V. Alexeev

Compact moduli and reflection groups

I will describe a class of varieties, related to reflection groups, whose moduli spaces admit functorial geometrically meaningful toroidal compactifications.

A. Beauville

Limits of the trivial vector bundle

Which vector bundles appear in a family where the general member is trivial? I will discuss this question for rank 2 vector bundles, in particular on curves.

R. Bezrukavnikov

Automorphisms of derived categories of coherent sheaves and real variations of stability

I will discuss examples of a fundamental groups acting by automorphisms of the derived category of coherent sheaves on a local Calabi–Yau variety. These actions and related t-structures on these derived categories appear in constructions of representation theory, local geometric Langlands duality and mirror symmetry.

O. Debarre

Periods of polarized hyperkähler manifolds

Hyperkähler manifolds are higher-dimensional analogs of K3 surfaces. Verbitsky and Markman recently proved that their period map is an open embedding. In a joint work with E. Macrì, we explicitly determine the image of this map in some cases. I will explain this result together with a nice application (found by Bayer and Mongardi) to the (almost complete) determination of the image of the period map for cubic fourfolds, hereby partially recovering a result of Laza.

R. Donagi

The Geometric Langlands Conjecture and Non-Abelian Hodge Theory

We will review the Geometric Langlands Conjecture, a non-abelian generalization of the theory of curves and their Jacobians. We will compare it to its arithmetic variants and discuss its overlap with homological mirror symmetry. We will then outline our program for proving GLC using non Abelian Hodge theory and Hitchin's system. We will describe some recent results on the construction of automorphic sheaves in specific cases. These cases will be described in detail in the subsequent talks by Pantev and Simpson.

A. Efimov

On the K-theory of derived categories of sheaves of vector spaces

We will explain that derived category of all sheaves of vector spaces (without any constructibility assumptions) on a locally compact space is a reasonable object: it is a dualizable cocomplete category (this notion is due to Drinfeld and Gaitsgory). It will be shown that for dualizable categories all the usual invariants like Hochschild (co)homology and K-theory are well-defined (and are non-trivial despite the presence of infinite direct sums). We will compute the K-theory and Hochschild (co)homology of this derived category, and sketch some potential applications.

D. Gaitsgory

Geometric proof of the Tamagawa number formula

I'll outline an approach developed in a joint work with Jacob Lurie to prove the Tamagawa number formula over function fields. This fomula can be restated as saying that the (weighted) number of $\mathbb{F}_q$-points on the moduli space $\mathrm{Bun}_G(X)$ (here G is a semi-simple group and X is a projective curve over $\mathbb{F}_q$) is given by the Euler product over places x of X over the (weighted) number of $\mathbb{F}_x$-points of BG. We show, using the Grothendieck–Lefschetz trace formula, that the above numerical product formula is a consequence of a geometric statement that expresses etale cohomology of $\mathrm{Bun}_G(X)$ in terms of the cohomology of BG; in topology the latter expression is known as the Atiyah–Bott formula. The bulk of the work is a derivation of the Atiyah–Bott formula in the context of algebraic geometry (when we cannot express $\mathrm{Bun}_G(X)$ via gauge theory).

S. Gorchinskiy

Relative Milnor K-groups and differential forms of split nilpotent extensions

The talk is based on common works with Dimitrii Tyurin and with Denis Osipov. We prove a version of the famous Goodwillies theorem with algebraic K-groups being replaced by Milnor K-groups. Namely, given a commutative ring with a nilpotent ideal such that the quotient splits, we construct an isomorphism between the relative Milnor K-group of degree $n+1$ and the quotient of the relative module of differential forms of degree n over the de Rham differential of the analogous module of degree $n-1$. For this we also assume that the rings have enough invertible elements in a sense. This theorem is in line with previously known numerous results from algebraic K-theory. Nevertheless, unlike them, our proof is based only on the Steinberg relation and on explicit tricks with symbols in Milnor K-groups.

Ph. Griffiths

Hodge theory and moduli

This talk will be at the interface of the two topics; moduli and singularities and secondly Hodge theory and degenerations of Hodge structures. There is a KSBA moduli space $\mathcal{M}$ for varieties X of general type. The local singularity structure of X is understood but the global structure much less so. The moduli space of polarized Hodge structures (PHS's) and their degenerations is better understood. Using the classical work on several variable degenerations of PHS's, there is a classification of limiting mixed Hodge structures and the incidence relations among them.

The goal of this talk is to relate the two topics, specifically to discuss and illustrate how to use Hodge theory to study the boundary structure of $\overline{\mathcal{M}}$.

