Algebraic Geometry in East Asia 2016
January 18–22, University of Tokyo

Schedule

	Jan. 18	Jan. 19	Jan. 20	Jan. 21	Jan. 22
10:30–11:20	Baohua Fu	Fumiharu Kato	Huai-Liang Chang	Pham Hoang Hiep	Chenyang Xu
11:50–12:40	Tatsuyuki Hikita	Kwokwai Chan	Wei-Ping Li	Jen-Chieh Hsiao	Jheng-Jie Chen
14:20–15:10	Junmyeong Jang	Kazushi Ueda	Insong Choe	DongSeon Hwang	Lei Zhang
15:30–16:20	Hao Sun	Zheng Hua	Euisung Park	Shin-Yao Jow	Ching-Jui Lai
16:40–17:30	Mingshuo Zhou	Genki Ouchi		Jinhyung Park	De-Qi Zhang
18:00–20:00	Welcome Party				

Titles and Abstracts

Kwokwai Chan (Chinese University of Hong Kong)
Title: *HMS for local CY manifolds via SYZ*

Abstract: In this talk, I will explain how SYZ (Strominger-Yau-Zaslow) mirror constructions can be applied to realize the equivalences predicted by Kontsevich's homological mirror symmetry (HMS) conjecture in the case of certain local Calabi-Yau manifolds. Some of the results are based on joint works (some in progress) with Daniel Pomerleano and Kazushi Ueda. My work reported in this talk was substantially supported by a grant from the HKSAR RGC (Project No. CUHK400213).

Huai-Liang Chang (Hong Kong University of Science and Technology)
Title: *Application of cosection localization via P fields*

Abstract: Cosection localization discovered by Y.H. Kiem and J. Li. has been found with various applications. It was used in Gromov Witten, Donaldson Thomas and Seiberg Witten invariants. Recently, after the discovery of "P fields", a cosection is constructed as the algebraic counterpart of Witten's equation (Hamiltonian Floer equation in higher genus). Its localization then constructs Landau Ginzburg spaces's curve enumeration immediately after moduli's setup. Via P fields this also reproduces every projective hypersurface's quasi-map invariants. In this talk I will survey these progresses and some future extensions.

Jheng-Jie Chen (National Central University)
Title: *Pseudo-Effecitivities of second Chern classes via a filp and a divisorial contraction of type I*

Abstract: Let X be a projective terminal threefold with anti-canonical divisor $-K_X$ nef. We would like to know if the second Chern class $c_2(X)$ is pseudo-effective. This is the case when numerical dimension $\nu(-K_X)$ is not 2 due to several works by Professors Kollár, Miyaoka, Mori, Takagi, Keel, Matsuki, Mckernan. Then, Professor Xie gives some partial results and ideas for the remaining case. In this talk, we will discuss the pseudo-effecitivities $c_2(X)$ and $c_2(X^+)$ (resp. $c_2(Y)$) via a flip $X \dashrightarrow X^+$ (resp. a divisorial contraction $X \to Y$ which contracts a divisor to a curve). This is a joint work with Professor Jungkai Chen.

Insong Choe (Konkuk University)
Title: *Segre invariants of symplectic and orthogonal bundles over a curve*

Abstract: The classical Segre invariant can be generalized to principal G-bundles over a curve. In this talk, we discuss on the sharp upper bound of the generalized Segre invariant of symplectic and orthogonal bundles. This generalizes Hirschowitz' bound for vector bundles on one hand, and sharpens the Holla-Narasimhan's bound for arbitrary G-bundles on the other hand. This is a joint work with George H. Hitching.

Baohua Fu (AMSS, Chinese Academy of Sciences)
Title: Minimal rational curves on wonderful group compactifications

Abstract: Consider a simple algebraic group G of adjoint type, and its wonderful compactification X. We show that X admits a unique family of minimal rational curves, and we explicitly describe the subfamily consisting of curves through a general point. As an application, we show that X has the target rigidity property when G is not of type A_1. This is a joint work with M. Brion.

Tatsuyuki Hikita (Kyoto University)
Title: *On an algebro-geometric realization of the cohomology ring of conical symplectic resolutions*

Abstract: DeConcini-Procesi and Tanisaki proved that the cohomology ring of Springer fibers of type A can be realized as the coordinate ring of scheme-theoretic intersection of some nilpotent orbit closures and Cartan subalgebra. In this talk, I'd like to explain a conjectural description of the cohomology ring of conical symplectic resolutions generalizing DeConcini-Procesi-Tanisaki's result. This description is based on a duality between certain conical symplectic resolutions which is called symplectic duality.

Jen-Chieh Hsiao (National Cheng Kung University)
Title: *On the multigraded Hilbert scheme parametrizing ideals in the Weyl algebra*

Abstract: Multigraded Hilbert scheme introduced by Haiman and Sturmfels parametrizes ideals with the same Hilbert function in a multigraded polynomial ring. It generalizes several Hilbert scheme constructions such as Hilbert schemes of points in affine space, toric Hilbert schemes, Hilbert schemes of abelian group orbits, and Grothendieck's classical Hilbert schemes. In this talk, I will explain how one can extend the results of Haiman and Sturmfels to the case of Weyl algebras.

