Intersection of positive closed currents

Taeyong Ahn

Inha University, Korea

In this talk, we discuss the intersection of positive closed currents on domains. As tools, we use pluripotential theory and the theory of density. Also, some superpotentials might be discussed. Then we introduce reasonable sufficient conditions for the definition of the wedge product of positive closed currents. Also, we will see an analytic formulation in the self-intersecting case, that is, the set theoretic fact $A \cap A = A$.

Gromov Kähler hyperbolicity and eigenvalue estimates on bounded symmetric domains

Ye-Won Luke Cho

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In 1991, Gromov introduced the notion of Kähler hyperbolic manifolds which in particular generalizes Kähler manifolds with Riemannian sectional curvature negatively pinched from above. Gromov's basic estimate on such manifolds yields vanishing theorem for harmonic forms and also a lower bound for the eigenvalues of the Laplacian of the given Kähler metric. The bound is determined by a uniform constant and so-called 'Kähler hyperbolicity length' of the metric.

In this talk, I shall explain a method to obtain eigenvalue estimates for the Laplacian of the complete Kähler-Einstein metrics on bounded symmetric domains using the aforementioned estimate. The method in particular provides the optimal eigenvalue estimate on the complex hyperbolic space (and polydiscs) which is sharper than McKean's estimate(1970). This is joint work with Young-Jun Choi and Kang-Hyurk Lee

Partition functions of determinantal point processes on polarized Kähler manifolds

Kiyoon Eum

KAIST, Korea

Determinantal point processes on polarized Kähler manifolds are random point processes on Kähler manifolds introduced by Berman. It was also adapted by Klevtsov in the study of the quantum Hall effect. In this talk, I will explain the definition of determinantal point processes on polarized Kähler manifolds as a generalization of the Coulomb gas on the complex plane. I will then discuss how one can derive a Zabrodin–Wiegmann type expansion in this generalized setting and present its application in Kähler geometry.

Harmonic Metrics for Higgs Bundles of Rank 3 in the Hitchin Section

Hitoshi Fujioka

Kyoto U, Japan

Given a tuple of holomorphic differentials on a Riemann surface, one can define a Higgs bundle in the Hitchin section and a natural symmetric pairing of the Higgs bundle. We study whether a Higgs bundle of rank 3 in the Hitchin section has a compatible harmonic metric when the spectral curve is a 2-sheeted branched covering of the Riemann surface. In particular, we give a condition for Higgs bundles in the Hitchin section on $\mathbb{C}$ or $\mathbb{C}^*$ to have compatible harmonic metrics.

Rigidity theorems for holomorphic self-maps on the corona

Yongxin Gao

Nankai U, China

Each analytic self-map of the unit disk admits a natural extension as a self-map on the corona (the maximal ideal space of bounded holomorphic functions). In this talk, we will discuss the fixed points of such maps outside the disk. We will also give several rigidity theorems of such maps on the corona.

Slope stability of sheaves for big cohomology classes and the Kobayashi-Hitchin correspondence

Satoshi Jinnouchi

Osaka U, Japan

The Kobayashi-Hitchin correspondence is the one to one correspondence between slope stable sheaves and Hermitian-Einstein sheaves. Traditionally, this correspondence has been studied in the context of Kähler classes. In this talk, I introduce the notions of slope stability and Hermitian-Einstein metrics for big classes on normal analytic spaces. These notions exhibit a form of bimeromorphic invariance. As a consequence of the invariance, I will explain the Kobayashi-Hitchin correspondence on projective manifolds of general type.

Hyperbolicity of adjoint line bundles on spherical varieties

Minseong Kwon

KAIST, IBS-CCG, Korea

Algebraic hyperbolicity was introduced by Demailly as an algebraic analogue of Kobayashi hyperbolicity. Indeed, for a projective manifold, Kobayashi hyperbolicity implies algebraic hyperbolicity, and algebraic hyperbolicity implies non-existence of rational curve and elliptic curve. It is a general principle that a sufficiently positive line bundle is hyperbolic, in the sense that the zero loci of its very general sections are algebraically hyperbolic. However, it is a challenging problem to compute an optimal lower bound for positivity of a line bundle to guarantee hyperbolicity. Recently, Moraga and Yeong obtained such an optimal bound for adjoint line bundles on smooth toric varieties, and asked if the same bound holds for arbitrary projective manifolds. In this talk, I will consider spherical varieties, which form a large class of almost homogeneous varieties, including generalized flag manifolds and toric varieties. Namely, I will give a positive answer to the question of Moraga and Yeong for spherical varieties with smooth orbit closures. This talk is based on a joint work in progress with Haesong Seo.

On the $\overline{\partial}$-equation with L^2 estimates on singular complex spaces

Zhenqian Li

Xiangtan U, China

In this talk, we present the unsolvability of $\overline{\partial}$-equation with weighted L^2 estimates involved curvature terms on any singular normal complex space in general. Moreover, in the non-normal case, we also give a complete description on L^2-solvability of the $\overline{\partial}$-equation with weighted L^2 estimates for plane curve singularities and their variants in the higher dimension. This talk is based on a joint work with Prof. Zhi Li and Xiangyu Zhou.ng work in the Thesis of Gang Tian on the asymptotics of Bergman kernel, supervised by Professor Yau, plays an important role in this work.

Schwarz lemma for general Bergman metrics

Hoseob Seo

Seoul National University, Korea

The Schwarz-Pick lemma in one complex variable says every holomorphic function from the unit disk into itself decreases the Bergman metric. As its generalization, Yau's Schwarz lemma states that a holomorphic function between certain complex manifolds with bounded curvature decreases the Bergman metric as well. In this talk, we present a different type of generalization of Schwarz-Pick lemma and compare our result with previously known versions of the Schwarz lemma. This is a joint work with Jihun Yum.

