

The 27th Symposium of Complex Geometry (Kanazawa) 2021

	November 1	November 2	November3	November4
9:15-9:30	tea	tea	tea	tea
9:30-10:30	Mabuchi*	Fujita*	Streets	Ohsawa*
10:50-11:50	R. Kobayashi	Inoue	S. Honda*	Tsuji *
Lunch				
13:00-13:30	tea	tea	tea	
13:30-14:30	Odaka	Futaki	Moriyama	Hashimoto*
14:50-15:50	Kuwagaki *	Apostolov	Hattori	S. Saito*

Venue: Osaka University E404 and online

(*) indicates an in-person speaker, and all others will be online speakers.

Nov. 1

9:30-10:30 Toshiki Mabuchi (Osaka University)

Title: On the problem of deformation invariance of plurigenera for compact Kähler manifolds

10:50-11:50 Ryoichi Kobayashi (Nagoya University)

Title: How to find subvarieties obstructing Kobayashi hyperbolicity and related problems

13:30-14:30 Yuji Odaka (Kyoto University)

Title: Collapsing hyperKähler metrics, limit measures on intervals, and Moduli compactifications

14:50-15:50 Tatsuki Kuwagaki(Osaka University)

Title: Sheaf quantization of Lagrangian

Nov. 2

9:30- 10:30 Kento Fujita(Osaka University)

Title: The Calabi problem for Fano threefolds

10:50-11:50 Eiji Inoue (RIKEN)

Title: Perelman's entropy in Kahler geometry and its non-archimedean reflection

13:30-14:30 Akito Futaki (Tsinghua University, The University of Tokyo)

Title: Conformally Kähler, Einstein-Maxwell metrics

14:50-15:50 Vestislav Apostolov (The University of Nantes)

Title: WEIGHTED K-STABILITY OF KÄHLER MANIFOLDS AND EXTREMALITY OF SASAKI MANIFOLDS

Nov. 3

9:30- 10:30 Jeffrey Streets (University of California, Irvine)

Title: Generalized Ricci Flow

10:50-11:50 Shouhei Honda (Tohoku University)

Title: Collapsed limit spaces may be not collapsed in a synthetic sense

13:30-14:30 Takayuki Moriyama (Mie University)

Title: Quaternionic k -vector fields on quaternionic Kähler manifolds

14:50-15:50 Masafumi Hattori (Kyoto University)

Title: A decomposition formula for J-stability

Nov. 4

9:30- 10:30 Takeo Ohsawa (Nagoya University)

Title: On the cohomology vanishing with polynomial growth on complex manifolds with pseudoconvex boundary

10:50-11:50 Hajime Tsuji (Sophia University)

Title: Adiabatic limits of Kähler-Ricci flows

13:30-14:30 Yoshinori Hashimoto (Tokyo Institute of Technology)

Title: Expected centre of mass of the random Kodaira embedding

14:50-15:50 Shunsuke Saito (Tokyo University of Science)

Title: Algebro-geometric stabilities for polarized toric varieties

ABSTRACT

Toshiki Mabuchi (Osaka University)

Title: On the problem of deformation invariance of plurigenera for compact Kähler manifolds

abstract: In this talk, we give a report of our recent work on the problem of deformation invariance of plurigenera for compact Kähler manifolds.

Ryoichi Kobayashi (Nagoya University)

Title: How to find subvarieties obstructing Kobayashi hyperbolicity and related problems

abstract: I will introduce an elementary idea, based on certain sequence of Grassmann manifolds, how to find subvarieties obstructing Kobayashi hyperbolicity. There are several problems and known results which are understood or possibly understood by variations of this idea.

Yuji Odaka (Kyoto University)

Title: Collapsing hyperKähler metrics, limit measures on intervals, and Moduli compactifications

abstract: Honda-Sun-Zhang showed that if K3 metrics collapse to an interval, the limit measure is of the form $\int_V dx$ (V : PL function), as presented by S.Honda 2 years ago in this conference series. The principal aim of this talk will be to show a conjectural but explicit complete classification of V with at most 18 non-linear points and two "totally different" approaches to it (my arXiv: 2010.00416 and [Osh] by Y.Oshima cited therein). This is a sequel to the research monograph with Y.Oshima (Memoir MSJ vol 40).