Zheng Hua (University of Hong Kong)
Title: *Contraction algebra and invariants associated to three dimensional flopping contraction*

Abstract: The contraction algebra is defined by Donovan and Wemyss in the study of noncommutative deformation theory. In this talk, we will explain how to use contraction algebra to study the three dimensional flopping contraction. We will show that the derived category of singularities and the subcategory of complexes support on the exceptional curve can be reconstructed from the contraction algebra. These reconstruction theorems suggest that the contraction algebra can be viewed as a noncommutative analogue of the Milnor ring of hyper surface singularity. We will also explain how to recover the genus 0 Gopakumar-Vafa invariants from the contraction algebra. This is a joint work with Yukinobu Toda.

DongSeon Hwang (Ajou University)
Title: *Explicit classification of log del Pezzo surfaces of Picard number one*

Abstract: I will speak on the classification of log del Pezzo surfaces of Picard number one in terms of explicit birational geometry. This is accomplished by the complete description of the theory of log del Pezzo surfaces of Picard number one initiated by Miyanishi and Zhang.

Fumiharu Kato (Tokyo Institute of Technology)
Title: *On henselian rigid geometry*

Abstract: This is partly a join-work with Shuji Saito (Tokyo Institute of Technology). Henselian rigid geometry is the 'henselian-analytic' version of the rigid geometry, where spaces are derived from henselian schemes, instead of formal schemes. There are several interesting aspects of this analytic geometry, many of which indicates its inherent richness in application to algebraic geometry. Starting with the tour around its foundational aspects, we announce and prove some of the new results, such as an analogue of Zariski Main Theorem, the existence of 'scheme-theoretic' closure of analytic subspaces, and a few more, which convey the interesting analytico-algebraic 'hybrid nature' of henselian rigid geometry.

Junmyeong Jang (University of Ulsan)
Title: *A non-symplectic automorphism of order 21 or 28 of a K3 surface*

Abstract: An automorphism of a K3 surface is purely non-symplectic if it is of finite order and the order of the induced morphism on global 2 forms is equal to the order of automorphism itself. In this talk, we will see there is a unique pair of a K3 surface and a purely non-symplectic automorphism of order 21 up to isomorphism when the base characteristic does not divides 42 and there are 2 pairs of K3 surfaces and purely non-symplectic automorphisms of order 28 when the base characteristic does not divide 28.

Shin-Yao Jow (National Tsing Hua University)
Title: *Continuity of Nakayama's sigma-decomposition on polyhedral boundary of the pseudoeffective cone*

Abstract: Nakayama's sigma-decomposition is an analogue of Zariski decomposition in arbitrary dimensions. It is continous in the interior of the pseudoeffective cone but generally not on the boundary. We will show that it is continuous at locally polyhedral boundary points.

Ching-Jui Lai (National Taiwan University)
Title: *Surface with maximal canonical degree*

Abstract: A. Beauville showed in 1979's that if the canonical map of a complex smooth projective surface is generically finite, then the degree is at most 36. We exhibit examples of minimal surface attaining this maximal canonical degree which are only constructed recently. This is joint work with S.K. Yeung.

Wei-Ping Li (Hong Kong University of Science and Technology)
Title: *Master Spin Fields on the Quintic*

Abstract: The Gromov-Witten invariants of the quintic is one of the most famous research topics from the very first day of mirror symmetry to today. There is another physical theory for the quintic polynomial, called Landau-Ginzburg theory. Physicists conjectured that these two theories can be identified via some mysterious transformations. The analytical construction of enumerative invariants in the affine LG-space was given by Fan-Jarvis-Ruan (FJRW invariants). Master Spin Field theory is a mathematical attempt to unlock the mysterious link between GW-invariants and FJRW-invariants. It uses the newly developed technologies such as the cosection localization by Kiem and J.Li and the P-fields theory of Chang and J. Li. It is an on-going joint work with H.L. Chang, J. Li and Melissa Liu.

Genki Ouchi (University of Tokyo)
Title: *Lagrangian embeddings of cubic fourfolds containing a plane*

Abstract: For a cubic 4-fold X not containing a plane, Lehn et al constructed an irreducible holomorphic symplectic 8-fold which contains X as a Lagrangian submanifold via twisted cubic curves on X. In this talk, I will talk about

Lagrangian embeddings of cubic 4-folds containing a plane. The desired irreducible holomorphic symplectic 8-fold can be constructed as a moduli space of Bridgeland stable objects on the derived categories of twisted K3 surfaces.

