Abstracts

Luchezar Avramov, University Nebraska-Lincoln, USA:
Title: Quasi-polynomial growth of free resolutions
Abstract: When R is a noetherian local ring and M a finitely generated R-module, the sequence $(\beta^R_n(M))_{n\ge 0}$ of Betti numbers records the ranks of the free modules in a minimal free resolution of M. It has long been known that R is a local complete intersection of codimension c if and only if every such Betti sequence is eventually given by a quasi-polynomial in n of period 2, degree at most $c-1$, with constant leading coefficient. I will present recently discovered relations between the number of constant coefficients of Betti quasi-polynomials, the codimensions of quadratic embeddings of the tangent cone of R, and the structure of the Yoneda algebra $\mathrm{Ext}^*_R(k,k)$, where k is the residue field of R. The results are from joint work with Aelxandra Sceleanu and Zheng Young, and with Nicholas Packauskas and Mark Walker.

Severin Barmeier, Max-Planck-Institute, Bonn, Germany:
Titel: L-infinity algebras for deformations of categories of quasi-coherent sheaves
Abstract: (joint with Y. Frégier) We explain how to obtain an explicit L-infinity algebra structure on the Gerstenhaber-Schack complex controlling deformations of the Abelian category of (quasi)coherent sheaves on a variety X, in case X can be covered by two affine open sets. Such deformations are controlled by the second Hochschild cohomology of the variety and for X a smooth complex variety, say, the HKR decomposition gives a concrete geometric interpretation: deformations of (Q)Coh (X) can be viewed as deformation quantizations and (simultaneous) deformation of the complex structure. The compatibility between these two types of deformation is then encoded in the Maurer-Cartan equation of the L-infinity algebra.

Igor Burban, University Paderborn, Germany:
Title: “Tame non-commutative nodal curves and homological mirror symmetry for compact surfaces with boundary”
Abstract: In my talk, based on a joint work with Yuriy Drozd, I am going to explain how tame non-commutative nodal curves naturally appear in the context of the homological mirror symmetry for compact oriented surfaces with non-empty boundary.

Winfried Bruns, University Osnabrück, Germany:
Title: Wilf’s conjecture by multiplicity
Abstract: Let S be a numerical semigroup. Its embedding dimension $e(S)$ is the minimal number of generators, the Frobenius number $F(S)$ is the largest integer $\notin S$, and $n(S)$ counts the elements in S that are $<F(S)$. Wilf's conjecture states that $F(S) < e(S)n(S)$. It has been proved in many cases, but remainsl a major open problem in the combinatorial theory of numerical semigroups. We will show that for fixed multiplicity $m=m(S)$, the smallest nonzero element of S, the conjecture can be decided algorithmically by polyhedral methods using the parametrization of multiplicity m semigroups by the lattice points of the Kunz polyhedron P_m. With them we have verified the conjecture for $m\le 17$.
This is joint work with Pedro Garcia-Sanchez, Christopher O'Neill and Dane Wilburne.

Aldo Conca, University Genova, Italy:
Title: Cartwright-Sturmfels ideals and Herzog's conjecture.
I will present a circle of ideas that led to the definition of Cartwright-Sturmfels ideals and to the proof of Herzog's conjecture on the rigidity of the extremal Betti numbers under a Groebner deformation with reduced spacial fiber.
Joint work with Emanuela De Negri (Genova), Elisa Gorla (Neuchatel) and Matteo Varbaro (Genova).

William Crawley-Boevey, University Bielefeld, Gemany:
Title: Combinatorics of faithfully balanced modules
Abstract: This is joint work with Biao Ma, Baptiste Rognerud and Julia Sauter. In this talk I shall discuss the combinatorics of faithfully balanced modules for the algebra of upper triangular n by n matrices. The theory extends known results about tilting modules, which are classified by binary trees, and counted with the Catalan numbers. The number of faithfully balanced modules is a 2-factorial number. Amongst them are n! modules with n indecomposable summands, which can be classified by interleaved binary trees or by increasing binary trees.

Wolfgang Ebeling, University Hannover, Germany:
Title: Lattices for Landau-Ginzburg orbifolds
Abstract: We consider a pair consisting of an invertible polynomial and a finite abelian group of its symmetries. Berglund, H\"ubsch, and Henningson proposed a duality between such pairs giving rise to mirror symmetry. We define an orbifoldized signature for such a pair using the orbifoldized elliptic genus. In the case of three variables and based on the homological mirror symmetry picture, we introduce two integral lattices, a transcendental and an algebraic one. We show that these lattices have the same rank and that the signature of the transcendental one is the orbifoldized signature. Finally, we give some evidence that these lattices are interchanged under the duality of pairs. This is joint work with Atsushi Takahashi.

