Pramod N. Achar

Title: The nearby cycles formalism for parity sheaves

Abstract: A large part of my talk will be expository in nature, about parity sheaves on flag varieties and the role they have played in recent advances in geometric representation theory, such as the proof of the tilting character formula for algebraic groups. One recurring difficulty in the subject is that most sheaf-theoretic operations don't send parity sheaves to parity sheaves – but in some cases, it is possible to make sense of them in terms of chain complexes of parity sheaves. I will discuss some old results of this nature (recollement formalism), some new results (nearby cycles), and some potential applications.

Valery Alexeev

Title: Reflection groups and compact moduli

Abstract: I will discuss a series of compactifications of moduli spaces of surfaces associated with reflection groups

Seidon Alsaody

Title: Exceptional Groups and Related Algebras

Abstract: Exceptional groups (over arbitrary rings) are related to octonion algebras, triality and exceptional Jordan algebras. I will talk about recent results of an approach to these objects using certain torsors (principal homogeneous spaces) under smaller exceptional groups, and explain how an explicit understanding of these torsors provides insight into the objects and their interrelations.

Stéphanie Cupit-Foutou

Title: Spherical Geometric Invariant Theory

Abstract: I shall present some recent results about semiprojective spherical varieties from the perspective of GIT.

Philippe Gille

Title: On Serre's conjecture II for groups of type E7

Abstract: Serre's conjecture II is a vanishing conjecture in non-abelian Galois cohomology. It was stated in 1962 and is still open for trialitarian groups and groups of type E. We shall discuss the state of the art on the topic focusing on the E7 case.

Friedrich Knop

Title: Brion's finiteness theorem over perfect fields

Abstract: Let G be a connected reductive group. A G-variety X is called spherical if a Borel subgroup B of G has an open orbit in X. If the ground field is algebraically closed of characteristic zero, Brion has proved that the number of B-orbits in a spherical variety is finite. His method was deformation to the horospherical case. A more general result was obtained independently by Vinberg using the same method. Later Matsuki found a simpler argument by reduction to the rank-1-case. We will present a generalization of the theorems of Brion and Vinberg to arbitrary perfect ground fields. This is joint work with V. Zhgoon.

Shrawan Kumar

Title: Facets of tensor cone of symmetrizable Kac-Moody Lie algebras

Abstract: This is a joint work with Nicolas Ressayre. In this work, we are interested in the decomposition of the saturated tensor product of two representations of a symmetrizable Kac-Moody Lie algebra $\mathfrak{g}$. Let P_+ be the set of dominant integral weights. For $\lambda \in P_+$, $L(\lambda)$ denotes the (irreducible) integrable, highest weight representation of $\mathfrak{g}$ with highest weight λ. Let $P_{+,\mathbb{Q}}$ be the rational convex cone generated by P_+. Consider the *saturated tensor cone*

$$\Gamma(\mathfrak{g}) := \{(\lambda_1, \lambda_2, \mu) \in P^3_{+,\mathbb{Q}} \mid \exists N \geq 1 \text{ with } L(N\mu) \subset L(N\lambda_1) \otimes L(N\lambda_2)\}.$$

If $\mathfrak{g}$ is finite dimensional, $\Gamma(\mathfrak{g})$ is a convex polyhedral cone described by Belkale-Kumar by an explicit finite list of inequalities, which was proved to be an irredundant set of inequalities by Ressayre. In general, $\Gamma(\mathfrak{g})$ is neither polyhedral, nor closed. Brown-Kumar obtained a list of inequalities that describe $\Gamma(\mathfrak{g})$ conjecturally. In this work, we prove that each of the Brown-Kumar's inequalities corresponds to a codimension one face of $\Gamma(\mathfrak{g})$. Ressayre has proved that this set of inequalities is sufficient in the case of affine Kac-Moody Lie algebras. The sufficiency question is still open for non-affine $\mathfrak{g}$.

