Michel Brion - On the fundamental groups of commutative algebraic groups

It is well-known that the second homotopy group of any Lie group is zero. A remarkable analogue of this result is due to Serre and Oort for commutative algebraic groups over an algebraically closed field: they introduced higher homotopy groups (as derived functors of the "largest finite quotient"), and showed that these vanish in degrees at least two. The talk will discuss generalizations of this result to an arbitrary ground field, in relation to projective covers of commutative algebraic groups.

Michael Ehrig - Relative cellular algebras

In this talk we discuss the notion of relative cellular algebras, an idempotent adapted generalization of cellular algebras. We will start the talk by recalling the notion of cellular algebras and what one gains with this property. We will then discuss examples of algebras that are not cellular, but do share some of the properties of cellular algebras. This will lead to the definition of relative cellular algebras. We will discuss how these relate to ordinary cellular algebras and which results of the theory of cellular algebras can be obtained for the relative case. This is joint work with Daniel Tubbenhauer.

Evgeny Feigin - Semi-infinite Plücker relations

The classical Plücker relations describe the embedding of the type A flag varieties to the product of projectivized fundamental modules. The corresponding homogeneous coordinate ring is isomorphic to the direct sum of dual irreducible representations. We describe the semi-infinite analogue of the story with the simple Lie algebra replaced by the current algebra. We study the Drinfeld-Plücker embedding and describe the reduced scheme structure of the semi-infinite flag varieties. We show that the global Weyl modules serve as the replacement for the irreducible representations of the underlying simple Lie algebra. The talk is based on the joint work with Ievgen Makedonskyi.

Jacopo Gandini – The Bruhat order on hermitian symmetric varieties, and on abelian ideals of Borel subalgebras

Let G be a simple algebraic group over an algebraically closed field of characteristic different from 2. Let P be a parabolic subgroup of G with abelian unipotent radical P^u, let L be a Levi factor of P and let B be a Borel subgroup of G contained in P. Then B acts with finitely many orbits both on the Lie algebra of P^u and on G/L, which is called a symmetric variety of Hermitian type. In the talk, I will describe the Bruhat order of these B-orbits (that is, the partial order defined by the inclusions of their closures) in terms of suitable Weyl group elements, proving two related conjectures of Panyushev (concerning the B-orbits in the Lie algebra of P^u) and of Richardson-Ryan (concerning the B-orbits in G/L). Then I will discuss how to generalize Panyushev conjecture to the case of any abelian ideal a of the Lie algebra of B: in this case as well, B acts with finitely many orbits on a, and I will explain how the Bruhat order of the B-orbits on a is controlled by suitable involutions of the affine Weyl group. The talk is based on two joint works, the first one with A. Maffei, and the second one (in preparation) with A. Maffei, P. Moseneder-Frajria and P. Papi.

Yael Karshon - Bott canonical basis?

Together with Jihyeon Jessie Yang, we are trying to resurrect an old idea of Raoul Bott, for geometrically constructing canonical bases for unitary representations of compact Lie groups. We use large torus actions on families of Bott-Samelson manifolds over ^{n}. Our construction requires the vanishing of higher cohomology of sheaves of holomorphic sections of certain line bundles over the total spaces of such families; this vanishing is conjectural, hence the question mark in the title.

Masaki Kashiwara - Quiver-Hecke algebras, R-matrices and Localization

The module category of quiver Hecke algebras is a monoidal category whose Grothendieck algebra is isomorphic to the quantum unipotent coordinate ring. When the associated quantum group is of finite type, we can localize it by the central objects to obtain a rigid monoidal category.

Hanspeter Kraft - Small G-Varieties

There exist several concepts of “smallness” for a variety X equipped with an action of a reductive algebraic group G. E.g. we can consider the dimension of the invariant field of X or look at the complexity of X. In all these cases the hope is to find a classification in the “small” cases.
In the joint work with Susanna Zimmermann and Andriy Regeta we take a slightly different approach and consider affine G-varieties with the property that all nontrivial orbits are isomorphic to orbits of highest weight vectors. These are what we call small G-varieties. The motivation to look at these varieties came from our study of actions of the group Aff_n of affine transformations of affine n-space A^n. E.g. it is not difficult to see that there is only one faithful action of Aff_n on an affine variety of dimension n, namely the standard action on A^n.
One of the main result for small G-varieties is that the coordinate ring O(X) is a graded G-algebra. This means that for any two isotypic components $O(X)_\lambda$ and $O(X)_\mu$ of O(X) we have $O(X)_\lambda * O(X)_\mu \subset O(X)_{\lambda+\mu}$. Moreover, the highest weights appearing in O(X) are all of the same type, i.e. they are integer multiples of a fixed dominant weight λ_0. As a consequence, we obtain an equivalence of the category of small G-varieties of a fixed type with the so-called fix-pointed affine K^*-varieties.
Here is an interesting consequence. Proposition. Let $n > 4$. A smooth affine SL_n-variety of dimension $d < 2n-2$ is an SL_n-vector bundle over a smooth variety of dimension d-n with fiber the standard representation K^n or its dual.