This talk is based on joint work with Mark Green, Radu Laza, and Colleen Robles.

S. Gukov

Hitchin character and the affine Grassmannian

We will consider a surprisingly simple problem which, however, turns out to have numerous applications to the geometric Langlands program and to categorification of quantum group invariants in low dimensional topology. Furthermore, three different integrable systems will play a role in our discussion: the Hitchin system will enter the formulation of the problem, the so-called "q-boson" will be part of the solution, and the Painleve VI will appear in between. The talk is primarily based on a series of papers by Du Pei, some joint with the speaker.

N. Hitchin

The critical locus of integrable systems

Algebraically completely integrable systems are complex symplectic varieties which are fibrations with generic fibre an abelian variety with tangent bundle trivialized by Hamiltonian vector fields. The kth critical locus is where k of the vector fields vanish. There is a notion of nondegeneracy for such a locus which yields a subintegrable system, fibred by lower dimensional abelian varieties. The talk will discuss the situation for the integrable system arising from rank 2 Higgs bundles and related systems.

D. Huybrechts

Motivic aspects of K3 surfaces and the Hodge conjecture for products of them

We will report on an approach to Buskins result proving the Hodge conjecture for products of two K3 surfaces with CM using twisted derived categories. This allows one

to compare motives of isogenous K3 surfaces, but the case of K3 surfaces with RM is still wide open.

J.-M. Hwang

Rigidity of Legendrian singularities

Let (M, D) be a holomorphic contact manifold, i.e., a complex manifold M of dimension $2m+1$ equipped with a holomorphic contact structure D. An m-dimensional complex analytic subvariety Z in M is called a Legendrian subvariety if the smooth locus of Z is tangent to D. A Legendrian singularity means the germ of a Legendrian subvariety at a point. We discuss some rigidity results on Legendrian singularities.

L. Katzarkov

$P = W$ conjecture: Examples and applications.

TBA

Yu. Kawamata

On non-commutative deformations of simple collections in a category of perverse coherent sheaves

We recall the theory of multi-pointed non-commutative deformations of simple collections in an abelian category, and apply it to the case of a category of perverse coherent sheaves over a commutative base space.

I. Krichever

Real-normalized differentials: degenerations and applications

In the talk a new analytical approach to the study of differentials, vector bundles, ... on families of curves degenerating to a stable singular curve will be presented. As an application of this approach we will describe a proper compactification of the moduli space of the real-normalized differential, and new upper bound on the dimension of complete cycles in the moduli space of algebraic curves of compact type.

J. Morgan

Perverse sheaves and integral duality

TBA

T. Pantev

Modular spectral cover and Hecke eigensheaves on rational surfaces

In this talk I will discuss a specific implementation of the approach outlined in Donagi's talk for constructing Hecke eigensheaves by combining Fourier–Mukai duality with non-abelian Hodge theory. I will use the case of GL(2) local systems on the projective line with tame ramification at five points to illustrate the general method. I will explain the resulting algebraic geometric question and will show how it can be solved explicitly by a higher dimensional version of the spectral cover construction and some interesting calculations with parabolic Chern classes. The focus will be on the projective geometry of the moduli spaces involved, and on the singularities and geometric subtleties needed for the correct formulation of the correspondence. This is part of a joint work with Donagi and Simpson.

Yu. Prokhorov

The rationality problem for conic bundles

I will outline an approach to the rationality problem of three-dimensional conic bundles based on the Sarkisov program and Mori theory.

C. Simpson

Parabolic Chern classes for GL Higgs bundles on the moduli of bundles over a genus 2 curve

This is joint work in progress with R. Donagi and T. Pantev. We consider an example of their idea of applying the nonabelian Hodge correspondence to construct local systems over open subsets of Bun as predicted by the Geometric Langlands Correspondence. Here, we look at the case of compact genus 2 curves and Bun is the intersection of two quadrics in $\mathbb{P}^5$. One has the vector bundle on this variety obtained by pushforward from a general fiber of the Hitchin fibration, then one imposes a parabolic structure along the "wobbly locus". The question addressed here is how, with an appropriate choice of parabolic weight, to obtain vanishing of the first and second parabolic Chern classes.

C. Voisin

Gonality and zero-cycles of abelian varieties

The gonality of a variety is defined as the minimal gonality of a curve sitting in the variety. We prove that the gonality of a very general abelian variety of dimension g goes to infinity with g. We use for this a generalization of a method due to Pirola that we will describe. The method also leads to a number of other applications concerning 0-cycles modulo rational equivalence on very general abelian varieties.