

Categorical and analytic invariants in Algebraic geometry 1

Multipointed NC deformations and CY3folds

Y. Kawamata

(September 14, 2015, 10:30)

I will consider non-commutative deformation functor from the category of r -pointed Artin algebras to the category of sets arising from a simple collection of sheaves on a variety. If the variety is a 3-dimensional local Calabi–Yau manifold near the supports of the sheaves, then we prove that the semi-universal family becomes a relative spherical object over the deformation ring and gives a spherical twist of the derived category if the deformation stops after finitely many iterated extensions. We also consider a generalization in the case of Calabi–Yau category.

On categorical joins

A. G. Kuznetsov

(September 14, 2015, 11:50)

I will discuss a categorical version of a join of two varieties and its relation to homological projective duality. This is a work in progress joint with Alex Perry.

Non-commutative virtual structure sheaves

Yu. Toda

(September 14, 14:00)

The moduli spaces of stable sheaves on algebraic varieties admit certain non-commutative structures, which I call quasi NC structures. In this talk, I show that the quasi NC structures on these moduli spaces arise as truncations of smooth quasi NC dg-schemes. This result is used to introduce the notion of NC virtual structure sheaves on the moduli spaces of stable sheaves which admit perfect obstruction theories. I will then show that the NC virtual structure sheaves are described in terms of Schur complexes of perfect obstruction theories.

Moduli of relations of quivers

K. Ueda

(September 14, 2015, 15:10)

The derived category of coherent sheaves on an algebraic variety admitting a tilting object is described in terms of a quiver with relations, and one can study not necessarily commutative deformations of the variety by deforming the relations. In the talk, we will discuss our joint work with Tarig Abdelgadir and Shinnosuke Okawa on moduli spaces of relations of quivers associated with the projective plane, the quadric surface, and cubic surfaces.

***P*-functors**

T. Logvinenko

(September 14, 2015, 16:30)

P^n objects are a class of objects in derived categories of algebraic varieties first studied by Huybrechts and Thomas. They were shown to give rise, naturally, to derived autoequivalences. It was also shown that they could sometimes be produced out of spherical objects by taking a hyperplane section of the ambient variety.

In this talk we'll explain how to generalise the above to the notion of P -functors between (enhanced) triangulated categories. We'll also discuss a closely related notion of a non-commutative line bundle over such category. This is based on work in progress with Rina Anno and Ciaran Meachan.

Homological invariants of DG algebras and generalized degeneration

A. I. Efimov

(September 15, 2015, 10:30)

We will introduce a new invariant of any associative DG algebra. It comes with a map to its negative cyclic homology. It is expected that this map is zero for any DG algebra over a field of characteristic zero. This vanishing would imply the Kontsevich-Soibelman degeneration conjecture for smooth and proper DG algebras.

Lagrangian embeddings of cubic fourfolds containing a plane

G. Ouchi

(September 15, 2015, 11:50)

I will talk about the construction of Lagrangian embeddings of cubic fourfolds containing a plane.

Recently, Lehn et al constructed Lagrangian embeddings of cubic fourfolds NOT containing a plane via twisted cubic curves on cubic fourfolds.

In this talk, we will construct desired holomorphic symplectic 8-folds as moduli spaces of Bridgeland stable objects in derived categories of some twisted K3 surfaces.

Calabi–Yau structures on dg categories and shifted symplectic structures on moduli

Ch. Brav

(September 15, 2015, 13:00)

We define a relative notion of Calabi–Yau structure for a morphism of dg categories, which in the absolute case reduces to the standard notion of Calabi–Yau structure on a finite type dg category. We explain how a Calabi–Yau structure on a finite type dg category induces a shifted symplectic structure on its derived moduli stack of objects and how a Calabi–Yau structure on a morphism of dg categories with Calabi–Yau source induces a Lagrangian structure on the corresponding map of moduli stacks. Our construction gives a new construction of many of the known examples of shifted symplectic structures on moduli stacks, as well as providing some new examples not accessible by previous constructions. This is joint work in progress with Tobias Dyckerhoff.

Looking geometry from the moduli spaces of CICYs

Sh. Hosono

(September 16, 2015, 10:30)

I will discuss some examples of multiple LCSs in the moduli spaces of Calabi–Yau complete intersections described by Gorenstein cones. It turns

out that most examples are related to the linear duality due to Kuznetsov and also the conjecture by Batyrev and Nill. These examples are generalizations of the complete intersections of five $(1, 1)$ divisors in $\mathbb{P}^4 \times \mathbb{P}^4$, which I studied with Hiromichi Takagi finding interesting relation to the geometry of three dimensional Reye congruences.

From Riemann to Feynman geometry in Feynman approach to QFT

A. S. Losev

(September 16, 2015, 11:50)

In the Feynmann approach to QFT correlators are given as an integrals over the space of fields. Since the space of fields is infinite-dimensional the integral has no mathematical sense, and in practical applications this definition is accompanied by the special rules of computation of the integral. These rules (called renormalization procedures) differ from theory to theory, and people are not even trying to prove that different rules lead to equivalent definitions.