Tatsuki Kuwagaki(Osaka University)

Title: Sheaf quantization of Lagrangian submanifold

abstract: In this talk, I'll give an introduction to "sheaf quantization", which is a topological version of quantization of Lagrangian submanifolds. The notion is defined and developed in last 10 years and have various applications. After introducing some examples and basic usages, I'll explain relations between sheaf quantization, deformation quantization, and Fukaya category.

Kento Fujita(Osaka University)

Title: The Calabi problem for Fano threefolds

abstract: There are 105 irreducible families of smooth Fano threefolds, which have been classified by Iskovskikh, Mori and Mukai. For each family, we determine whether its general member admits a Kaehler-Einstein metric or not. This is a joint work with Carolina Araujo, Ana-Maria Castravet, Ivan Cheltsov, Anne-Sophie Kaloghiros, Jesus Martinez-Garcia, Constantin Shramov, Hendrik Suess and Nivedita Viswanathan.

Eiji Inoue (RIKEN)

Title: Perelman's entropy in Kahler geometry and its non-archimedean reflection

abstract: Perelman's entropy is a mysterious functional originally introduced in his analysis of Ricci flow and Ricci soliton. In recent studies on mu-cscK metric, which is a variant of canonical Kähler metric, a different perspective for Perelman's entropy was unveiled. I explain two topics.

1. It turns out the critical points of the functional restricted to (the tangent bundle of) the space of Kähler potentials $\mathcal{H}(X, L)$ are precisely mu-cscK metrics. Following the idea in Berman-Berndtsson's proof on the convexity of the Mabuchi functional, we show the functional is monotonic along geodesic rays in $\mathcal{H}(X, L)$. The limit along geodesic ray gives an invariant $\mu(\mathcal{X}, \mathcal{L})$ of test configuration. The invariant is related to μ Futaki invariant and hence to μ K-stability. This in particular implies Donaldson type inequality on Perelman's entropy and the μ K-semistability of μ -cscK manifold. Though I explained a similar topic in the last symposium, the monotonicity along $C^{1,1}$ geodesic ray is an important update. In this talk, I want to focus on the second topic, so I explain these results only briefly.

2. The invariant $\mu(\mathcal{X}, \mathcal{L})$ is expressed by equivariant intersection on \mathcal{L} and $K_{\mathcal{X}}$. From the first topic, we are motivated to find a maximizer of this functional. I explain a non-archimedean approach to this problem, following the idea in Boucksom-Jonsson's non-archimedean approach to K-stability. The main theorem in this topic is an extension of the invariant to an usc functional on a complete metric space $\mathcal{E}^{\text{exp}}(X, L)$ consisting of non-archimedean psh metrics. For this purpose, we develop generalities on non-archimedean pluripotential theory. We introduce 'moment measure' on Berkovich space for non-archimedean psh metrics. The measure can be considered as a hybrid of non-archimedean Monge-Ampere measure and Duistermaat-Heckman measure. Using moment measure, the functional is explicitly expressed by an integration on Berkovich space.

Akito Futaki (Tsinghua University, The University of Tokyo)

Title: Conformally Kähler, Einstein-Maxwell metrics

abstract: A conformally Kähler, Einstein-Maxwell (cKEM for short) metric is a Riemannian metrics with constant scalar curvature conformally equivalent to a Kähler metric with conformal factor the square of a Killing potential. Futaki and Ono formulated a volume minimization principle to detect which Killing vector fields can give such a conformal factor, applied it to Hirzebruch surfaces, and obtained explicit candidates for the Killing vector fields. Though they showed numerical evidence that those Killing vector fields give examples of new cKEM metrics they could not give a theoretical proof. In this talk I report a recent theoretical proof by Viza De Souza that those Killing vector fields actually give rise to new cKEM metrics.