Projective embedding of complex manifolds and its applications

Jingzhou Sun

Shantou U, China

I will report on our progress in recent years about the projective embedding of complex manifolds and its applications in algebraic stabilities and in degeneration of Kahler-Einstein manifolds.

On the sharp L^2 estimate of Skoda division theorem

Masakazu Takakura

Tokyo Metropolitan U, Japan

Given a tuple of holomorphic functions $(g_1, \ldots, g_r, f)$ on a complex manifold X, when there exist a tuple of holomorphic functions $(h_1, \ldots, h_r)$ such that $\sum_{i=1}^{r} g_i h_i = f$?

This is known as the division problem, a fundamental question in several complex variables and complex geometry.

Skoda studied this problem using Hörmander's L^2 existence theorem and established an existence of a solution with L^2 estimates.

In this talk, I will give a sharp L^2 estimate for the Skoda-type division. This estimate is based on Guan-Zhou's $\bar{\partial}$ estimate technique appeared in their sharp L^2 extesion theorem. We also explain that the sharp estimate of division leads the above sharp L^2 extesion theorem.

Rigidity of proper holomorphic maps between nonequidimensional Fock-Bargmann-Hartogs domains

Lei Wang

Huazhong U of Science and Tech., China

The Fock-Bargmann-Hartogs domain $D_{n,m}(\mu)(\mu > 0)$ in $\mathbb{C}^{n+m}$ is defined by the inequality $\|w\|^2 < e^{-\mu\|z\|^2}$, where $(z, w) \in \mathbb{C}^n \times \mathbb{C}^m$, which is an unbounded non-hyperbolic domain in $\mathbb{C}^n \times \mathbb{C}^m$. In this talk I will discuss the rigidity of proper holomorphic maps between nonequidimensional Fock-Bargmann-Hartogs domains.

An abundance-type result for the tangent bundles of compact Kähler manifolds

Juanyong Wang

Chinese Academy of Sciences, China

The Abundance conjecture is a central problem in algebraic geometry and complex geometry. It asserts that a weak positivity condition (nefness, pseudoeffectivity) for the canonical bundle implies a strict stronger one (semiampleness, effectivity). This abundance principle is expected to hold for other canonically defined vector bundles on compact Kähler manifolds. For the case of tangent bundles, this is in fact a conjecture of Campana-Peternell (1991), which states that if the tangent bundle of a compact Kähler manifold is nef then it is globally generated up to finite étale cover. In this talk, I will explain our recent progress towards the Campana-Peternell conjecture: we prove that the tangent bundle is big thus semiample.

Bigness and approximation theorems with ideal sheaves on weakly pseudoconvex manifolds

Yuta Watanabe

Chuo U, Japan

The Kodaira embedding theorem plays an important role in complex geometry; it was generalized by Takayama to weakly pseudoconvex manifolds. In this talk, the embedding theorem for positive line bundles is extended to the case of a line bundle L equipped with a singular positive Hermitian metric h, and in particular, it is clarified that the adjoint bundle of L becomes big. Here, weakly pseudoconvex manifolds have a Kähler current, but it is not necessarily Kähler, and nevertheless, the claims hold.

Strong openness property for multiplier ideal sheaves

Bo Xiao

Peking U, China

Multiplier ideal sheaves play an important role in several complex variables and complex algebraic geometry. In 2001, Demailly propoesd his famous strong

openness conjecture for multiplier ideal sheaves, and it was firstly solved by Guan-Zhou in 2013. The multiplier submodule sheaves are a generalization for multiplier ideal sheaves in the vector bundle case.

Recently, we establish an L^2 extension theorem for Nakano semi-positive singular Hermitian metrics on holomorphic vector bundles, and the strong openness property for the multiplier submodule sheaves associated to Nakano semi-positive singular Hermitian metrics on holomorphic vector bundles. This is a joint work with Zhuo Liu, Hui Yang and Xiangyu Zhou.

Limit of Bergman kernels on a tower of coverings of compact Kähler manifolds

Sungmin Yoo

Incheon National University, Korea

A famous theorem by Kazhdan states that a tower of coverings of compact Riemann surfaces with genus ≥ 2 converging to *the universal covering* is Bergman stable (convergence of the pull-back of the Bergman kernels). Recently, Baik, Shokrieh and Wu generalized Kazhdan's theorem where the top covering is *any infinite Galois covering* of a compact Riemann surface using the convergence of the L^2-Betti numbers. In this talk, as a higher dimensional generalization of the above results, we show that any tower of Galois coverings of a compact Kähler manifold converging to an infinite Galois covering is Bergman stable using the convergence of the L^2-Hodge numbers. This talk is based on a joint work with J. Yum.

Semipositivity of nef and big line bundles

Yangyang Zhang

Osaka Metropolitan U, Japan

This study focuses on the relationship between algebraic properties (such as nefness and bigness) and complex geometric properties (such as semipositivity) in complex geometry. It addresses the open problem: "Do there exist line

bundles that are nef and big but not semipositive?" This question was raised by Professors Filip and Tosatti, and it serves as a significant theme bridging algebraic and complex geometry. By employing the theoretical framework of the first obstruction class, the goal is to geometrically examine the conditions under which semipositivity holds.

Positivity of twisted direct image sheaves

Yongpan Zou

U of Tokyo, Japan

For a projective surjective morphism $f : X \to Y$ of complex manifolds with connected fibers, let L be a line bundle on X. We are interested in its adjoint direct image sheaf. In general, the positivity of the line bundle L induces positivity of the direct image sheaves. We will introduce some recently results and relative questions.