

Algebraic Geometry in East Asia, 2023

Title & Abstract

Monday (November 6)

Qifeng Li (Shandong University)

Title: The geometric structures associated with VMRT-structures

Abstract: The local structures of VMRT's (the varieties of minimal rational tangents) carry much information on global geometry of manifolds. A typical example is the Cartan-Fubini type extension theorem due to Hwang and Mok, which indicates that Fano manifolds of Picard number one can be determined by their local VMRT-structures. We are interested in isotrivial VMRT-structures, the simplest local VMRT-structures. In this talk, we will discuss on the geometric structures associated with the isotrivial VMRT-structures as well as the applications in algebraic geometry. This talk is based on joint works with Jun-Muk Hwang.

Takehiko Yasuda (Osaka University)

Title: Orbifold pseudo-effective cones

Abstract: The pseudo-effective cone plays a key role in formulating the Batyrev-Manin conjecture, which concerns rational points of a variety over a number field. I am going to talk about a generalization of pseudo-effective cones to Deligne-Mumford stacks, called orbifold pseudo-effective cones. I explain how we can generalize the Batyrev-Manin conjecture to Deligne-Mumford stacks, using this notion. The generalized conjecture includes also the Malle conjecture on counting Galois extensions of a number field as a special case. This is a joint work with Ratko Darda.

Jeong-Seop Kim (Korea Institute for Advanced Study)

Title: Smooth projective varieties with big tangent bundles

Abstract: After Mori's solution to Hartshorne's conjecture on ample tangent bundles, there are similar questions to characterize a smooth projective variety with certain positivity of its tangent bundle, including Campana-Peternell conjecture on nef tangent bundles. In this talk, I will review recent progress on the question about big tangent bundles initiated by A. Höring, J. Liu, and F. Shao, and introduce some examples and non-examples. This talk is based on joint work with Hosung Kim and Yongnam Lee.

Akihiro Kanemitsu (Saitama University)

Title: K3 surfaces of genus 13 and curves of genus 3

Abstract: Let C be a hyperelliptic curve of genus 3 and L a line bundle of odd degree. The moduli space N of rank 2 stable bundles with determinant L is embedded into the Grassmann variety $Gr(8,2)$ as the zero locus $Gr(8,2,P)$ of a pencil P of quadric forms (Desale-Ramanan). We give a description of K3 surfaces of genus 13 in N by using vector bundles on N . And we discuss some generalizations of this description. This is a joint work with Professor Shigeru Mukai.

Tuesday (November 7)

Tatsuro Kawakami (Kyoto University)

Title: Local and Global Applications of the Trace Map of Sheaves of Differential Forms

Abstract: In this talk, I will discuss several results that can be proven by using the splitting of trace maps of sheaves of differential forms.

From a local perspective, I will talk about an application related to the extendability of differential forms on quotient singularities.

On the global side, I will show that normal projective varieties admitting polarized endomorphisms satisfy Bott vanishing.

The latter part of this talk is based on joint work with Burt Totaro.

Van Thinh Dao (Institute of Mathematics, VAST)

Title: Deligne correspondence over Henselian local ring.

Abstract: Let C be an algebraically closed field of characteristic 0. We consider the formal punctured disk, $\text{Spec } C((x))$ - the spectrum of the field of Laurent series over C . In 1987, Deligne established an equivalence between the category of regular-singular connections on the formal punctured disk and the ones on the punctured affine line. In the same year, N. Katz considered the same problem in a more general setting. These results are closely related to the 21st Hilbert's problem. In this talk, we will generalize Deligne's equivalence to the case of a strict Henselian ring of equal characteristic 0, i.e., we replace the base field C with a Henselian ring. This result is a joint work with dos Santos, Phung Ho Hai, and Pham Thanh Tam.

Sungrak Choi (Yonsei University)

Title: Adjoint Asymptotic Multiplier Ideal Sheaves

In this talk, we define and study a triple called a potential triple which consists of a pair (X, Δ) and a polarizing pseudoeffective divisor D .

To such a triple, we define so called a potential multiplier ideal sheaf which gives a simultaneous generalization of the multiplier ideal sheaf and asymptotic multiplier ideal sheaf. We give a description of the closed subset defined by potential multiplier ideal sheaf in terms of the minimal model program. We also characterize the case where potential multiplier ideal sheaf is trivial. Lastly, we also prove a Nadel type vanishing theorem of cohomology for potential multiplier ideal sheaf. This is a joint work with S.Jang and D.Kim.

