Zelevinsky conference

Wed Apr 24, 2013

9am - 10am Dean's remarks/ announcements/breakfast

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com

10am - 11am Sergey Fomin: Andrei's theorems

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description: I will recall some of my favorite mathematical results due to Andrei Zelevinsky.

11:30am - 12:30pm

Allen Knutson: Bruhat atlases on wonderful compactifications and elsewhere

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
Each opposite Bruhat cell on a flag manifold comes with a stratification (its intersection with the Schubert varieties) with many beautiful properties -- not only are the strata individually nice (normal, Cohen-Macaulay, etc.) but the stratification as a whole can be generated, in a sense, by the divisor complementary to the open stratum. If M is a manifold with a stratification, define a "Bruhat atlas" on M to be a system of charts, each stratified-isomorphic to an opposite Bruhat cell. This is a theory of examples, of which the two most interesting are partial flag manifolds and wonderful compactifications of groups. This work is joint with Xuhua He and Jiang-Hua Lu. When M is affine but not smooth, one might still hope to identify M with one of the strata in such a cell. Zelevinskii ('85) and Fulton ('92) gave examples of this (in both cases, refining the stratification on M). I'll explain how to do this for the cluster variety of type A_n.

2:30pm - 3:30pm

Daniel Labardini-Fragoso: On mutations of species with potentials

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
I will report on work in progress, joint with Andrei Zelevinsky, concerning a generalization of Derksen-Weyman-Zelevinsky's mutation theory of quivers with potentials to non-simply laced quivers. More precisely, we propose a mutation theory of species with potentials for species that arise from *strongly primitive* skew-symmetrizable matrices, that is skew-symmetrizable matrices that admit skew-symmetrizers whose diagonal entries are all pairwise coprime. This mutation theory of species with potentials satisfies most of the properties satisfied by Derksen-Weyman-Zelevinsky's QP-mutation theory, and covers several instances of skew-symmetrizable matrices that cannot be unfolded from the cluster algebra point of view.

Zelevinsky conference

4pm - 5pm Michael Shapiro: Mutationally finite cluster algebras

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
In 2003, Fomin and Zelevinsky obtained Cartan-Killing type classification of all cluster algebras of finite type, i.e. cluster algebras having only finitely many distinct cluster variables. A wider class of cluster algebras is formed by cluster algebras of finite mutation type which have finitely many exchange matrices (but are allowed to have infinitely many cluster variables). Ia a series of papers with A.Felikson, P.Tumarkin and H.Thomas we classified all mutationally finite cluster algebras. Except finitely many cases, almost all mutationally finite cluster algebras are associated with triangulations of 2-dimensional surfaces (generally speaking, surfaces with orbifold points). All mutationally finite non skew-symmetric cases are obtained from skew-symmetric cases by construction of folding (notion due to A.Zelevinsky). Based on the mutational finite classification we described growth rate of cluster algebras.

Thu Apr 25, 2013

9am - 9:30am Breakfast

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com

9:30am - 10:30am Alexander Braverman: Instantons and W-algebras

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
(joint work with M. Finkelberg and H. Nakajima) Let G be a simple simply connected algebraic group of A,D,E type. Let g be its Lie algebra and let also g_aff denote the corresponding affine Lie algebra. I am going to discuss a relation between representation theory of the W-algebra associated with g_aff (which I am going to recall during the talk) and geometry of moduli spaces of G-bundles on P^2 trivialized at infinity (a.k.a. the space of framed G-instantons on the 4-sphere). In case G=SL(n) our results imply (a somewhat modified) version of the previously known results of Maulik-Okounkov and Schiffmann-Vasserot and they are motivated by the so called Alday-Gaiotto-Tachikawa conjecture in mathematical physics. As an application we are going to give a geometric interpretation of some interesting structures on W-algebras (such as, for example, Feigin-Frenkel duality). In the end of the talk I am going to speculate about how to generalize the above results to more general (non-simply laced and twisted) affine Lie algebras.