Özgür Esentepe, University Toronto, Canada:
Title: The Cohomology Annihilator Ideal over Gorenstein Local Rings
Abstract: I am going to talk about the first part of my PhD thesis: a question raised by Ragnar-Olaf Buchweitz and how I managed to solve it. The cohomology annihilator ideal of a commutative Noetherian ring R is the ideal of R which uniformly annihilates all Ext modules over R. It has been introduced by Iyengar and Takahashi a couple years ago and has been studied deeply by them and others. In his famous manuscript, Buchweitz proves that if R is a complete intersection, then the cohomology annihilator ideal contains the Jacobian ideal of R. However, these two ideals very rarely coincide. It was Buchweitz's observation that the vector space dimensions of the quotient algebras for these two ideals have a precise relation in some cases. He asked me to explain this relation. I showed that if R is a one dimensional Gorenstein local ring which is complete and reduced, then the cohomology annihilator coincides with the conductor ideal. This explains Buchweitz's observation via Milnor-Jung formula.

Vincent Gelinas, University Dublin, Ireland:
Title: The Bernstein-Gel'fand-Gel'fand correspondence beyond complete intersections of quadrics.
We extend the BGG correspondence of Buchweitz beyond projective complete intersections of quadrics, to any projective variety whose coordinate ring is absolutely Koszul Gorenstein. Our techniques, while they apply to noncommutative algebras, are drawn from local commutative algebra and originate from research on rationality of Poincaré series. The BGG correspondence holds in particular for elliptic normal curves of degree ≥ 4, del Pezzo surfaces of degree ≥ 4, canonical curves satisfying Petri's theorem, some arithmetically Gorenstein K3 surfaces, varieties related to these by hyperplane sections and many others. When applied to a Calabi-yau variety X, we obtain a derived equivalence of X with a Koszul dual noncommutative projective scheme $X^{!}$. Time willing, we will discuss Koszul duality for the elliptic normal curve.

Jürgen Herzog, University Duisburg-Essen, Germany:
Title: Hibi rings and the trace of the canonical module
Abstract: In a recent paper, together with Takayuki Hibi and Dunitru Stamate, we considereded the trace of the canonical module ωR of a local Cohen-Macaulay ring (R, m). The significance of this trace is that it describes the non-Gorenstein locus of R. Thus R is Gorenstein if and only if tr(ωR) = R. If the trace of ωR comes very close to R, namely if m ⊆ tr(ωR), we call R nearly Gorenstein.
In 1987 Hibi introduced a class of algebras which nowadays are called Hibi rings. They naturally appear in various algebraic and combina-torial contexts. Given a finite poset P , the Hibi ring K[P] attached to it is a toric algebra whose generators correspond to the poset ideals of P . A classical result of Hibi says that K[P] is Gorenstein if and only if P is pure, and in the paper with Hibi and Stamate we classified the nearly Gorenstein Hibi rings. More recently, in joint work with Fatemeh Mohammadi and Janet Page, Hibi rings which are Goren-stein on the punctured spectrum are classified, by using the trace of the canonical module. In this lecture I will report on these results.

Osamu Iyama, Nagoya University, Japan:
Title: Tilting theory for Gorenstein rings In dimension one
Abstract:
For a Z-graded Gorenstein ring R, we study the stable category of Z-graded maximal Cohen-Macaulay R-modules, which is canonically triangle equivalent to the singularity category of Buchweitz and Orlov. Its thick subcategory \underline{CM}^Z_0R is central in representation theory since it enjoys Auslander-Reiten-Serre duality and has almost split triangles. In the case dim R = 1, we prove that \underline{CM}^Z_0R always admits a silting object, and that it admits a tilting object if and only if either R is regular or the a-invariant of R is non-negative. We also show that, if R is reduced and non-regular, then its a-invariant is non-negative and the above tilting object gives a full strong exceptional collection.

Bernhard Keller, University Paris Diderot, France:
Title: Tate-Hochschild cohomology from the singularity category
Abstract: The singularity category (or stable derived category) was introduced by Buchweitz in 1986 and rediscovered in a geometric context by Orlov in 2003. It measures the failure of regularity of an algebra or scheme. Following Buchweitz, one defines the Tate-Hochschild cohomology of an algebra as the Yoneda algebra of the identity bimodule in the singularity category of bimodules. In recent work, Zhengfang Wang has shown that Tate-Hochschild cohomology is endowed with the same rich structure as classical Hochschild cohomology: a Gerstenhaber bracket in cohomology and a B-infinity structure at the cochain level. This suggests that Tate-Hochschild cohomology might be isomorphic to the classical Hochschild cohomology of a (differential graded) category, in analogy with a theorem of Lowen-Van den Bergh in the classical case. We show that indeed, at least as a graded algebra, Tate-Hochschild cohomology is the classical Hochschild cohomology of the singularity category with its canonical dg enhancement. In joint work with Zheng Hua, we have applied this to prove a weakened version of a conjecture by Donovan-Wemyss on the reconstruction of a (complete, local, cDV) singularity from its contraction algebra, i.e. the algebra representing the non commutative deformations of the exceptional fiber of a resolution.