Sheng Meng (ECNU)

Title: Dream building blocks of surjective endomorphisms

Abstract: Let f be a surjective endomorphism of a normal projective variety. I shall introduce our new Dream Building Blocks Conjecture: f is either isomorphic, dynamical imprimitive, polarized, quasi-abelian, or strongly imprimitive. The smooth 3-dimensional case has been proved by our recent work and applications have been made towards Kawaguchi-Silverman conjecture and Zariski dense orbit conjecture. This is a joint work with De-Qi Zhang.

Wednesday (November 8)

Michael McBreen (CUHK)

Title: Periodic and loop hypertoric spaces.

Abstract: Hypertoric or toric hyperkahler varieties are a class of (non-compact) complete hyperkahler spaces admitting a maximal hyperhamiltonian action of a torus. They are important examples of symplectic resolutions, a class of spaces which arise as moduli of vacuum in gauge theory and in geometric representation theory. I will discuss joint work with Sheshmani and Yau, which gives an approximation to the loop space of a hypertoric variety in terms of limits of finite dimensional hypertoric varieties. We apply this construction to the study of certain twisted quasimap invariants of hypertoric spaces, and to give an interesting presentation of elliptic stable envelopes for such spaces. In both cases, a surprising symplectic duality between the loop space and a periodic hypertoric variety plays a starring role.

Hong Duc Nguyen (Thang Long University)

Title: Motivic integration on special rigid varieties and the motivic integral identity conjecture

Abstract: We construct a new theory of equivariant motivic integration on rigid varieties, which is a continuation of our recent work on the theory of equivariant motivic integration on special formal schemes. The key point of the construction is to show that two formal models of a special smooth rigid variety can be dominated by a third formal model. The same statement for quasi-compact rigid varieties was obtained by Bosch, Lütkebohmert and Raynaud in 1993. As a consequence, we are able to define a notion of motivic volume of a special smooth rigid variety which is independent of the choice of its models. We prove that the motivic volume can be extended to a homomorphism from a certain Grothendieck ring of special smooth rigid varieties to the classical Grothendieck ring of varieties. Furthermore, this motivic volume admits a Fubini's type property. Applying this theory we prove the original version of the motivic integral identity conjecture by Kontsevich and Soibelman for formal functions.

Yujie Luo (National University of Singapore)

The title of my talk is: Boundedness of divisors computing minimal log discrepancies and ACC conjecture for MLDs.

The abstract is: Consider a log canonical log pair (X, B) with coefficients in a DCC set Γ and \mathbb{Q} -Gorenstein base X . It is conjectured that there exists an upper bound N depending only on $\dim X$ and Γ , such that there exist an exceptional divisor E over X computing the minimal log discrepancy for (X, B) and the log discrepancy of E respect to X is bounded by N . This conjecture is confirmed in dimension two completely and later in dimension three terminal case, and it plays a very important role in the proof of ACC conjecture for minimal log discrepancies for terminal 3-fold pairs. The talk is based on joint works with Jingjun Han and Jihao Liu.

You-Cheng Chou (Academia Sinica)

Title: Quantum K-invariants = Gopakumar-Vafa invariants on Calabi-Yau threefolds at genus 0

Abstract: In this talk, I will show that on Calabi-Yau threefold a genus zero quantum K-invariant (QK) can be written as linear combination of Gopakumar-Vafa invariants (GV) with coefficients from an explicit "multiple cover formula". Conversely, GV can be determined by QK in a similar manner. Such a relation preserves the integrality, which gives another proof of the integrality of GV at genus 0. This is a joint work with Yuan-Pin Lee.

Chang-Yeon Chough (Sogang University)

Title: Descent in derived algebraic geometry

Abstract: Among many different ways to introduce derived algebraic geometry is an interplay between ordinary algebraic geometry and homotopy theory. The infinity-category theory, as a manifestation of homotopy theory, supplies better descent results even for ordinary 4oether-geometric objects, not to mention objects of interest in the derived setting. I'll explain what this means in the first half. The second half will be devoted to my recent work on some excision and descent results for commutative ring spectra, generalizing Milnor excision for perfect complexes of ordinary commutative rings and v-descent for perfect complexes of locally 4oetherian derived stacks by Halpern-Leistner and Preygel, respectively. No prior experience on derived algebraic geometry is required for the talk.