11am - 12pm

Mikhail Kapranov: Categorification of supersymmetry and stable homotopy groups of spheres

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
The "minimal sign skeleton" necessary to formulate the Koszul sign rule is a certain Picard category, a symmetric monoidal category with all objects and morphisms invertible. It can be seen as the free Picard category generated by one object and corresponds, by Grothendieck's dictionary, to the truncation of the spherical spectrum S in degrees 0 and 1 so that $\{\pm 1\}$ appears as the first stable homotopy group of spheres $\pi_{n+1}(S^n)$. This suggest a "higher" or categorified versions of super-mathematics which utilize deeper structure of S. The first concept on this path is that of a supersymmetric monoidal category which is categorified version of the concept of a supercommutative algebra.

Zelevinsky conference

2pm - 3pm

Bernard Leclerc: A cluster algebra approach to q-characters of Kirillov-Reshetikhin modules

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
We describe a cluster algebra algorithm for calculating q-characters ofKirillov-Reshetikhin modules for any untwisted quantum affine algebraU_q(ĝ). This yields a geometric q-character formula for tensor productsof Kirillov-Reshetikhin modules. When g is of type A, D, E, thisformula extends Nakajima's formula for q-characters of standard modulesin terms of homology of graded quiver varieties. This is a joint workwith David Hernandez.

3pm - 4pm poster session

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com

4pm - 5pm

Alexander Goncharov: Configurations, potentials, components and canonical bases

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
This is a joint work with Linhui Shen (Yale). A pair (G; S), where G is a split reductive group and S a decorated surface, gives rise to a moduli space A(G;S) related to the moduli space of G-local systems on S. We introduce a rational function W on A(G;S), the potential. Its tropicalisation determines a subset of integral tropical points of A(G;S), which we call G-laminations on S. We prove that G-laminations parametrise top components of an infinite dimensional stack, the surface affine Grassmannian. These cycles materialise canonical bases. For example, when S is a disc with special points on the boundary, we get canonical basis in invariants of tensor products of representation of the Langlands dual group. We view W as the potential for a Landau-Ginzburg model on A(G;S), and conjecture that the pair (A(G,S); W) is mirror dual to the moduli space of local systems on S for the Langlands dual group.

Fri Apr 26, 2013

9am - 9:30am Breakfast

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com

9:30am - 10:30am Harm Derksen: Minimal Presentations of Modules

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
In my talk I will discuss minimal presentations of modules of finite dimensional algebras. For quivers of Dynkin type, generic minimal presentations are closely related to the g-vectors of cluster algebras with coefficients. I will explain how, in a way, the notion of cluster mutation can be extended to generic minimal presentations of modules of finite dimensional algebras.

Zelevinsky conference

11am - 12pm

Robert Marsh: Dimer models with boundary and cluster categories associated to Grassmannians

Where: 106 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
A dimer model can be defined as a quiver embedded into a surface in such a way that the complement is a disjoint union of disks with oriented boundaries. Such models can also be considered in the case of a surface with boundary. The Postnikov diagrams used by Scott to describe the cluster structure of the homogeneous coordinate ring of the Grassmannian give rise to dimer models on a disk in this sense. We associate a natural potential to such a dimer model and define a modified version, A, of the corresponding Jacobian algebra, taking the boundary into account. B. Jensen, A. King and X. Su have defined an algebra which gives rise to a category modelling the cluster structure of the homogeneous coordinate ring of the Grassmannian. We show that this algebra can be realised as an idempotent subalgebra of the algebra A.

2pm - 3pm Joseph Bernstein: Some results on regular holonomic g-modules

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description: for abstract, see attached PDF.