Kevin Langlois

Title: Intersection cohomology and torus actions of complexity one

Abstract: (Joint work with Marta Agustín Vicente) Intersection cohomology is a tool that allows to describe the topology of singularities. In this talk, we focus on the calculation of the (rational) intersection cohomology Betti numbers of a complex complete normal algebraic varieties with a torus action of complexity one (i.e., an action of an algebraic torus whose general orbits are of codimension one). This class of algebraic varieties encompasses the complete toric varieties (by choosing a subtorus of codimension one) and the complete normal surfaces with a non-trivial $\mathbb{C}^{\star}$-action. Intersection cohomology for the surface and toric cases was studied around the 90's by Stanley, Denef and Loeser, Fieseler, Bernstein and Lunts, Fieseler and Kaup, Braden and MacPherson, ..., and many others. We suggest a natural generalization using the geometric and combinatorial approach of Altmann, Hausen, and Suess for normal varieties with a torus action in terms of the language of divisorial fans. Roughly speaking, this description encodes for a normal variety with a complexity-one torus action, the data of an equivariant proper birational map (*the contraction map*), where the target space is our initial variety, and the source space is a toric fibration over a smooth algebraic curve. Using recent results of de Cataldo, Migliorini, and Mustaţă, and looking at the decomposition theorem for the contraction map, we will explain how inductively describe the intersection cohomology Betti numbers in terms of the associated divisorial fan.

Emmanuel Letellier

Title: Exotic Fourier transforms on connected reductive groups

Abstract: The use of Fourier transforms in representation theory was initiated by Springer to establish his well-known correspondence, it was later used by Kawanaka and Lusztig to investigate the generalized Gelfand-Graev characters. More recently it was used by Juteau to construct the modular Springer correspondence. However the connection between Fourier transforms and representations of finite Lie groups is rather indirect precisely because Fourier transforms are defined on Lie algebras. The only exception concerns GL_n as it is naturally embedded in its Lie algebra. In this special case Fourier transforms have very powerful applications : cohomological interpretation of coefficients structure of the character ring of $\mathrm{GL}_n(\mathbb{F}_q)$, cohomology of quiver varieties, Kac conjectures on quiver representations. In fact all these applications come from the fact that we can construct the unipotent characters of $\mathrm{GL}_n(\mathbb{F}_q)$ as the Fourier transform of nilpotent orbits of $\mathfrak{gl}_n$. In this talk we will discuss the case of other reductive groups motivated by the work of Braverman-Kazhdan and then Lafforgue. This is joint work with Laumon.

Peter Littelmann

Title: Semitoric degenerations via Newton-Okounkov bodies and Standard Monomial Theory.

Abstract: Sequences of Schubert varieties, contained in each other and successively of codimension one, naturally lead to valuations on the field of rational functions of the flag variety. By taking the minimum over all these valuations, one gets a quasi valuation which leads to a semitoric degeneration of the flag variety. We show that this semitoric degeneration is strongly related to the Standard Monomial Theory on flag varieties as originally initiated by Seshadri, Lakshmibai and Musili. This is work in progress jointly with Rocco Chirivi and Xin Fang.

Giancarlo Lucchini Arteche

Title: Smooth quotients of abelian varieties by finite groups

Abstract: Let G be a finite group acting on an abelian variety A fixing the origin and consider the quotient variety A/G. A natural question one could ask is whether this quotient is smooth. In a joint work with Robert Auffarth, we classify the pairs (A, G) with this property, which turn out to be quite scarce. In this talk, I will give an outline of the proof of such a result and hint some possible applications.

Laurent Manivel

Title: On Fano complete intersections in rational homogeneous varieties

Abstract: Complete intersections inside rational homogeneous varieties provide interesting examples of Fano manifolds. We classify those Fano complete intersections which are locally rigid, and those which are quasi-homogeneous. (Joint work with Chenyu Bai and Baohua Fu).

Lucy Moser-Jauslin

Title: Real structures on complex varieties and on complex G-varieties

Abstract: In this talk, we will discuss some new results concerning the description of real structures on complex varieties and on complex varieties endowed with an action of an algebraic group.

