

ABSTRACTS OF SEMINAR TALKS, SPRING 2018

In this document, you can find the abstracts of the Algebraic Geometry Student Seminar talks from Spring 2018. They are listed from the more recent to the older ones.

APRIL 24

Speaker: Arnaud

Title: The Nash problem and terminal valuations

Abstract: In 1995 Nash defined two sets of valuations on a singular variety X and asked how they are related. Although it is known that in the general case the two sets are not equal, we know they coincide for surfaces and toric varieties. In this talk I will discuss a result of de Fernex and Docampo where they define a new class of valuations, terminal valuations, which gives a natural proof of the surface case.

APRIL 17

Speaker: Mirko

Title: Specialization of rationality

Abstract: Last summer Maxim Kontsevich and Yuri Tschinkel published on the arXiv a brilliant and elegant solution to the following problem: If rational varieties degenerate to a smooth one, is this variety rational? In this talk I will survey some of the modern achievements in the field of rationality problems and I will focus on the result of the two authors.

APRIL 10

Speaker: Yen-An

Title: Emptiness of Homogeneous Linear Systems with Ten General

Base Points

Abstract: Nagatas conjecture says that for any curve in the projective plane of degree d with multiplicities m at ten general points, we always have the ratio $\frac{d}{m}$ is greater than $\sqrt{10} \approx 3.1622$. In this talk, I will show that there is no such curve if $\frac{d}{m} < 117/37 \approx 3.162162$. The technique is based on the blow-up and twist method introduced by Ciliberto and Miranda.

Reference: arXiv:0910.1171 [math.AG]

APRIL 3

Speaker: Huachen

Title: Hodge theory and derived categories of cubic fourfolds

Abstract: Both the Hodge diamond and the derived category of a smooth cubic fourfold can be decomposed into some simple pieces and a highly nontrivial part, which looks like a K3 surface. In their paper (<https://arxiv.org/abs/1211.3758>), Addington and Thomas showed that these two viewpoints are generically equivalent. I'll try to explain their work.

Reference: arXiv:1211.3758 [math.AG]

MARCH 27

Speaker: Erjuan

Title: The Extended Locus of Hodge Classes

Abstract: This talk will follow Christian Schnell's paper "The extended locus of Hodge classes". First, instead of studying only one Hodge class, we should study the locus of all Hodge classes. By an example, we will see the limit of a sequence of non Hodge classes could be a Hodge class. Therefore, we should extend the locus of Hodge classes such that it contains the limit Hodge classes. In order to construct the extended locus of Hodge classes, we first describe the locus of Hodge classes as the "kernel" of a holomorphic map, then extending the locus of Hodge classes becomes extending the holomorphic map. We will see the extended locus of Hodge classes is an analytic variety and it contains the locus of Hodge classes. Furthermore, if we consider the locus

of Hodge classes for the universal family of hyperplane sections, then the extended locus of Hodge classes will contain all positive dimension compact analytic subset.

Reference: arXiv:1401.7303 [math.AG]

MARCH 13

Speaker: Matteo

Title: Beilinson's resolution of the diagonal and quiver stability conditions

Abstract: I will prove Beilinson's celebrated result about the resolution of the diagonal for \mathbb{P}^n and explain how this provides us with a full strong exceptional collection for $D^b(\mathbb{P}^n)$. From here, I will show how we can define stability conditions on \mathbb{P}^n with heart given by the abelian category of representations of a certain quiver associated to the exceptional collection; we will then focus on a recent construction by A. Bertram called "Euler stability condition" and explore some of its properties. If time permits, I will say something about what we expect out of this theory and illustrate a few attempts at generalizing this construction on other varieties.

MARCH 6

Speaker: You-Cheng

Title: A proof of Witten Conjecture

Abstract: In this talk, I will sketch a proof of Witten Conjecture given by Kontsevich at 1992. First I will state Witten conjecture. Then I will introduce two models, the combinatorial model of moduli space of curves and matrix integral model. Finally, I will explain how to use these two models to prove Witten conjecture.

Reference: <https://projecteuclid.org/euclid.cmp/1104250524>

FEBRUARY 27

Speaker: Javier

Title: Diagonal F -regularity and one application

Abstract: In this talk I'll report on an ongoing project with D. Smolkin. In this work we introduce a new type of F -regularity, called "Diagonal F -regularity", that satisfies the so-called Uniform Symbolic Topology Property (USTP). This provides with new examples on which this property holds. I'll explain what diagonal F -regularity is, using this as an apology to explore some more general aspects of positive characteristic algebraic geometry. Time permitting, I'll explain why this implies USTP based on Smolkin's work on subadditivity for test ideals. In particular, I hope to discuss what the USTP problem is about.

FEBRUARY 20

Speaker: Stefano

Title: The canonical bundle formula

Abstract: In this talk, I will introduce the canonical bundle formula. This machinery was first developed to study the canonical class of minimal elliptic surfaces. I will give a sketch of the original setup, and then discuss how the construction generalizes to log Calabi-Yau fibrations in higher dimension. Time permitting, I will mention how the canonical bundle formula is used to define adjunction in higher codimension.

FEBRUARY 13

Speaker: Marin

Title: Tropical Brill-Noether theorem

Abstract: In this talk I will introduce abstract tropical curves and construct a Brill-Noether general tropical curve. If time permits, I will explain how this implies the existence of Brill-Noether general curve over \mathbb{C} .

Reference: arXiv: 1001.2774v3 [math.AG]

FEBRUARY 6

Speaker: Christian

Title: A survey of anabelian geometry

Abstract: Anabelian geometry is a program initiated by Grothendieck to study varieties which are “determined” by their fundamental groups. In this talk, we give a brief survey of some results and open questions in anabelian geometry, and discuss how conjectures about motives relate to anabelian geometry.

JANUARY 30

Speaker: Franco

Title: Moduli of stable pairs on curves

Abstract: Pairs are the datum of a vector bundle together with a section. These objects were first introduced by Bradlow and Garcia-Prada, as relevant physical objects. Moduli spaces of stable pairs on curves are an interesting intersection of several areas of algebraic geometry: curves in projective space, moduli spaces, and the minimal model program in relation to wall crossing. We’ll explore the interplay between these aspects following the paper by Bertram “Stable pairs and log flips”.

Reference: arXiv: 9707002 [math.AG]

JANUARY 23

Speaker: Joaquín

Title: Bounding singular surfaces via Chern numbers

Abstract: It is known that given a projective surface with mild singularities we can obtain a minimal model by contracting a sequence of curves. A natural question is which invariants of the surface can bound the number of such contractions. In this talk, I will show that a linear combination of the Chern numbers, motivated by the BMY inequality, is one of such invariants. As an application, I will discuss how to use such result to prove that certain sets of singular surfaces with bounded

Chern numbers can be put together in a compact family

Reference: arXiv: 1705.00256 [math.AG]

JANUARY 16

Speaker: Chuanhao

Title: Zeros of log-one-forms and log-mixed Hodge modules

Abstract: M. Popa and C. Schnell have shown that, for any projective smooth variety of general type, there exists no non-vanishing global holomorphic one-form on it. To prove this result, they use generic vanishing theorem of Saito's mixed Hodge modules (MHM). To generalize this result to a log-setting, we need some logarithmic comparison results in MHM to build a relation between log-one-forms and MHM.