GeL XX

Géométrie Algébrique en Liberté, Grenoble, 2012

Junior talks

Agnieszka Bodzenta-Skibińska
Derived categories and deformations of smooth rational surfaces

Full exceptional collections on smooth projective varieties provide a description of the derived category of coherent sheaves by means of DG algebras. I will show how to calculate these DG algebras for exceptional collections on rational surfaces consisting of line bundles. I will also show on examples how these DG algebras behave under deformations of the underlying varieties.

Gabriele Di Cerbo
Effective Iitaka fibration

An important problem in algebraic geometry is to study the structure of pluricanonical maps. Tsuji, Takayama and Hacon-McKernan solved the problem when the variety is of general type. Recently the question of extending their result for varieties of positive Kodaira dimension has been extensively studied. I will talk about some of these results and their connection to other interesting questions, such as singularities of the minimal model and the ACC condition for pseudo-effective thresholds.
The talk is based on my preprint on the arxiv http://arxiv.org/abs/1111.6662 and on another paper which I'm writing.

Patrick Graf
Bogomolov–Sommese vanishing on log canonical pairs

Bogomolov–Sommese vanishing on log canonical pairs
Let (X, D) be a projective log canonical pair. I will show that for any number p, the sheaf of reflexive logarithmic p-forms does not contain a Weil divisorial subsheaf whose Kodaira–Iitaka dimension exceeds p. This generalizes a classical theorem of Bogomolov and Sommese.
In fact, I will prove a more general version of this result which also deals with the orbifoldes géométriques introduced by Campana. The main ingredients to the proof are the extension theorem of Greb–Kebekus–Kovács–Peternell, a new version of the Negativity lemma, the minimal model program, and a residue map for symmetric differentials on dlt pairs.
I will also give an example showing that the statement cannot be generalized to spaces with Du Bois singularities.

As an application, I will give a Kodaira–Akizuki–Nakano-type vanishing result which also holds for Kähler differentials.

Michael Kemeny
Chow groups and stable maps

In this talk, I will describe an approach to the Bloch conjectures on K3 surfaces. These conjectures predict that a symplectic involution acting on a K3 surface should act trivially on the Chow group of points. One approach towards this problem, which has been successfully applied in one third of all cases, is to use degenerations of stable maps. One uses these degenerations to cover the K3 surface with nodal, elliptic curves which are invariant under the symplectomorphism, and then concludes that the symplectomorphism acted trivially on the Chow group. I will describe this approach.
If time permits, I would also like to give a short sketch of other possible approaches to the other two thirds of the problem, including a derived categoric approach.

Thomas Krämer
Tannakian categories, perverse sheaves and the moduli of abelian varieties

We consider Tannakian categories that are generated by perverse sheaves on abelian varieties. For the perverse intersection cohomology sheaf attached to the theta divisor of a principally polarized abelian variety, we discuss the relationship of the obtained Tannaka groups with the Schottky problem.

Zachary Maddock
A ratio of integration relating GIT quotients by abelian and non-abelian groups

For a reductive group G (with maximal torus T) acting linearly on a projective variety X, let R be the ratio between the integral on the GIT quotient $X//G$ of a dimension 0 Chow class α and the integral on the quotient $X//T$ of a lift of α capped with the T-equivariant Chern class of the representation $Lie(G)/Lie(T)$. I show that this integral is independent of the choice of maximal torus, the choice of linearization, and the choice of projective variety. I give an algebraic proof when G is of type A_n, that $R = (n+1)! = |W|$, the order of the Weyl group. This ratio R is related to formulas in symplectic geometry in the works of L. Jeffreys, F. Kirwan, and S. Martin. Using Martin's result, I can show that this implies that $R = |W|$ for any reductive group over an arbitrary field. Finding a purely algebraic proof of this result in general is still an open area of research.

Alex Massarenti
The Automorphisms group of $\overline{M}_{g,n}$

The moduli stack $\overline{\mathcal{M}}_{g,n}$ parametrizing Deligne-Mumford stable n-pointed genus g curves and its coarse moduli space $\overline{M}_{g,n}$: the Deligne-Mumford compactification of the moduli space of n-pointed genus g smooth curves from several decades are among the most studied objects in algebraic geometry, despite this many natural questions about their biregular and birational geometry remain unanswered. In particular we are interested in their automorphisms groups.

The symmetric group on n elements S_n acts on $\overline{\mathcal{M}}_{g,n}$ and $\overline{M}_{g,n}$ by permuting the marked points. We will prove that the automorphisms groups of $\overline{\mathcal{M}}_{g,n}$ and $\overline{M}_{g,n}$ are isomorphic to the symmetric group S_n for any g, n such that $2g - 2 + n \geq 3$, and compute the remaining cases. In doing this we will give an explicit description of $\overline{M}_{1,2}$ as a weighted blow-up of the weighted projective plane $\mathbb{P}(1, 2, 3)$.

Giovanni Mongardi
On symplectic automorphisms of holomorphic symplectic fourfolds

It is possible to extend to deformations of the Hilbert square of a K3 surface several general results on automorphisms of K3 surfaces, In particular Conway's sporadic group Co_1 plays the role of Mathieu's group M_{23}. However there are automorphisms on these fourfolds that are not induced by automorphisms of a K3 surface. I will state results and examples showing this behaviour.

Charles Siegel
The Schottky Problem in genus five

For any algebraic curve, you can attach a piece of linear data called a "principally polarized abelian variety" which is just a complex vector space along with a full lattice contained in it. The classical Torelli theorem says that this data uniquely determines a curve, that is, the map from curves to ppav's is injective. Starting at genus 4, the image is a subvariety, and the Schottky problem consists of attempting to describe this subvariety as explicitly as possible. I'll discuss previous work, ranging from 1888 to the 1980s, as well as my own work on the genus 5 case.

Jonathan Skowera
Białynicki-Birula decomposition of Deligne-Mumford stacks

An action of the multiplicative group G_m can be used to decompose Deligne-Mumford stacks of stable maps, thereby facilitating the computation of cohomology through the well-known Białynicki-Birula decomposition. In particular, this process expresses the cohomology of the stack in terms of the cohomology of fixed point loci. As one would hope, this property applies more broadly to any smooth, proper Deligne-Mumford stack over an algebraically closed field of characteristic zero, and by an argument with motives, to any geometric cohomology theory over $\mathbb{Q}$. The only technical assumption is that the coarse moduli space of the stack be a scheme.

Dmitry Zakharov
Partial compactification of the zero section of the universal abelian variety

The moduli space of principally polarized abelian varieties is one of the central objects of study in algebraic geometry. The moduli space is not compact, and admits several natural compactifications. All of these compactifications are extensions of Mumford's partial compactification by semi-abelic varieties of torus rank one. The partial compactification is the base for a universal family that admits a zero-section. In our joint work with Samuel Grushevsky, we calculate the

class of the zero section in the Chow ring of the partial compactification of the universal abelian variety.

Letao Zhang
Modular Forms and Special Cubic Fourfolds

We study the degree of the special cubic fourfolds in the Hilbert scheme of cubic fourfolds via a computation of the generating series of Heegner divisors of even lattice of signature (2, 20). We obtain degrees of special cubic fourfolds and the rank of the picard group of the corresponding moduli space with rational coefficients.