Clélia Pech

Title: Quantum cohomology for horospherical varieties

Abstract: Non-homogeneous horospherical varieties have been classified by Pasquier and include the well known odd symplectic Grassmannians. In this talk I will explain how to study their quantum cohomology, with a view towards Dubrovin's conjecture. In particular, I will describe the cohomology groups of these varieties as well as a Chevalley formula, and prove that many Gromov-Witten invariants are enumerative. The consequence is that we can prove in many cases that the quantum cohomology is semisimple. I will also give a presentation of the quantum cohomology ring for odd symplectic Grassmannians. Finally, I will explain mirror constructions in two cases. This is joint work with R. Gonzales, N. Perrin, and A. Samokhin.

Nicolas Perrin

Title: Quantum K-theory of grassmannians

Abstract: (joint work with A. Buch, P.-E. Chaput and L. Mihalcea) Quantum K-theory is the generalisation of quantum cohomology to K-theory. I will present some results, both qualitative and computational on quantum K-theory of grassmannians (and some avatars like cominuscule spaces): finiteness, positivity and Chevalley formulas.

Andriy Regeta

Title: Is an affine spherical variety determined by its automorphism group?

Abstract: In this talk I will show that "many" affine spherical varieties are determined by their automorphism groups seen as ind-groups (in the category of irreducible affine normal varieties). If the automorphism group is considered only as an abstract group, the problem becomes much more complicated. I will discuss some partial results in this direction.

Simon Riche

Title: A topological approach to Soergel theory

Abstract: In the early 1990's, Soergel proposed a new approach to the study of a regular block of category O of complex semisimple Lie algebras, by comparing projective objects in this category with certain modules over a coinvariant invariant nowadays called "Soergel modules". This regular block is equivalent to a category of perverse sheaves on the associated flag variety, so that these results can also stated in terms of topology. In this talk we will present a new approach to these results, obtained in joint work with R. Bezrukavnikov, which leads to a proof which is completely independent of Representation Theory, and works for arbitrary coefficients.

Gerald Schwarz

Title: Singularities of symplectic reductions

Abstract: Let V be a unitary representation of the compact Lie group K where K has Lie algebra $\mathfrak{k}$. Then there is a canonical moment mapping $\mu\colon V \to \mathfrak{k}^*$ which is equivariant with respect to the K-actions on V and $\mathfrak{k}^*$. Let M denote the zero set of μ and let M_0 (the symplectic reduction) denote the quotient space M/K which is a real semi-algebraic set. In most cases the algebra of regular functions A on M_0 is isomorphic to the restriction of $\mathbb{R}[V]^K$ to M. Note that if K is finite, then $\mu = 0$, $M_0 = V/K$ and often one has that $\mathbb{R}[V]^K$ is Gorenstein. We investigate algebraic properties of A and M_0 and consider the following questions.

1. Is there a finite group H and unitary H-module W such that $M_0 \simeq W/H$? In other words, when is M_0 an orbifold?
2. Let X denote the complexification of M_0. When does X have rational singularities? When does X have symplectic singularities? When does X have Gorenstein singularities?

Vikraman Uma

Title: Equivariant K-theory of regular compactification bundles

Abstract: Let G be a connected reductive algebraic group. Let $\mathcal{E} \longrightarrow \mathcal{B}$ be a principal $G \times G$-bundle and X be a regular compactification of G. In this talk we shall describe the Grothendieck ring of the associated fibre bundle $\mathcal{E}(X) := \mathcal{E} \times_{G\times G} X$, as an algebra over the Grothendieck ring of a canonical toric bundle over a flag bundle over $\mathcal{B}$. These are relative versions of the results on the equivariant K-theory of regular compactifications, and generalize the classical results on the Grothendieck rings of projective bundles, toric bundles and flag bundles.

Bart Van Steirteghem

Title: Weight monoids of smooth affine spherical varieties: characterization and computation

Abstract: Let G be a connected complex reductive group. About a decade ago, I. Loseu proved F. Knop's conjecture that a smooth affine spherical G-variety X is uniquely determined by its weight monoid, which is the set of irreducible representations of G that occur in the coordinate ring of X. I will discuss two approaches to a natural follow-up question: which monoids of dominant weights are realized in this way? This is joint work with G. Pezzini and F. Knop