

Algebraic Groups, Finite Groups, Geometries, Representations

50 years of Chevalley Seminar

September 22 – September 26, 2014

Monday

09:00 – 10:00 **Serge Bouc** (Amiens), Correspondence functors

10:10 – 11:10 **Ivan Marin** (Amiens), Report on the BMR freeness conjecture

Coffee Break

11:30 – 12:30 **Cédric Lecouvey** (Tours), Random Littelman paths conditioned in a Weyl chamber

Lunch

17:00 – 17:50 **Gabriel Navarro** (Valencia), Exceptional Characters and the McKay Conjecture

18:00 – 19:00 **Pierre Cartier** (Paris), La trajectoire politique de Claude Chevalley

19:30 *Dinner*

Tuesday

09:00 – 10:00 **Markus Linckelmann** (London), On integrable derivations of block algebras

10:10 – 11:10 **Gunter Malle** (Kaiserslautern), Decomposition numbers and Lusztig induction

Coffee Break

11:30 – 12:30 **Cédric Bonnafé** (Montpellier), Calogero-Moser cellular characters : the smooth case

Lunch

17:00 – 18:00 **Guy Henniart** (Orsay), Classification des représentations admissibles irréductibles modulo p des groupes réductifs p -adiques

18:10 – 19:10 **Pierre Cartier** (Paris), Un algébriste impénitent

19:30 *Dinner*

Wednesday

09:00 – 10:00 **Jiping Zhang** (Peking), Character degree problems and adequacy of subgroups

10:10 – 11:10 **Raphaël Rouquier** (UCLA), *TBA*

Coffee Break

11:30 – 12:30 **Shaun Stevens** (Norwich), Reducibility points and L-packets for classical groups

Lunch

Free Afternoon

19:30 *Dinner*

Thursday

09:00 – 10:00 **Maria Chlouveraki** (Versailles), The Yokonuma-Hecke algebra of type A

10:10 – 11:10 **François Digne** (Amiens), Conjugation of periodic elements in ribbon categories

Coffee Break

11:30 – 12:30 **Britta Späth** (Kaiserslautern), Clifford theory for Dade’s Conjecture

Lunch

17:00 – 18:00 **Geoff Robinson** (Aberdeen), From semisimple modules to low norm virtual projectives

18:10 – 19:10 **Michel Broué** (Paris), Some memories of Chevalley Seminar

19:30 *Dinner*

Friday

09:00 – 10:00 **Shigeo Koshitani** (Chiba), Scott modules and its Brauer construction

10:10 – 11:10 **Maxim Nazarov** (York), Generalized Harish-Chandra isomorphism and multidimensional Chevalley theorem

Coffee Break

11:30 – 12:30 **Geordie Williamson** (Bonn), Lusztig’s conjecture and torsion explosion

Lunch

14:30 Soutenance de thèse de **Léo Dreyfus-Schmidt**

Abstracts

Cédric Bonnafé (Montpellier)

Title : Calogero-Moser cellular characters : the smooth case

Abstract : Joint work with R. Rouquier.

Using the representation theory of Cherednik algebra at $t = 0$, we define a family of “Calogero-Moser cellular characters” for any complex reflection group W . Whenever W is a Coxeter group, we conjecture that they coincide with the “Kazhdan-Lusztig cellular characters”. We shall give some evidences for this conjecture. Our main result is that, whenever the associated Calogero-Moser space is smooth, then all the Calogero-Moser cellular characters are irreducible. This implies in particular that our conjecture holds in type A and for some particular choices of the parameters in type B .

Serge Bouc (Amiens)

Title : Correspondence functors

Abstract : In this joint work with Jacques Thévenaz, we develop the representation theory of *finite sets and correspondences* : let $k\mathcal{C}$ the category of finite sets, in which morphisms are k -linear combinations of correspondences (where k is a given commutative ring), and let \mathcal{F}_k be the category of *correspondence functors* (over k), i.e. the category of k -linear functors from $k\mathcal{C}$ to k -modules. This category \mathcal{F}_k is an abelian k -linear category.

In such a framework, it is of crucial importance to describe the algebra of *essential endomorphisms* of a given object. This is what we achieved in a previous work on the algebra of essential relations on a finite set, describing in particular its simple modules. This description leads to a *parametrization* of the simple functors on $k\mathcal{C}$ by triples (E, R, V) consisting of a finite set E , a partial order relation R on E , and a simple k -linear representation V of the automorphism group of (E, R) .

An important class of correspondence functors originates in *lattices* : to each finite lattice T , we associate the functor F_T of “functions from a set to T ”. We introduce a suitable k -linear category of lattices for which the assignment $T \mapsto F_T$ becomes a *fully faithful* k -linear functor. We also show that the functor F_T is projective in \mathcal{F}_k if and only if the lattice T is *distributive*.

The case where T is a *total order* is of particular interest : the endomorphism algebra of F_T turns out to be naturally isomorphic to a direct product of matrix algebras over k . As a consequence, when k is a field and R is a total order on E , the simple functor parameterized by (E, R, k) is also projective and injective.

