

The 25th Symposium of Complex Geometry Kanazawa 2019

	Nov.11	Nov.12	Nov.13	Nov.14
9:10-9:20	coffee	coffee	coffee	coffee
9:20-10:20	Hwang	S. Honda	Taji	Noguchi
10:30-11:30	Ohsawa	R. Kobayashi	Tsuji	Mabuchi
Lunch				
13:00-13:20	coffee	coffee	coffee	
13:20-14:20	S. Honda	Hisamoto	Yoshikawa	
14:30-15:30	Ohshima	Hasegawa	Yeping Zhang	
15:40-16:40	Matsumoto	Hamano	Goto	
17:00-17:40	Peiqiang Lin			
17:50-18:30	Miyatake	18:00- reception		

Venue: Shiinoki Cultural Complex, Ishikawa Prefecture, 3F, Seminar Room B
(Seminar Room A for only the morning of November 14)

Nov. 11

9:20- 10:20 Jun-Muk Hwang (KIAS)

Title: Infinitesimal neighborhoods of submanifolds

10:30-11:30 Takeo Ohsawa (Nagoya University)

Title: Rigidity and analyticity by the L^2 method

13:20-14:20 Shouhei Honda (Tohoku University)

Title: Non-collapsed/collapsed Gromov-Hausdorff limit spaces, synthetic treatment of Ricci curvature, and relation to complex geometry I

14:30-15:30 Yoshiki Oshima (Osaka University)

Title: Compactifications of locally symmetric spaces and Gromov-Hausdorff limits of K3 surfaces

15:40-16:40 Yoshihiko Matsumoto (Osaka University)

Title: CR structures, ACH-Einstein fillings, and almost complex structures

17:00-17:40 Peiqiang Lin (Nagoya University)

Title: The second main theorem for holomorphic curves intersecting hypersurfaces in $\mathbb{P}^n$

17:50-18:30 Natsuo Miyatake (Osaka University)

Title: Abelian vortex equations and Kazdan-Warner type equations associated with Unitary representations of tori

Nov. 12

9:20- 10:20 Shouhei Honda (Tohoku University)

Title: Non-collapsed/collapsed Gromov-Hausdorff limit spaces, synthetic treatment of Ricci curvature, and relation to complex geometry II

10:30-11:30 Ryoichi Kobayashi (Nagoya University)

Title: Geometry related to weak concentration

13:20-14:20 Tomoyuki Hisamoto (Nagoya University)

Title: Greatest lower bound of the Calabi type functional

14:30-15:30 Keizo Hasegawa (Niigata University)

Title: Complete classification of unimodular Sasaki and Vaisman Lie groups

15:40-16:40 Sachiko Hamano (Osaka city University)

Title: On variational formula for hydrodynamic differentials and its application

Nov. 13

9:20- 10:20 Behrouz Taji (The University of Sydney)

Title: On the Kodaira dimension of base spaces of projective families of manifolds with good minimal models

10:30-11:30 Hajime Tsuji (Sophia University)

Title: Application of canonical measures to the Iitaka conjecture

13:20-14:20 Ken-ichi Yoshikawa (Kyoto University)

Title: Enriques $2n$ -folds and analytic torsion

14:30-15:30 Yeping Zhang (Kyoto University)

Title: BCOV invariant and birational equivalence

15:40-16:40 Ryushi Goto (Osaka University)

Title: Matsushima-Lichnerowicz type theorem of generalized Kähler manifolds

Nov. 14

9:20- 10:20 Junjiro Noguchi (The University of Tokyo)

Title: Value distribution theory on semi-abelian varieties and arithmetic problems

10:30-11:30 Toshiki Mabuchi (Osaka University)

Title: A natural compactification of the moduli space of pseudo-normed graded rings

ABSTRACT

Speaker: Jun-Muk Hwang (KIAS)

Title: Infinitesimal neighborhoods of submanifolds

abstract: We discuss the rigidity problem of infinitesimal neighborhoods of compact submanifolds of complex manifolds, which goes back to a question of Nirenberg and Spencer asking whether a finite-order infinitesimal neighborhood determines the germ of a submanifold when the normal bundle is positive. To study the problem for a larger class of submanifolds, we reformulate the problem in terms of families of infinitesimal neighborhoods of submanifolds. We explain some affirmative results on this reformulated problem.