Euisung Park (Korea University)
Title: *On hypersurfaces containing projective varieties*

Abstract: Let $X \subset \mathbb{P}^{n+c}$ be an n-dimensional nondegenerate projective variety of degree d and codimension $c > 0$. Then basic invariants of X satisfy a few inequalities. To be precise,

1. $d \geq c + 1$,

2. the Castelnuovo-Mumford regularity of X is ≥ 2 with equality if and only if $d = c + 1$,

3. the Green-Lazarsfeld index of X is $\leq c - 1$ for $d \geq c + 2$ and infinite if $d = c + 1$, and

4. the graded Betti number $\beta_{1,p}(X)$ of X satisfies $\beta_{p,1}(X) \leq p\binom{c+1}{p+1}$ with equality if and only if $d = c + 1$.

Here the Green-Lazarsfeld index of X is the largest integer ℓ such that the minimal free resolution of the homogeneous ideal of X is linear until the $(\ell-1)$-th step. So, varieties of minimal degree $d = c + 1$ are characterized as the boundary case of the above inequalities. In this talk, I want to speak about the next cases with respect to these inequalities.

Jinhyung Park (KIAS)
Title: *Castelnuovo bounds for normalities of projective varieties*

Abstract: Eisenbud and Goto conjectured that Castelnuovo-Mumford regularity of a projective variety is bounded by degree - codimension +1. This conjecture is equivalent to giving sharp bounds for both Castelnuovo-Mumford regularity of structure sheaf and normality. First, I show a sharp bound for Castelnuovo-Mumford regularity of structure sheaf, and classify the extremal and the next to extremal cases. In the rest of the talk, I focus on bounds for normalities. After a quick review of methods used by Gruson-Lazarsfeld-Peskine and Lazarsfeld, I give bounds for normalities of scrolls and terminal threefolds. Finally, I present another bound for normality using double point divisors. This talk is based on joint works with Sijong Kwak and Wenbo Niu.

Pham Hoang Hiep (Vietnam Academy of Science and Technology)
Title: *The log canonical thresholds and the complex Monge-Ampère masses*
Abstract: We will talk about relationships between the log canonical thresholds and the complex Monge-Ampère masses of plurisubharmonic functions.

Hao Sun (Shanghai Normal University)
Title: *Slopes of non-hyperelliptic surface fibrations in positive characteristic*

Abstract: Let $f : S \to B$ be a non-hyperelliptic semi-stable surface fibration in positive characteristic with genus $g \geq 17$. We show that $K_f^2 \geq 4\chi_f$. This is a joint work with Xin Lu.

Kazushi Ueda (University of Tokyo)
Title: *Compact moduli of noncommutative del Pezzo surfaces*

Abstract: In the talk, we will discuss our joint works with Tarig Abdelgadir, Izuru Mori, and Shinnosuke Okawa on compact moduli schemes of not necessarily commutative deformations of del Pezzo surfaces in terms of quivers. In the cases of the projective plane, the quadric surface and cubic surfaces, we can give explicit descriptions of these moduli schemes.

Chenyang Xu (BICMR, Peking University)
Title: *Finiteness of fundamental groups*

Abstract: It is conjectured that the fundamental group of the smooth locus of a log Fano varieties is finite. By using the stratifies Morse theory, we will show that this relates to the finiteness of the local fundamental group of a klt singularity. As a result, we prove that for a three dimensional Fano variety with only canonical singularities, the conjecture is true. (This is a joint work with Zhiyu Tian).

De-Qi Zhang (National University of Singapore)
Title: *Jordan property for non-linear algebraic groups and projective varieties*

Abstract: A century ago, Camille Jordan proved that complex general linear group $\mathrm{GL}_n(\mathbb{C})$ has the Jordan property: there is a Jordan constant C_n such that every finite subgroup H of $\mathrm{GL}_n(\mathbb{C})$ has an abelian subgroup H_1 of index $[H : H_1] < C_n$. We show that every connected algebraic group G (which is not necessarily linear) has the Jordan property with the Jordan constant depending only on $\dim G$, and that the full automorphism group $\mathrm{Aut}(X)$ of every projective variety X has the Jordan property.

Lei Zhang (Shaanxi Normal University)
Title: *Recent progresses in subadditivity of Kodaira dimensions in positive characteristics*

Abstract: We will introduce the recent progresses in weak positivity and subadditivity of Kodaira dimensions in positive characteristics, and discuss the connections between them. And applications of some other topics such as minimal model theory, vector bundles in this area will also be mentioned.

Mingshuo Zhou (Hangzhou Dianzi University)
Title: *Frobenius split type of moduli space of parabolic bundles over curves*

Abstract: In 1996, Mehta and Ramadas proved that moduli space of semistable rank two parabolic bundles over a generic smooth curve is Frobenius split for generic choices of parabolic points. In this talk, we study the moduli space

of arbitrary rank parabolic bundles with fixed determinant over a smooth complex curve, and prove that its modulo p reduction is Frobenius split for p large enough. This is a joint work with Xiaotao Sun.