Bernhard Krötz - Plancherel theory for real spherical spaces

To begin with I will explain how methods from algebraic geometry can be effectively used to describe the large scale geometry of homogeneous (real spherical) spaces. Then we move on to the finer geometry such as smooth compactifications and explain the linkage to Plancherel theory. The approach originates in the work of Sakellaridis and Venkatesh for p-adic spherical spaces and is novel in the sense that it was even unknown for G=SL(2,R) and its attached homogeneous spaces G/H. In order to convey the ideas clearly we will mainly focus on this class of examples. The talk is based on joint work with Patrick Delorme, Friedrich Knop, Job Kuit, Eric Opdam, Eitan Sayag, Henrik Schlichtkrull, and Sofien Souaifi (obtained in a variety of different projects).

Martina Lanini - Sheaves on the alcoves and modular representations

I'll report on a joint project with Peter Fiebig. The aim of the project is to provide a new perspective on the problem of calculating irreducible characters of reductive algebraic groups in positive characteristics. Given a finite root system R and a field k we introduce an exact category C of sheaves on the partially ordered set of alcoves associated with R, and we show that the indecomposable projective objects in C encode the desired characters.

Markus Reineke - Support sheaves for linear degenerations of flag varieties

Linear degenerations of flag varieties arise from relaxation of the containment relation between subspaces constituting a flag. We first describe the geometry of the individual degenerations qualitatively. Then we turn to global aspects, namely, how cohomology changes along the family of degenerations. We describe this change in terms of supporting perverse sheaves via quantum groups. This is a report on a joint project with G. Cerulli Irelli, X. Fang, E. Feigin and G. Fourier.

Nicolai Reshetikhin - Geometric asymptotics in representation theory and integrable systems

Associators in the category of finite dimensional representations of simple Lie algebras are also known as a 6j-symbols. They, and their q-analogs, play important role in many applications in physics and in the study of invariants of knots and 3-manifolds.

One of the important problems about 6j symbols and their q-analogs is to finds their asymptotic when the highest weights go to infinity along a ray. This asymptotic is also known as the semiclassical limit or geometric asymptotic. Ponzano and Regge found an asymptotical formula for the 6j symbols in this limit expressing the asymptotics in terms of the geometry of corresponding coadjoint orbits. The goal of this talk is to show how such asymptotics can be computed for other simple Lie algebras and how they are related to integrable systems.

Petra Schwer - Casting shadows in affine Weyl groups

Suppose w is a (reduced) word in an affine Weyl group W. Its shadows with respect to some orientation Φ is the set of all subwords of w that are positive with respect to Φ.
This notion of a shadow generalizes the Bruhat order on W in a natural, geometric way. Similarly, one can define shadows of elements in the co-root and weight lattices associated with W.
I will introduce the concept of shadows and show you a rainbow of applications. We will, for example, learn how to interpret non-emptiness of certain double coset intersections in semisimple algebraic groups using shadows. For example, we will see that one can express various Kostant-type convexity theorems using shadows. Overall I hope to advertize this geometric approach to the study of double coset intersections.

Catharina Stroppel - From affine Weyl groups to link invariants and orbifolds

In this talk we will consider a class of Coxeter groups (including the affine Weyl groups of type B and D) and connect them with braids and links arising from certain orbifolds. We will explain some new Reshethikin-Turaev type approach to construct polynomial invariants of such links mimicking the "classical" invariant of knots attached to any quantum group. In particular, we obtain a generalized Jones polynomial. If time allows we will mention briefly how this might be categorified.

Models for toric arrangements

Corrado De Concini

Joint with Giovanni Gaiffi, arXiv:1608.08746, arXiv:1801.04383.

Let $T = G_m^n$ be an algebraic torus over an algebraically closed field K, $X(T)$ its character group. A *layer* in T is the subvariety

$$\mathcal{K}_{\Gamma,\phi} = \{t \in T | \, \chi(t) = \phi(\chi), \, \forall \chi \in \Gamma\}$$

where Γ is a split direct summand of $X^*(T)$ and $\phi : \Gamma \to K^*$ is a homomorphism. A finite collection $\mathcal{F}$ of layers is called a toric arrangement.

Set

$$\mathcal{A} = T \setminus (\cup_{\mathcal{K}_{\Gamma,\phi} \in \mathcal{F}} \mathcal{K}_{\Gamma,\phi}).$$

I am going to explain how to construct projective varieties Y with the property that $\mathcal{A} \subset Y$ and $Y \setminus \mathcal{A}$ is a divisor with normal crossings and smooth irreducible components.

Furthermore when $K = \mathbb{C}$, I am going to give a presentation of the integral cohomology ring $H^*(Y, \mathbb{Z})$.