3pm - 4pm Lauren Williams: Network parameterizations for the Grassmannian

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
Deodhar introduced his decomposition of partial flag varieties as a tool for understanding Kazhdan-Lusztig polynomials. The Deodhar decomposition of the Grassmannian is also useful in the context of soliton solutions to the KP equation. Our main result is an explicit parameterization of each Deodhar component in the Grassmannian in terms of weighted networks. We also give a (minimal) characterization of each Deodhar component in terms of Plucker coordinates. Note that in his study of the non-negative Grassmannian, Postnikov constructed parameterizations of positroid cells that used certain planar networks. Our construction generalizes his -- but in our more general setup, we lose planarity. This is joint work with Kelli Talaska. If time permits, I may also briefly mention some connections to soliton solutions of the KP equation (joint work with Yuji Kodama).

4:30pm - 5:30pm

Vera Serganova: Weight modules over the Weyl algebras and sl(n)

Where: 108 West Willage G
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
(joint with D. Grantcharov) We study the category of sl(n)-modules with bounded weight multiplicities. Simple objects in this category play an important role in O. Mathieu classification of all simple weight modules. The main result is the description of blocks in this category in terms of quivers with relations. We use the geometric realization of this category via D-modules on the projective space and a twisted localization functor.

Some results on regular holonomic $\mathfrak{g}$-modules.

Joseph Bernstein. Tel Aviv University

Abstract.

Let $\mathfrak{g}$ be a reductive Lie algebra over an algebraically closed field k of characteristic 0. We denote by $\mathcal{M}(\mathfrak{g})$ the category of $\mathfrak{g}$-modules.

The aim of my talk is to introduce two "small" subcategories of the category $\mathcal{M}(\mathfrak{g})$ – categories of **holonomic** and **regular holonomic** $\mathfrak{g}$-modules, $\mathcal{M}(\mathfrak{g})_{rh} \subset \mathcal{M}(\mathfrak{g})_h \subset \mathcal{M}(\mathfrak{g})$.

Namely if M is a $\mathcal{Z}(\mathfrak{g})$-finite $\mathfrak{g}$-module then using localization theory we can construct the corresponding $\mathcal{D}$-module $\mathcal{F}_M$, and we call the module M holonomic (respectively regular holonomic) if the $\mathcal{D}$-module $\mathcal{F}_M$ has this property.

The importance of these notions comes from the fact that most "natural" $\mathfrak{g}$-modules one encounters are regular holonomic (or sometimes holonomic). Another interesting feature is that it is difficult to describe these subcategories directly in the language of $\mathfrak{g}$-modules.

I will describe some basic results about these categories and present some applications of them in representation theory.

Zelevinsky conference

Sat Apr 27, 2013

9am - 9:30am Breakfast

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com

9:30am - 10:30am Vladimir Retakh: Noncommutative Laurent Phenomenon

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
This is an introduction to the lecture of A. Berenstein on noncommutative cluster algebras (his lecture and my talk are based on our joint work.) I will discuss various noncommutative Laurent phenomena including examples coming from noncommutative triangulations of oriented surfaces. As byproducts of the theory, I will describe new topological invariants of closed oriented surfaces and outline a proof of Laurentness of a noncommutative Kontsevich recursion.

11am - 12pm Bernd Sturmfels: Mixed Discriminants

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
The mixed discriminant of n Laurent polynomials in n variables is the irreducible polynomial in the coefficients which vanishes whenever two of the roots coincide. We present joint work with Cattani, Cueto, Dickenstein and Di Rocco that places the mixed discriminant into the framework developed 25 years ago by Gel'fand, Kapranov and Zelevinsky. We study the degree of the mixed discriminant using tropical geometry, and we present an explicit degree formula is given for the case of plane curves.

2pm - 3pm Tomoki Nakanishi: Wonder of sine-Gordon Y-systems

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
The sine-Gordon Y-systems and the reduced sine-Gordon Y-systems were introduced by Tateo in the 90's in the study of the integrable deformation of conformal field theory by the thermodynamic Bethe ansatz method. The periodicity property and the dilogarithm identities concerning these Y-systems were conjectured by Tateo, and only a part of them have been proved so far. We formulate these Y-systems by the polygon realization of cluster algebras of types A and D, and prove the conjectured periodicity and dilogarithm identities in full generality. As it turns out, there is a wonderful interplay among continued fractions, triangulations of polygons, cluster algebras, and Y-systems. This is a joint work with Salvatore Stella.