Matthew Pressland, University Stuttgart, Germany:
Title: Calabi-Yau singularity categories
Abstract: I will explain a construction of Iwanaga-Gorenstein algebras having Calabi-Yau singularity categories. I will outline several connections between this construction and Buchweitz's work, and, time-permitting, also say something about the original motivation, coming from the theory of cluster algebras.

Frank-Olaf Schreyer, University Saarland, Germany:
Title: Hyperelliptic curve, complete intersection of two quadrics and theit Ulrich complexity.
Abstract: The smooth complete intersection of two even dimensional quadrics $X =Q_0 \cap Q_1 \subset \mathbb P^{2g+1}$ is closely related to an hyperelliptic curve E. For example, the coordinate ring $K[x_0,x_1,y]/(y^2-f(x))$ with y of degree $g+1$ can recovered as the center of the even dimensional Clifford algebra of $q=x_0q_0+x_1q_1% over $K[x_0,x_1]$. The thesis of Miles Reid says that the variety of $g-1$ dimension linear subspaces of X is isomorphic to the Jacobian of E. Orlov and Bondal proved that the derived category $D^b(E)$ embedds as a full subcategory into $D^b(X)$.
In the talk I will report on unpublished work of Ragnar and myself, which gives an elementary proof of these results which works on the category of modules. In particular we are able to compute experimentally the Ulrich complexity, that is the smallest rank of an Ulrich module on X.

Louis-Philippe Thibault, University Trondheim, Norway:
Title: Stable categories of graded Cohen-Macaulay modules over Gorenstein algebras of different parameters
Abstract: The stable category $\underline{\sf CM}^{\mathbb Z}(S^G)$, where S is a polynomial ring and $G<SL(n, k)$ is finite, has been studied for different gradings. Assuming that the skew-group algebra $S\#G$ is endowed with the grading structure of a bimodule Calabi-Yau algebra of Gorenstein parameter 1, Amiot, Iyama and Reiten constructed a triangle equivalence with the derived category of a finite-dimensional algebra. A similar equivalence was also obtained by Iyama and Takahashi provided that S is generated in degree 1, in which case $S\#G$ has Gorenstein parameter n. This result was later generalised to noetherian AS-regular Koszul algebras by Mori and Ueyama. We are interested in understanding the cases where the Gorenstein parameter is arbitrary. In this talk, we will discuss the situation in which the Beilinson algebra is a levelled algebra and give a generalisation of the equivalence of Mori and Ueyama.

Gordana Todorov, Northeastern University, Boston, MA, USA
Joint work with: Karin Baur, Eleonore Faber, Sira Gratz, Khrystyna Serhiyenko
Title: Friezes satisfying higher Slk-determinants
Abstract: The cluster algebra structure on the homogeneous coordinate ring of the Grassmannian of k-subspaces in n-space is used in order to describe Slk-friezes using Pl¨ucker coordinates. When this cluster algebra is of finite type, the SLk-friezes are in bijection with the so-called mesh friezes of the corresponding Grass-mannian cluster category.

Jerzy Weyman, University Connecticut, USA:
Title: Equations of canonical curves and tangent developable of rational normal curve.
Abstract: I will discuss the recent proof (joint with Aprodu, Farkas, Papadima and Raicu) of Green conjecture for general canonical curve (proved by Voisin on 2005 and 2007 by different method).
I will also discuss the connection of this result with Koszul modules.

Catharina Stroppel, University Bonn, Deutschland:
Title: Quantum cohomology via integrable systems and DAHAs
Abstract: In this talk I will briefly explain quanytum cohomology of Grassmannians and then develop an intergable systems which describes its multiplication. It is connected with the combinatorics of symmetric functions in noncommuting variables. If times allows I will indicate how this naturally fits with actions of Cherednik's double affine Hecke algebra.

Julia Sauter, University Bielefeld, Deutschland:
Title: Seeing things relative
Abstract: I will recall Auslander-Solberg's exact structures on the category of finite-dimensional modules over a finite-dimensional algebra and the corresponding relative homological algebra. I had three questions when I encountered it: 1) What is tau-tilting theory in this exact structure? 2) Does the geometry of representation extend to this relative case? 3) Is there an Auslander correspondence taking these exact structures into account?
By now, we have answers to these questions which I will quickly explain. The relative Auslander correspondence is joint work with Biao Ma available on the arxiv.