In general, we obtain an explicit description of the simple functor S indexed by the triple (E, R, V) : we first choose a lattice T such that the poset of irreducible elements of T is isomorphic to (E, R) . We then introduce a specific subset G of T , containing E , and invariant by the group of automorphisms of (E, R) . The simple functor S appears as a quotient of F_T , and its evaluations can be described in terms of G and V . As a consequence, for each finite set X , the dimension of $S(X)$ can be explicitly computed.

Michel Broué (Paris)

Title : Some memories of Chevalley Seminar

Pierre Cartier (Paris-Diderot et IHES)

Premier exposé : La trajectoire politique de Claude Chevalley

Abstract : Dans les années 1930, Claude Chevalley se trouvait dans la mouvance des « Non-conformistes des années 1930 » selon le titre d’un ouvrage assez fameux. Non loin du personnalisme d’E. Mounier, et de « la jeune droite » de T. Maulnier, il adhéra au groupe « Ordre Nouveau » (à ne pas confondre avec d’autres mouvements du même nom et de triste réputation), en gros des pacifistes et des anarchistes de droite (oui! cela existe). Passant par dessus les années de guerre et d’exil, on le retrouvera, après 1970, avec Grothendieck dans « Survivre et vivre » et à Paris 8 (Vincennes). J’essaierai de montrer que cet itinéraire n’a rien d’erratique.

Second exposé : Un algébriste impénitent

Abstract : Claude Chevalley a eu plusieurs périodes mathématiques, qui l’ont mené du corps de classes aux groupes algébriques, mais toutes dominées par le goût de l’algèbre la plus pure. Je retracerai cet itinéraire, jalonné par plusieurs grands livres, fort influents.

Maria Chlouveraki (Versailles)

Title : The Yokonuma-Hecke algebra of type A

Abstract : Yokonuma-Hecke algebras were introduced by Yokonuma in the 60’s as generalisations of Iwahori-Hecke algebras. They have recently attracted the interest of topologists, because they naturally give rise to invariants for framed and classical knots. In this talk we will introduce and study the Yokonuma-Hecke algebra of type A from both algebraic and topological points of view.

François Digne (Amiens)

Title : Conjugation of periodic elements in ribbon categories

Abstract : Broué’s abelian defect conjectures in the case of finite groups of Lie type leads to questions about conjugacy of parabolic subgroups in Artin-Tits groups. In particular one has to understand the

conjugating elements and their centralizers in the case when these elements are “periodic”. These can be studied in the context of Garside categories, where general results on conjugation and centralizers of periodic elements can be proved. This is a joint work with Jean Michel.

Guy Henniart (Orsay)

Title : Classification des représentations admissibles irréductibles modulo p des groupes réductifs p -adiques

Abstract : Il s’agit de travaux communs avec Noriyuki Abe, Florian Herzig et Marie-France Vignéras. Nous considérons un corps local F de caractéristique résiduelle p et un groupe réductif G défini sur F . Nous fixons un corps algébriquement clos C de caractéristique p , et donnons une classification à la Harish-Chandra des représentations admissibles (condition de finitude) irréductibles de $G(F)$ dans des espaces vectoriels sur C . Un rôle important est joué dans la preuve par certains groupes réductifs finis, et nous utilisons les résultats de classification de leurs représentations irréductibles en caractéristique naturelle p , dus en particulier à Cabanes et Enguehard. Ces groupes réductifs apparaissent comme les quotients réductifs associés aux sous-groupes parahoriques “spéciaux” de $G(F)$.

Shigeo Koshitani (Chiba)

Title : Scott modules and its Brauer construction

Abstract : We will be discussing sufficient conditions for the Scott module $M := Sc(G, P)$ of a finite group G with vertex P , under which its Brauer construction $M(Q)$ with respect to any subgroup Q of P is still indecomposable as $C_G(Q)$ -module. The indecomposability is useful to get a stable equivalence or even a derived equivalence. This is joint work with R.Kessar and M.Linckelmann.

Cédric Lecouvey (Tours)

Title : Random Littelmann paths conditioned in a Weyl chamber

Abstract : The Pitman transform is a classical tool in the study of random walks on the line. It notably permits to obtain the law of simple random walks on the integers conditioned to stay positive. In 2008, it was observed by Biane, Bougerol and O’Connell that a natural generalisation of the Pitman transform could be defined on Littelmann paths. This suggests that conditionings of various random walks are controlled by the representation theory of Lie algebras and their generalisations. In the opposite direction, it should be possible to extract some information on multiplicities related to representation theory from their probabilistic interpretations. The purpose of this talk will be to precise these interactions between representation theory of Kac-Moody algebras and conditionings of random walks defined from the Littelmann path model. This is a joint work with E. Lesigne and M. Peigné.