3pm - 4pm poster session

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com

Zelevinsky conference

4pm - 5pm Ezra Miller: How do quivers and stratifications apply to biology?

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
Given a filtered topological space, the induced maps on the homology of its filtered pieces yield a quiver commonly known as its "persistent homology". This notion has numerous applications, including statistical methods for geometric structures in medical imaging and evolutionary biology. Dealing with singular structures leads to new notions of stratified persistent homology and raises stability questions. The motivation and primary applications for these developments involve extracting data from the geometry of blood vessels and quantifying variation in fruit fly wing veins.

Sun Apr 28, 2013

8:30am - 9am Breakfast

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com

9am - 10am Arkady Berenstein: Noncommutative Clusters

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
The goal of my talk (based on a joint paper with V. Retakh) is to introduce noncommutative clusters and their mutations, which can be viewed as vast generalizations of both ``classical" and quantum cluster structures. Each noncommutative cluster X is built on a torsion-free group G and a certain collection of its automorphisms. We assign to X a noncommutative algebra A(X) related to the group algebra of G, which is an analogue of the cluster algebra, and expect Noncommutative Laurent Phenomenon to hold in the most of algebras A(X). Our main examples of ``cluster groups" G include principal noncommutative tori which we define for any initial exchange matrix B and noncommutative triangulated groups which we define for all oriented surfaces.

10am - 11am Claus Ringel: Ubiquity and universality of quiver Grassmannians

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description:
Let k be an algebraically closed field, M a k-representation of a quiver and d a dimension vector. The corresponding quiver Grassmannian is the projective variety of all submodules of M with dimension vector d. Caldero and Chapoton have shown that quiver Grasmmannians play an important role when dealing with the cluster algebras introduced by Fomin and Zelevinsky. We want to draw the attention to M.Auslander's theory of morphisms determined by modules. It describes basic features of the module category of a finite-dimensional algebra in terms of submodule lattices, thus in terms of quiver Grassmannians. A recent preprint of Reineke asserts that any projective variety can be realized as a quiver Grassmannians. We are going to put this observation into its proper historical frame.

11:30am - 12:30pm Jerzy Weyman: Kac-moody Lie algebras and finite free resolutions

Where: 135 Shillman
Calendar: Zelevinsky conference
Created by: bwebste@gmail.com
Description: for abstract, see attached PDF.

Kac-moody Lie algebras and finite free resolutions.

Let us recall that a format $(r_n, ..., r_1)$ of the free complex

$$0 \to F_n \stackrel{d_n}{\to} F_{n-1} \to \ldots \to F_1 \stackrel{d_1}{\to} F_0$$

over a commutative Noetherian ring is the sequence of ranks r_i of the i-th differentials d_i. We will assume that rank $F_i = r_r + r_{i+1}$.

We say that an acyclic complex F_{gen} of a given format over a given ring R_{gen} is generic if for every complex G of this format over a Noetherian ring S there exists a homomorphism $f : R_{gen} \to S$ such that $G = F_{gen} \otimes_{R_{gen}} S$.

For complexes of length 2 the existence of the generic acyclic complex was established by Hochster and Huneke in the 1970's. It is a normalization of the ring giving a generic complex (two matrices with composition zero and rank conditions).

I will discuss the ideas of the proof of the following result. Associate to a triple of ranks (r_3, r_2, r_1) a triple $(p, q, r) = (r_3 + 1, r_2 - 1, r_1 + 1)$. Associate to (p, q, r) the graph $T_{p,q,r}$ (three arms of lengths $p-1, q-1, r-1$ attached to the central vertex). Then there exists a generic ring R_{gen} for this format with a multiplicity free action of the Lie algebra $\underline{gl}(F_0) \times \underline{gl}(F_2) \times \underline{g}(T_{p,q,r})$.

The ring R_{gen} is Noetherian if and only if $T_{p,q,r}$ is a Dynkin graph.