Thursday (November 9)

Shinnosuke Okawa (Osaka University)

Title: The infinite dihedral group and noncommutative quadrics

Abstract: Weyl groups play a central role in the study of del Pezzo surfaces. On the other hand, if we bring noncommutative deformations into the picture, they are expected to be superseded by the corresponding affine Weyl groups. In this talk I will explain how this expectation is realized in the case of noncommutative $\mathbb{P}^1 \times \mathbb{P}^1$, where the group is the infinite dihedral group (= the affine Weyl group of type A_1), in terms of generators and autoequivalences of (derived) categories.

Kangjin Han (DGIST)

Title: Sullivant-Talaska ideal of the cyclic Gaussian Graphical Model

Abstract: In this talk, we introduce a conjecture due to Sturmfels and Uhler concerning generation of the prime ideal of the variety associated to the Gaussian graphical model of any cycle graph and explain how to prove it. Our methods are also applicable to a large class of ideals with radical initial ideals. This work is done jointly with A. Conner and M. Michalek.

Xun Yu (Tianjin University)

Title: Smooth complex projective varieties with infinitely many real forms

Abstract: The real form problem asks how many different ways one can describe a given complex variety by polynomial equations with real coefficients, up to isomorphisms over the real number field. In this talk, I will discuss some recent results about smooth complex projective varieties with infinitely many real forms. This talk is based on joint works with T.-C. Dinh, C. Gachet, H.-Y. Lin, K. Oguiso, and L. Wang.

Guolei Zhong (Institute for Basic Science)

Title: Dynamical rigidity of Fano manifold of Picard number 1 with big tangent bundle

Abstract: We prove a dynamical rigidity for Fano manifold of Picard number 1 with big tangent bundle whose VMRT along a general point is not dual defective. As applications, we study the non-bigness of tangent bundles of smooth complete intersections, del Pezzo manifolds and Mukai manifolds as well as their endomorphisms. This talk is based on my joint works with Feng Shao.

Zhiyuan Li (SCMS, Fudan University)

Title: Birational geometry of moduli space of polarized K3 surfaces of genus 4

Abstract: Moduli space of polarized K3 surfaces has several natural compactifications such as the Baily-Borel compactification, GIT compactification and compactifications based on K-stability. It is natural to reconcile these different compactifications from a geometric and birational point of view. This was done in the 80's by Shah and Looijenga for the genus 2 case, and more recently by Laza-O'Grady and Ascher-DeVleming-Liu for genus 3. In this talk, I will discuss the K3 surfaces of genus 4 and make some predictions on the general cases. More specifically, we give an interpolation between the Baily-Borel and GIT models following the general outlines of the Hassett-Keel-Looijenga (HKL) program. We then discuss the connection to the K-stability point of view. This is a joint work with Greer, Laza, Fei and Tian.

Friday (November 10)

Jheng-Jie Chen (National Central University)

Title: The ascending chain condition and some computations of 3-fold canonical thresholds

Abstract: In this talk, we will briefly introduce the minimal model program and Sarkisov program. Then, we will recall some classifications of divisorial contractions that contract divisors to points in dimension 3 due to the works of Professors Kawamata, Hayakawa, Kawakita and Yamamoto. Then, I will show how these classifications implies the ascending chain condition (ACC) of the set T_3^{can} of canonical threshold in dimension 3. If time permits, I will give some computations on the set T_3^{can} . Note that the results rely on the classifications of divisorial contractions that contract divisors to points.

Kuan-Wen Lai (Academia Sinica)

Title: Fourier–Mukai numbers of cubic fourfolds and the rationality problem

Abstract: The derived category of a cubic fourfold contains a subcategory, termed as the “K3 category”, which behaves similarly to the derived category of a K3 surface. In this talk, I will introduce formulas for the number of Fourier–Mukai partners of the K3 category of a very general special cubic fourfold. For special cubic fourfolds of discriminant 20, I will provide a construction of the Fourier–Mukai equivalence using Cremona transformations, and then demonstrate how the construction yields new examples of rational cubic fourfolds.