We propose the following radical change of the situation. The Riemannian geometry with infinite-dimensional space of fields should be replaced by so-called Feynman geometry where the space is replaced by an A-infinity structure that is either finite dimensional (strong Feynman geometry) or infinite-dimensional with operations belong to the trace-class (weekly Feynman) geometry. We give an example of such geometries: lattice A-infinity geometry and noncommutative fuzzy geometry as examples of strongly Feynman geometries, and Costello A-infinity geometry as an example of weekly Feynman geometry, and discuss a program of reformulation of QFT, in which standard infinite dimensional integral should be replaced by a limit of the existing integrals over fields in Feynman geometries.

Joint work with Sen Hu, USTC

The Calabi–Yau completion for a formal parameter

A. Ikeda

(September 16, 2015, 13:00)

In this talk, we introduce the notion of a Calabi–Yau completion for a formal parameter as an analogue of Keller’s Calabi–Yau completion for an

integer. By using it, we construct the matrix representation of the spherical twists which factors the Hecke algebra.

Vertex algebras and Gromov–Witten invariants

T. Milanov

(September 17, 2015, 10:30)

My talk will be based on my on-going project with B. Bakalov, whose goal is to use the methods of representation theory of vertex algebras to compute the Gromov–Witten invariants of a compact Kahler orbifold with a semi-simple quantum cohomology. Our construction can be formulated in more general framework using the language of semi-simple Frobenius manifolds. As an application, I will explain how our methods can be used to compute Givental’s J-function of \mathbb{P}^1 .

On the Frobenius manifold from the Gromov–Witten theory for an orbifold projective line with r orbifold points

Yu. Shiraishi

(September 17, 2015, 11:50)

In this talk, I will explain the Frobenius structure on the orbifold quantum cohomology ring of an orbifold projective line with r orbifold points. In particular, I will show that this Frobenius structure can be determined by certain initial conditions. This result should be the key theorem to show that this Frobenius structure is isomorphic to the (conjectural) Frobenius structure constructed from the invariant theory of the corresponding extended cuspidal Weyl group.

Categorical Kaehler Metrics

L. Katzarkov

(September 17, 2015, 14:00)

In this talk we will develop a parallel and build an analogue of Kaehler theory for manifolds in the case of categories. Examples and applications will be discussed.

Calabi–Yau dg categories to Frobenius manifolds via primitive forms

A. Takahashi

(September 17, 2015, 15:10)

It is one of the most important problems in mirror symmetry to construct functorially Frobenius manifolds from Calabi–Yau dg categories since the Kontsevich’s homological mirror symmetry should imply the classical one, the isomorphism of Frobenius manifolds between the one from Gromov–Witten theory and the one from the deformation theory. This talk gives an approach to this problem based on the theory of primitive forms. Under a formality assumption, we shall construct formal primitive forms, which enable us to have formal Frobenius manifolds.

Joins and Hadamard products

S. Galkin

(September 17, 2015, 16:30)

I will discuss a procedure of creating new deformation classes of projective varieties by smoothing a join of two known ones. This way starting from two elliptic curves one can obtain various interesting Calabi–Yau threefolds, some are non-simply-connected. Also this explains that Calabi–Yau threefolds of degree 25, obtained as intersection of two Grassmannians in \mathbb{P}^9 , are in fact linear sections of a smooth Fano sixfold. In a sense, this procedure is a generalization of complete intersection for non-hypersurface case. I will explain why quantum periods of such new Calabi–Yau varieties are Hadamard products of the quantum periods of original pieces. Also if the original varieties had mirror-dual functions $f(x)$ and $g(y)$, then a smoothing of a join will have mirror-dual function given by exterior product $f(x)g(y)$.

Explicit Dolgachev surfaces and exceptional collections

I. V. Karzhemanov

(September 18, 2015, 10:30)

We will talk about recent and very recent explicit constructions of Dolgachev surfaces and exceptional collections on them.

Exceptional sheaves on the Hirzebruch surface \mathbb{F}_2

H. Uehara

(September 18, 2015, 11:50)

The structures of exceptional objects on Del Pezzo surfaces are completely determined by Kuleshov and Orlov. On the other hand, the structure of exceptional objects on weak Del Pezzo surfaces are much more complicated by the existence of -2 -curves. We study the structure of exceptional sheaves on the Hirzebruch surface with a -2 -curve, the easiest example of weak Del Pezzo surfaces. My talk is based on a joint work with Shinnosuke Okawa.

Degenerations of del Pezzo surfaces in terminal \mathbb{Q} -Gorenstein families

Yu. G. Prokhorov

(September 18, 2015, 14:00)

I will consider degenerations of del Pezzo surfaces in a one-parameter families under assumptions that the total space is \mathbb{Q} -Gorenstein and the central fiber is normal and has only log canonical singularities.

On the special McKay correspondence

A. Ishii

(September 18, 2015, 15:10)

I discuss the McKay correspondence for a small finite subgroup of $GL(2, \mathbb{C})$ and report on a joint work (in progress) with Iku Nakamura.

Skew-growth function for dual Artin monoid

K. Saito

(September 18, 2015, 16:30)

Artin group is the fundamental group of the compliment of the discriminant loci of classical Lie types, and is defined by the Artin braid relations. The monoid inside the Artin group generated by simple generators, called

Artin monoid, is a lattice and is used to give a discription of the universal covering of the compliment of the discriminant. Recently, people found another lattice structure in the Artin group by using generators corresponding to all reflections, and call it the dual Artin monoid. We show that the skew growth function of the dual Artin monoid has exactly the rank number of zero loci on the interval $(0, 1]$. The same statement for the original Artin monoid still remains to be a conjecture. Joint work with T. Ishibe.