Markus Linckelmann (London)

Title : On integrable derivations of block algebras

Abstract : Integrable derivations arise in the context of deformations of algebras, pioneered by Gershtenhaber and subsequently considered by many other authors. We investigate structural connections between block algebras, their local structure, their character theory, and the subgroups of the first Hochschild cohomology groups determined by integrable derivations. This is motivated by the question to which extent the local structure of a block algebra is invariant under Morita equivalences or stable equivalences of Morita type.

Gunter Malle (Kaiserslautern)

Title : Decomposition numbers and Lusztig induction

Abstract : There does not (yet) exist a general theory for describing decomposition numbers of finite reductive groups at primes different from the defining characteristic. We formulate a new conjecture predicting that characters of intersection cohomology complexes related to Lusztig induction should provide many new projective characters. We also present new, almost complete results on decomposition matrices of finite unitary groups of rank at most 10. This is joint work with Olivier Dudas.

Ivan Marin (Amiens)

Title : Report on the BMR freeness conjecture

Abstract : I will present arguably the most basic one among the set of conjectures stated in 1998 by Broue, Malle and Rouquier (following early work by Broue and Malle) about the generalized Iwahori-Hecke algebras associated to complex reflection groups. By a combination of several kind of arguments and lots of hand-written as well as computer-assisted calculations, it seems that a complete proof is now within reach. I will report on recent progress by my PhD student E. Chavli, as well as on a recent work by G. Pfeiffer and myself on this topic.

Gabriel Navarro (Valencia)

Title : Exceptional Characters and the McKay Conjecture

Abstract : We study the McKay conjecture in certain special cases.

Maxim Nazarov (York)

Title : Generalized Harish-Chandra isomorphism and multidimensional Chevalley theorem

Abstract : For any complex reductive Lie algebra \mathfrak{g} and any locally finite \mathfrak{g} -module V , we extend to the tensor product $U(\mathfrak{g}) \otimes V$ the Harish-Chandra description of \mathfrak{g} -invariants in the universal enveloping algebra $U(\mathfrak{g})$. We also extend to $S(\mathfrak{g}) \otimes V$ the classical Chevalley restriction theorem which describes \mathfrak{g} -invariants in the symmetric algebra $S(\mathfrak{g})$. This is a recent joint work with Khoroshkin and Vinberg. It has been already used by Alekseev with Moreau and by Joseph in their proofs of the Clifford algebra conjecture of Kostant.

Geoff Robinson (Aberdeen)

Title : From semisimple modules to low norm virtual projectives

Raphaël Rouquier (UCLA)

Title : TBA

Britta Späth (Kaiserslautern)

Title : Clifford theory for Dade's Conjecture

Abstract : In recent years many global/local conjectures in the representation theory of finite groups have seen remarkable progress. They have been deduced from still-conjectural properties of simple groups. The most comprehensive of those conjectures was stated by Dade. In this talk we will introduce an analogous reduction theorem for Dade's conjecture and present the Clifford-theoretic tools leading to this results.

Shaun Stevens (Norwich)

Title : Reducibility points and L-packets for classical groups

Abstract : For a classical group (symplectic, special orthogonal or unitary) over a nonarchimedean local field of odd characteristic, the identification of the cuspidal representations in an L-packet is related to the (ir)reducibility of certain parabolically induced representations. Via Bushnell–Kutzko's theory of types, this is related to induction of modules over certain affine Hecke algebras, whose structure can in turn be described in terms of Hecke algebras for finite reductive groups. I will try to describe how this works and the implications for L-packets, probably concentrating mostly on "depth zero" representations, where the connection with finite reductive groups is most transparent. This is joint work in progress, partly with Jaime Lust, and partly with Corinne Blondel and Guy Henniart.

Geordie Williamson (Bonn)

Title : Lusztig's conjecture and torsion explosion

Abstract : I will explain how recent results in number theory (the affine sieve of Bourgain, Gamburd and Sarnak) allow one to show that the torsion in the intersection cohomology of Schubert varieties in GL_n grows exponentially in n . Using results of Soergel one may deduce that any bound for Lusztig's conjecture has to be at least exponential in the Coxeter number. The applicability of the BGS sieve to our setting was pointed out to me by Peter McNamara.

Jiping Zhang (Peking)

Title : Character degree problems and adequacy of subgroups

Abstract : Character degrees problems has been intensively investigated in group theory. Adequacy of subgroups is very important in generalizations of Taylor-Wiles method for proving the automorphy of Galois representations. I will talk about some new progress on character degree problems and the application related to adequacy of subgroups.

Léo Dreyfus-Schmidt (Paris, Soutenance de thèse)

Title : Space of stability conditions in representation theory and Categorification of the Alvis-Curtis duality

Abstract : I will give an overview of some of the results of my thesis. Bridgeland has introduced the space of stability conditions attached to a triangulated category and showed that it is a complex manifold. We will study the interactions of the theory of stability conditions with modular

representation theory by investigating the space of stability conditions for Brauer tree algebras. Moreover, on a completely independent topic, we will discuss a categorification of the Coxeter complex and the Alvis-Curtis duality. We will see how we then recover results of Cabanes-Rickard and Linckelmann-Schroll.