Programme on

"Advances in Birational Geometry"

April 3 – May 26, 2017

organized by

Fedor Bogomolov (Courant Institute, NYU), Jean-Louis Colliot-Thélène (U Paris-Sud), Ludmil Katzarkov (U Vienna), Alexander Kuznetsov (Steklov Inst. Moscow), Alena Pirutka (Courant Institute, NYU), Yuri Tschinkel (Courant Institute, NYU)

Workshop 3

"Closing workshop - future directions"

May 15 – 19, 2017

ABSTRACTS

Valery Alexeev
Volumes of open surfaces

A volume of an open surface measures the rate of growth for the number of pluricanonical sections with simple poles at infinity. By Alexeev and Mori, there exists an absolute minimum for the set of positive volumes, with an explicit – but unrealistically small - bound. I will explain a related conjecture due to Kollar and some existing examples. Then I will explain a new candidate for the surface of the smallest volume, found in a joint work with Wenfei Liu.

Alexander Efimov
Stability conditions and localizations

I will show that the following fact holds: for a smooth projective curve X of positive genus and a rational number μ, the quotient of $D^b(X)$ by the triangulated subcategory generated by stable vector bundles of slope μ is equivalent to the derived category of finite-dimensional vector spaces over a skew-field. When the slope is equal to infinity, this skew-field is just a field of rational functions on X. I will also discuss generalization of such statement to other triangulated categories with stability conditions, and deduce some corollaries about semi-stable objects.

Morgan Veljko Brown
Characterization of toric log Calabi-Yau pairs.

Fabian Haiden
Categories and Filtrations

Gabriel Kerr
Homological mirror symmertry and the toric minimal model program

I will discuss a recent proof of homological mirror symmetry for elementary birational cobordisms. This theorem shows that the semi-orthogonal component associated to a flip or blow-up of the derived category of a variety is quasi-equivalent to a Fukaya-Seidel category on a mirror potential W. The potential

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arises as a degenerated component of the mirror of the original variety and is defined on a pair of pants (or a finite cover thereof). I will describe how this result fits in with minimal model program of toric varieties, the hms conjecture for hypersurfaces and categories of matrix factorizations.

Paul Horja
Toric schobers from GKZ D-modules

I will present a conjectural construction of a B-model schober determined by the GKZ D-module associated to a toric situation.

Marcello Bernardara
From noncommutative motivic measures to subgroups of the Cremona group.Categorical joins

Let X be a smooth projective variety over a field k, and assume that weak factorization holds (e.g., k has characteristic zero). I will introduce the Grothendieck ring of triangulated categories, and show how, using Bondal-Larsen-Lunts motivic measure, a subgroup of such ring will define a subgroup of the group Bir(X) of birational self-maps of X. A main example is given by the filtration via the motivic dimension, which induces a filtration on Bir(X). In the case of the Cremona group, it can be shown that this filtration is nontrivial. Some potential applications will be discussed.

Yan Soibelman
Quantum geometry of Riemann-Hilbert correspondence.

Ljudmila Kamenova
Hyperbolicity in hyperkaehler geometry

The Kobayashi pseudometric on a complex manifold M is the maximal pseudometric such that any holomorphic map from the Poincare disk to M is distance-decreasing. Kobayashi conjectured that this pseudometric vanishes on Calabi-Yau manifolds, and in particular, Calabi-Yau manifolds are Kobayashi non-hyperbolic. Using ergodicity of complex structures, together with S. Lu and M. Verbitsky we prove this conjecture for all K3 surfaces and for most classes of hyperkaehler manifolds. In the talk I will also give the algebraic version of hyperbolicity. Together with M. Verbitsky we prove that projective hyperkaehler manifolds with Picard rank at least two are algebraically non-hyperbolic.

Anton Mellit
Rationality of Ueno-Campana manifolds.

We consider varieties of the type E^n/Γ where E is an elliptic curve and Γ is a subgroup of the automorphism group of E acting on E^n diagonally. It is conjectured that when $n < |\Gamma|$, then $X = E^n/\Gamma$ is rational. We propose an approach for proving this statement, which is still open for $|\Gamma| = 6$ and $n = 4, 5$. We try to cover X by rational curves of certain type and count how many curves pass through a generic point. If the answer is 1, then we can sometimes reduce the question of rationality of X to the question of rationality of a closed subvariety of X. In an unexpected twist, existence of lattices D_6, E_8 and Λ_{10} turns out to be crucial.

Ivan Cheltsov
Rational and irrational singular quartic threefolds

Burkhardt and Igusa quartics admit a faithful action of the symmetric group of degree 6. There are other quartic threefolds with this property. All of them are singular. Beauville proved that all but four of them are irrational. Burkhardt and Igusa quartics are known to be rational. Two constructions of Todd imply the rationality of the remaining two quartic threefolds. In this talk, I will give an alternative proof of both these (irrationality and rationality) results. This proof is based on explicit small resolutions of so-called

Coble fourfold. This fourfold is the double cover of the four-dimensional projective space branched over Igusa quartic. This is a joint work with Sasha Kuznetsov and Costya Shramov.

Ilya Karzhemanov
Birational invariants and covariants

Alexander Kuznetsov
D-equivalence, L-equivalence and families of quadrics

I will talk about a conjectural relation between derived equivalence of smooth projective varieties and their classes in the Grothendieck ring of varieties. I will discuss in detail the classical case of K3 surfaces of degree 8 that comes from investigation of relation in the Grothendieck ring between families of quadrics.

Alex Perry
Categorical joins

I will describe a categorification of the classical join of two projective varieties, its relation to homological projective duality, and some applications. This is joint work with Alexander Kuznetsov.

Sergey Galkin
Degenerations to Normal Cone as Relations for a Grothendieckuesque Group

Jong Hae Keum
Equations of Fake Projective Planes

George Dimitrov
Topology on certain class of triangulated categories (categories with phase gap)

 All talks take place at the ESI, Boltzmann Lecture Hall!