Speaker: Takeo Ohsawa (Nagoya University)

Title: Rigidity and analyticity by the L^2 method

abstract: It was proved by Nishino in 1969 that a Stein submersion over the unit disc is trivial if the fibers are $\mathbb{C}$. Recently it turned out that an L^2 extension theorem is available to give its alternate proof. For the family of $\mathbb{C}^n$ with $n \geq 2$, a rigidity criterion can be proved by a similar method. It will be reported here that an L^2 vanishing theorem is available to give yet simpler proofs of these results and that the method yields a new generalization of Nishino's theorem for the deformations of once-punctured $\mathbb{CP}^n$. In this new approach, we shall generalize a theorem of Hartogs on the analyticity of continuous functions whose graph have Stein complement.

Speaker: Shouhei Honda (Tohoku University)

Title: Non-collapsed/collapsed Gromov-Hausdorff limit spaces, synthetic treatment of Ricci curvature, and relation to complex geometry I, II

abstract: I will mainly explain several structure results on metric measure spaces with Ricci bounds from below, which are typically appeared in the measured Gromov-Hausdorff limit spaces of Riemannian manifolds. In particular for some examples obtained by recent Sun-Zhang's work on the degeneration of hyper-Kähler metrics to 1 dimensional spaces we can calculate the optimal dimension from the point of view of metric measure geometry, which is not equal to 1 in general. A part of these talks is based on a joint work with S.Sun and R.Zhang.

Speaker: Yoshiki Oshima (Osaka University)

Title: Compactifications of locally symmetric spaces and Gromov-Hausdorff limits of K3

surfaces

abstract: The moduli spaces of polarized abelian varieties and K3 surfaces are known to have a structure of locally symmetric space. Around 1960, Ichiro Satake defined several compactifications of locally symmetric spaces, one of which is called as Baily-Borel compactification. In this talk, we discuss a close relationship between one of Satake compactifications (different from the Baily-Borel compactification) and the Gromov-Hausdorff convergence of Ricci-flat metrics on abelian varieties and K3 surfaces. This is a joint work with Yuji Odaka.

Speaker: Yoshihiko Matsumoto (Osaka University)

Title: CR structures, ACH-Einstein fillings, and almost complex structures

abstract: Along the lines of the idea of Einstein asymptotically complex hyperbolic (ACH) fillings of CR boundaries, I will discuss the problem of enhancing the filling structure of the bulk domain by giving a preferable almost complex structure to it. This is relevant to construction of boundary invariants. While our approach is based on the situation occurring in bounded strictly pseudoconvex domains in $\mathbb{C}^n$, we need to discuss almost complex structures in general because the boundary CR structures of ACH spaces are allowed to be non-integrable.

We introduce an energy functional for almost complex structures (that are compatible with an ACH metric), whose critical points will be considered preferable. A careful choice of the functional makes it possible to prove the existence and the local uniqueness for small perturbations of the boundary CR structure of strictly pseudoconvex domains, and the critical almost complex structure thus obtained has boundary asymptotic behavior that is strongly controlled by the boundary CR structure.

Speaker: Peiqiang Lin (Nagoya University)

Title: The second main theorem for holomorphic curves intersecting hypersurfaces in $\mathbb{P}^n$

abstract: For holomorphic curves in $\mathbb{P}^n$, according to Griffith's conjecture, the upper bound for sum of defect for hypersurfaces with degree d in simple normal crossings is expected to be $(n+1)/d$. In 2004, Min Ru proved that the upper bound cannot be larger than $n+1$. This is the best result before. We improve Min Ru's result and prove Griffith's conjecture in $\mathbb{P}^2$.

