is a homological invariant, thus extending a result attributed to Brauer claiming that the same group was a categorical invariant, i.e., invariant under Morita equivalences.

Joint work with Francisco Guil-Asensio (Universidad de Murcia) and Birge Huisgen-Zimmermann (UCSB).

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On Algebraic Closure with Combinatoric Applications

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In this talk, we will discuss the algebraic closure operators and its compositions with other operators such as rim operators, boundary operators, interior operators and side operations etc. Interesting applications of closure operators acting on sets, semilattices, lattices, abstract algebras, numbers sets and Galois connection between posets will be introduced and mentioned. Various components of the boundary derived from algebraic closure will be displayed. In particular, a solution of an open problem of Kuratowski type proposed by P.C. Hammer in 1960 will be presented.

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An Extension of Gabriel's Theorem. Quotient Associative Pairs

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In this work we generalize a result due to Gabriel. We prove that a ring R is left nonsingular and every nonzero left ideal of R contains a l-uniform element if and only if $Q^l_{max}(R) \cong \Pi_\alpha End_{\Delta_\alpha}(V_\alpha)$, with V_α a left vector space over a division ring Δ_α. We also introduce the notion of (general) left quotient pair of an associative pair and show the existence of a maximal left quotient pair for every semiprime or left nonsingular associative pair (an associative pair $P = (M, N)$ can be seen as the pair of bimodules of a certain Morita context (R, S, M, N)). Finally we study those associative pairs P for which $Q^l_{max}(P)$ is von Neumann regular and give a Gabriel-like characterization of associative pairs whose maximal left quotient pair is semiprime and artinian.

Joint work with Miguel Gómez-Lozano.

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