ACADEMY OF SCIENCES AND ARTS OF KOSOVA

Natural Sciences Section

SCIENTIFIC MEETING

THE LANGUAGE OF SYMMETRIES - A VIEWPOINT FROM REPRESENTATION THEORY AND GEOMETRY

11 July 2014, Prishtina

Symmetries are present almost everywhere in nature and they also show up in chemistry, physics, and mathematics. During this Scientific Meeting there will be discussed various aspects of the language of symmetries from the perspective of Representation Theory and Geometry.

SPEAKERS

Dr. Ethan Cotterill, Fluminese Federal University, Brazil
Dr. Harald Grobner, University of Vienna, Austria
Dr. Masoud Kamgarpour, University of Queensland, Australia
Robert Kremser, University of Munich, Germany
Dr. Marie-Amelie Lawn, University of Texas, Austin, USA
Dr. Justin Noel, University i Regensburg, Germany
Dr. Travis Schedler, University of Texas, Austin, USA

ORGANIZING COMMITTEE

Dr. Qamil Haxhibeqiri (Academy of Sciences and Arts of Kosova)

Dr. Masoud Kamgarpour (University of Queensland)

Dr. Qëndrim Gashi (University of Prishtina)

PARTICIPATION

The Organizing Committee invites all those who are interested to participate to register by sending an email to qamil.haxhibeqiri@uni-pr.edu or qendrim.gashi@uni-pr.edu. The deadline for registration is 20 June 2014. The registration and participation are free.

The event takes place at the Academy of Sciences and Arts of Kosova. Address: Agim Ramadani Street, n.n, 10000 Prishtina, Kosova.

PROGRAM

The detailed program will be published soon.

Please find below the titles and abstracts of the talks:

Dr. Ethan Cotterill, Federal University of Minas Gerais, Brazil

Dimension counts for singular rational curves

Abstract: Rational curves are essential tools for classifying algebraic varieties. Establishing dimension bounds for families of embedded rational curves that admit singularities of a particular type arises arises naturally as part of this classification. Singularities, in turn, are classified by their value semigroups. Unibranch singularities are associated to numerical semigroups, i.e. sub-semigroups of the natural numbers. These fit naturally into a tree, and each is associated with a particular weight, from which a bound on the dimension of the corresponding stratum in the Grassmannian may be derived. Understanding how weights grow as a function of (arithmetic) genus g, i.e. within the tree, is thus fundamental. We establish that for genus $g \leq 8$, the dimension of unibranch singularities is as one would naively expect, but that expectations fail as soon as $g = 9$. Multibranch singularities are far more complicated; in this case, we give a general classification strategy and again show, using semigroups, that dimension grows as expected relative to g when $g \leq 5$. This is joint work with Lia Fusaro Abrantes and Renato Vidal Martins.

Dr. Harald Grobner, University of Vienna, Austria

Rationality of special values of L-functions

Abstract: We will show some rationality results for special values of automorphic L-functions. These L-functions are analytic invariants of cuspidal automorphic representations, which encode important arithmetic information. Using geometrically defined periods, we will single out the transcendental part of these L-values, which is very well in the spirit of conjectures of Deligne, Gross and Beilinson.

Dr. Masoud Kamgarpour, University of Queensland, Australia

Symmetries in mathematics: a personal perspective

Abstract: Studying symmetries is one of the most powerful tools available to scientists for making sense of the world. In this talk, I will start by explaining how symmetries of geometric objects give rise to familiar matrix groups. Following suggestions of physicists, we will replace points of our spaces with strings or loops, thus arriving at loop spaces and loop groups. I will then explain some of the methods available for understanding the structure of loop groups and their representations. We will then switch gear and consider symmetries of certain differential equations. Here, too, we will see the loop group intervening. Finally, I will explain an intriguing conjectural relationship, suggested by the Langlands' philosophy, between differential equations and representations of loop groups.

Robert Kremser, University of Munich, Germany

Convex rank one subsets in symmetric spaces

Abstract: We will give some rigidity results concerning the boundary of convex subsets in symmetric spaces of higher rank. The subsets in question are closed, convex and with

nontrivial discrete boundary with respect to the Tits topology - hence convex rank one subsets.

We address the question: Does a convex rank one subset share the boundary with a convex subset of a rank one symmetric subspace?

Nontrivial convex rank one subsets, which are additionally invariant under an ($\mathbb{R}$)-Zariski dense subgroup of isometries of its ambient irreducible symmetric space, can only exist in rank 1 (Kleiner, Leeb). This result motivates the above question in the case of no additional data.

Dr. Marie-Amelie Lawn, University of Texas, Austin, USA

Immersions into Robertson-Walker spacetimes

Abstract: Robertson-Walker spacetimes are special cases of pseudo-Riemannian warped products which arise as exact solutions of the Einstein field equations in general relativity. We will consider hypersurfaces of such spaces and give a necessary and sufficient condition for a Riemannian manifold to locally isometrically immerse into them. If we have more time, we will speak about generalized associated families of surface immersions into 3D Robertson-Walker and homogeneous spaces.

Dr. Justin Noel, University i Regensburg, Germany

On a nilpotence conjecture of J. P. May

Abstract: In 1986 Peter May made the following conjecture: Suppose that R is a ring spectrum with power operations (e.g., a commutative S-algebra). Then the elements in the kernel of the integral Hurewicz homomorphism $\pi_* R \rightarrow H_* (R;Z)$ are nilpotent. The proof is short, simple and only uses results that have been around since the late 90's. As corollaries we obtain nilpotence results in various cobordism rings including Ω^{Spin}_* and Ω^{String}_*, the non-existence of commutative S-algebra structures on certain complex oriented ring spectra, and a partial analogue of Quillen's $\mathcal{F}$-isomorphism theorem for Lubin--Tate theories. This project is joint with Akhil Mathew and Niko Naumann.

Dr. Travis Schedler, University of Texas, Austin, USA

The Springer Correspondence and Poisson Homology

Abstract: The Springer Correspondence relates irreducible representations of the Weyl group of a semisimple complex Lie algebra to the geometry of the cone of nilpotent elements of the Lie algebra. The zeroth Poisson homology of a variety is the quotient of all functions by those spanned by Poisson brackets of functions. I will explain a conjecture with Proudfoot that assigns a grading to the irreducible representations of the Weyl group via the Poisson homology of the nilpotent cone. This conjecture is a kind of symplectic duality between this nilpotent cone and that of the Langlands dual. An analogous statement for hypertoric varieties is a theorem, which relates a hypertoric variety with its Gale dual, and assigns a second grading to its de Rham cohomology, which turns out to coincide with a different grading of Denham using the combinatorial Laplacian.