Speaker: Natsuo Miyatake (Osaka University)

Title: Abelian vortex equations and Kazdan-Warner type equations associated with Uni-

tary representations of tori

abstract: We discuss Hitchin-Kobayashi type correspondence for abelian vortex equations on any compact Kähler manifolds. The problem reduces to show the existence and the uniqueness of Kazdan-Warner type equations associated with Unitary representations of tori. Our main theorem is the existence and the uniqueness of such equations on any compact Riemannian manifolds.

Speaker: Ryoichi Kobayashi (Nagoya University)

Title: Geometry related to weak concentration

abstract: As is well-known, the strong concentration arising from iteration of a hyperbolic translation plays an essential role in conformally invariant variational problems such as harmonic maps from Riemann surfaces. In this talk, I will propose the weak concentration arising from iteration of a parabolic translation with several geometric problems related to this phenomenon. I will study in detail the collected Cohn-Vossen problem on finitely punctured Riemann surfaces from this view point and will discuss its applications to period condition of minimal surfaces.

Speaker: Tomoyuki Hisamoto (Nagoya University)

Title: Greatest lower bound of the Calabi type functional

abstract: Donaldson asked whether the lower bound of the Calabi functional is achieved by a sequence of the normalized Donaldson-Futaki invariants. We answer to the question for the Ricci curvature formalism, in place of the scalar curvature. The proof exploits the geometric flow which is designed to minimize the functional. We then take the multiplier ideal sheaves of a weak geodesic ray asymptotic to the flow.

Speaker: Keizo Hasegawa (Niigata University)

Title: Complete classification of unimodular Sasaki and Vaisman Lie groups

abstract: In a series of papers, we have been studying homogeneous locally conformally Kähler and Sasaki manifolds. In our recent works, applying “Modification” we have determined all homogeneous Sasaki and Vaisman manifolds of unimodular Lie groups, up to modifications [1]. In case of Lie groups, it is possible to determine all modifications; and thus obtain a complete classification of unimodular Sasaki and Vaisman Lie groups [2]. In particular, compact Sasaki and Vaisman solvmanifolds G/D , where G is a simply connected solvable Lie groups with a uniform lattice D can be determined.

REFERENCES:

- [1] D. Alekseevsky, K. Hasegawa, Y. Kamishima, Homogeneous Sasaki and Vaisman manifolds of unimodular Lie groups, To appear in Nagoya Math. J. (arXiv:1810.01095).
- [2] V. Cortes and K. Hasegawa, Classification of unimodular Sasaki and Vaisman Lie groups, Preprint.

Speaker: Sachiko Hamano (Osaka city University)

Title: On variational formula for hydrodynamic differentials and its application

abstract: We investigate conformal embeddings of a marked open Riemann surface of finite genus into closed Riemann surfaces with the same genus. The hydrodynamic differentials play an important role in describing the moduli space of conformal embeddings. From the viewpoint of several complex variables, we establish a new variational formula of hydrodynamic differentials for a family of open Riemann surfaces of finite genus with a complex parameter. We utilize this formula in characterizing the pseudoconvexity of the deformation space.

Speaker: Behrouz Taji (The University of Sydney)

Title: On the Kodaira dimension of base spaces of projective families of manifolds with good minimal models

abstract: A conjecture of Kebekus and Kovcs, which generalizes earlier conjectures of Shafarevich and Viehweg, predicts that variation in a family of projective complex manifolds with good minimal models is upper bounded by the Kodaira dimension of its base. For example, a smooth family of projective curves of genus at least equal to two over the projective line is isotrivial. Assuming that the variation in the family is maximal, this conjecture has been settled through combined works of many people, most notably Viehweg-Zuo, Campana-Paun and Popa-Schnell. My aim in this talk is to discuss a solution to this conjecture –in its full generality– when dimension of the base is at most equal to 5.

Speaker: Hajime Tsuji (Sophia University)

Title: Application of canonical measures to the Iitaka conjecture

abstract: We apply the plurisubharmonic variation of canonical measures To the Iitaka conjecture which asserts that for a projective family $F : X \rightarrow S$, the inequality of Kodaira dimensions

$$\kappa(X) \geq \kappa(S) + \kappa(X/S)$$

Holds. This is a joint work with J.Y. Cao.

