Geometry of homogeneous spaces and beyond.
Géométrie des espaces homogènes et au delà
(Org: **Kirill Zaynullin** (UOttawa) and/et **Changlong Zhong** (SUNY))

IVAN DIMITROV, Queen's University
A generalization of root systems

I will discuss the definition and properties of a notion that generalizes root systems. The resulting objects (GRS for short) include all finite root systems, Kostant root systems, and the root systems of basic classical Lie superalgebras. As a result, we obtain a unified treatment of some common properties of the above. I will also mention how GRS relate to flag manifolds (including exceptional flag manifolds) and to Nichols algebras.

This is a joint work with Rita Fioresi.

COLIN INGALLS, Carleton University
Stacks associated with non-commutative surfaces

This is joint work with Eleonore Faber, Matthew Satriano, and Shinnosuke Okawa. One of the main constructions of Connes' nocommutative geometry is a construction of the convolution algebra of a groupoid. It is not clear how to characterize which algebras can be obtained this way. We construct a groupoid associated to a smooth, finite over centre, noncommutative surface which has the same category of modules. This was done locally by Reiten and Van den bergh and in dimension one by Chan and I. We hope to use this result to study a Artin's conjectured classification of noncommutative surfaces by reduction to characteristic p.

MIKHAIL KOTCHETOV, Memorial University
Affine group schemes and gradings on algebras by abelian groups

Gradings by groups play an important role in the theory of associative and nonassociative algebras, including Lie and Jordan algebras. Of particular importance are the so-called fine gradings (that is, those that do not admit a proper refinement), because any grading on a finite-dimensional algebra can be obtained from them via a group homomorphism, although not in a unique way. If the ground field is algebraically closed and of characteristic 0, then the classification of fine abelian group gradings on an algebra (up to equivalence) is the same as the classification of maximal quasitori in the algebraic group of automorphisms (up to conjugation). Such a classification is now known for all finite-dimensional simple complex associative, Lie and Jordan algebras. To deal with algebras over an arbitrary field, one can use affine group schemes of automorphisms. I will illustrate this method by connecting abelian group gradings on classical central simple Lie algebras and those on central simple associative algebras with involution. For the latter, a graded version of the classical Wedderburn theorem can be used to reduce the study to the so-called graded-division algebras (meaning that all nonzero homogeneous elements are invertible) and sesquilinear forms over graded-division algebras with involution. This talk is based on joint work with A. Elduque and A. Rodrigo-Escudero.

NICOLE LEMIRE, University of Western Ontario
Low-Dimensional Algebraic Tori Split by 2-groups

Let T be an algebraic torus over a field F and let $\mathsf{CH}^2(BT)$ be the Chow group of codimension 2 cycles in its classifying space. Following work of Blinstein and Merkurjev on the structure of the torsion part of $\mathsf{CH}^2(BT)$, Scavia, in a recent preprint, found an example of an algebraic torus with non-trivial torsion in $\mathsf{CH}^2(BT)$. In recent joint work with Alexander Neshitov, we showed computationally that the group $\mathsf{CH}^2(BT)$ is torsion-free for all algebraic tori of dimension at most 5 and determine the conjugacy classes of finite subgroups of $\mathsf{GL}_6(\mathbb{Z})$ which correspond to 6-dimensional tori with nontrivial torsion in $\mathsf{CH}^2(BT)$. We explain these results using the birational structure of low-dimensional algebraic tori split by 2-groups.

CAMERON RUETHER, University of Ottawa
Chevalley Generators in Étale Stalks

Chevalley-Demazure group schemes are functors from the category of unital commutative rings to the category of groups, whose complex points recover classical linear algebraic groups such as SL_n, SO_n, etc. The group of points over an algebraically closed field can be completely described by Chevalley generators and their relations as detailed in Steinberg's famous Yale lecture notes. However, this description is insufficient over general rings where the subgroup generated by all Chevalley generators, called the elementary subgroup, is often a proper subgroup. Despite this, we will discuss how calculations with Chevalley generators are still sufficient to analyze group homomorphisms by looking at stalks with respect to the étale topology.

GEOFF VOOYS, Dalhousie University
A Pseudofunctorial Perspective on Equivariant Categories

In this talk we will present a unified perspective on categories of equivariant sheaves, equivariant derived categories, equivairant perverse sheaves, and other equivariant categories that goes through the language of pseudofunctors. More explicitly, for any field K and for any smooth algebraic group G acting on a quasi-projective K-variety X, we define a category $\mathbf{SfResl}_G(X)$ of certain G-resolutions of X for which if $F : \mathbf{SfResl}_G(X)^{\mathsf{op}} \to \mathfrak{Cat}$ is a pseudofunctor with some mild techinical conditions there is an equivariant category $F_G(X)$ induced by F. We will give many examples of the categories that arise in this language and some of the structure theorems that this language and construction makes immediate and useful for defining equivariant functors and equivariant adjoints. Time-permitting, we will also discuss some comparison theorems and current work in progress using these equivariant categories.