Speaker: Ken-ichi Yoshikawa (Kyoto University)

Title: Enriques $2n$ -folds and analytic torsion

abstract: In this talk, a compact connected Kähler manifold of even dimension is called simple Enriques if it is not simply connected and its universal covering is either Calabi-Yau or hyperkähler. These manifolds were introduced and studied independently by Boissière-Nieper-Weisskirchen-Sarti and Oguiso-Schröer. We introduce a holomorphic torsion invariant of simple Enriques $2n$ -folds and study the corresponding function on the moduli space of such manifolds. In the talk, we report its basic properties such as the strong plurisubharmonicity and the automorphy, as well as possible (conjectural) applications. If time allows, we will also report the explicit formula for the invariant as an automorphic function on the moduli space in some cases.

Speaker: Yeping Zhang (Kyoto University)

Title: BCOV invariant and birational equivalence

abstract: Bershadsky, Cecotti, Ooguri and Vafa constructed a real valued invariant for Calabi-Yau manifolds, which is now called BCOV invariant. Now we consider a pair (X, Y) , where X is a Kähler manifold and $Y \subseteq X$ is a canonical divisor. In this talk, we extend the BCOV invariant to such pairs. The extended BCOV invariant is well-behaved under birational equivalence. We expect that these considerations may eventually lead to a positive answer to Yoshikawa's conjecture that the BCOV invariant for Calabi-Yau threefold is a birational invariant.

Speaker: Ryushi Goto (Osaka University)

Title: Matsushima-Lichnerowicz type theorem of generalized Kähler manifolds

abstract: Fujiki and Donaldson show that the moment map framework plays a crucial role in Kähler geometry and scalar curvature arises as the moment map for the action of Hamiltonian diffeomorphisms. Generalized Kähler Geometry is a successful generalization of the ordinary Kähler Geometry. In pursuit of this analogy, we show that there exists the moment map on a generalized Kähler manifold under the certain cohomological condition. We prove that the Lie algebra of the reduced automorphisms is reductive if the scalar curvature of a generalized Kähler manifold is a constant, which is an extension of Matsushima-Lichnerowicz theorem. Many typical examples of generalized Kähler manifolds given by Holomorphic poisson structures are discussed.

Speaker: Junjiro Noguchi (The University of Tokyo)

Title: Value distribution theory on semi-abelian varieties and arithmetic problems

abstract: We begin with observing a yet another proof of Raynaud's Theorem (Manin-Mumford Conjecture) by a combination of a generalized big Picard theorem (N-, 1981) and o-minimal theory (Pila-Wilkie, 2006), which gives a direct relation of Nevanlinna theory and Diophantine geometry at the proof level (N-, 2018). We then discuss holomorphic sections of semi-abelian varieties in a relative setting (joint with Corvaja and Zannier). In a special case of affine Legendre elliptic scheme, we show that all holomorphic sections are rational by Yamanoi's S.M.T. and reduced to one of 3 torsion sections. We then discuss the higher dimensional case motivated by those results.

Speaker: Toshiki Mabuchi (Osaka University)

Title: A natural compactification of the moduli space of pseudo-normed graded rings

abstract: Graded rings (such as canonical rings) coming from the spaces of sections of polarized algebraic varieties are studied by many mathematicians. For instance, the pseudo-normed project proposed by S.-T. Yau and C.-Y. Chi gives us a new differential geometric aspect of the Torelli type theorem. In contrast to the G.I.T. limit in algebraic geometry (or to the Gromov-Hausdorff limit in Riemannian geometry), we have some straightforward compactification of the moduli space of pseudo-normed spaces. This construction allows us to obtain natural limits for sequences of pseudo-normed graded rings. As an example of such compactifications, we have the Deligne-Mumford compactification in which the notion of the orthogonal direct sum for pseudo-normed spaces comes up very naturally.