Vestislav Apostolov (The University of Nantes)

Title: WEIGHTED K-STABILITY OF KÄHLER MANIFOLDS AND EXTREMALITY OF SASAKI MANIFOLDS

abstract: In this talk, I will discuss an equivalence (established in a joint work with D. Calderbank) between extremal Sasaki structures and weighted extremal Kähler metrics in the sense of A. Lahdili. In the case of Sasaki-Einstein structures, this correspondence yields a special case of g -solitons on a Fano variety, studied by Berman-Witt-Nyström and Han-Li. This provides an alternative approach—entirely within the framework of Kähler geometry—to the K-stability of affine complex cones associated to a Sasaki polarizations, proposed by Collins–Székelyhidi. We will use this and a recent work by He-Li to show that the variational approach to special Kähler metrics can be applied to prove that extremal Sasaki manifolds are equivariantly K-polystable, thus improving upon the previously known K-semistability. Based on a joint work with Lahdili and Jubert.

Jeffrey Streets (University of California, Irvine)

Title: Generalized Ricci Flow

abstract: The generalized Ricci flow is a natural extension of the Ricci flow which incorporates torsion. In this talk I will describe fundamental geometric and analytic properties of this equation, leading to global existence and convergence results with applications to complex geometry.

Shouhei Honda (Tohoku University)

Title: Collapsed limit spaces may be not collapsed in a synthetic sense

abstract: Metric measure spaces with lower Ricci curvature bounds have well-studied recently from various viewpoints. De Philippis-Gigli raised a conjecture that such a space is actually non-collapsed if and only if the essential dimension attains the synthetic upper bound on the dimension, where this is related to the codimension 1 or 2 collapsing of K3 metrics due to a recent work of Sun-Zhang. We solve this conjecture by establishing an infinitesimal analogue of Varadhan's asymptotics. This talk is based on a joint work with Camillo Brena (Scuola Normale Superiore), Nicola Gigli (SISSA), and Xingyu Zhu (GeorgiaTech).

Takayuki Moriyama (Mie University)

Title: Quaternionic k -vector fields on quaternionic Kähler manifolds

abstract: On quaternionic Kähler manifolds, Dirac operators are defined. In this talk, we introduce a differential operator as a modified Dirac operator. Using the operator, we define a quaternionic k -vector field on a quaternionic Kähler manifold and show that any quaternionic k -vector field corresponds to a holomorphic k -vector field on the twistor space. We refer to the quaternionic k -vector field on S^4 . This is a joint work with Takashi Nitta.

Masafumi Hattori (Kyoto University)

Title: A decomposition formula for J-stability

abstract: J-stability plays an important role in K-stability and deeply related to the existence of a stationary solution of J-flow. Strikingly, G.Chen, Datar-Pingali and J.Song proved Lejmi-Szekelyhidi conjecture, uniform J-stability and J-positivity are equivalent, by differential geometric arguments recently. However, this fact has not been proved in algebro-geometric way before. In this talk, I would like to explain a decomposition formula of non-Archimedean J-functional, the $(n+1)$ -dimensional intersection number into n -dimensional intersection numbers and its applications to prove the conjecture for singular algebraic surfaces and to show that there exists a J-stable but not uniformly J-stable variety. (arXiv:2103.04603)

Takeo Ohsawa (Nagoya University)

Title: On the cohomology vanishing with polynomial growth on complex manifolds with pseudoconvex boundary

abstract: $\bar{\partial}$ cohomology groups with polynomial growth $H_{p,q}^{r,s}$ will be studied. It will be shown that, given a complex manifold M , a locally pseudoconvex bounded domain $\Omega \Subset M$

satisfying certain geometric boundary condition and a holomorphic vector bundle $E \rightarrow M$, $H_{p.g.}^{r,s}(\Omega, E) = 0$ holds for all $s \geq 1$ if E is Nakano positive and $r = \dim M$. It will be also shown that $H_{p.g.}^{r,s}(\Omega, E) = 0$ for all r and s with $r + s > \dim M$ if moreover $\text{rank} E = 1$. By Deligne-Mal'siniotis-Sasakura's comparison theorem, it follows in particular that, for any smooth projective variety X , for any ample line bundle $L \rightarrow X$ and for any effective divisor D on X such that $[D]_{|D|} \geq 0$, the algebraic cohomology $H_{alg}^s(X \setminus |D|, \Omega_X^r(L))$ vanishes if $r + s > \dim X$.

Hajime Tsuji (Sophia University)

Title: Adiabatic limits of Kähler-Ricci flows

abstract: We consider the variation of Kähler-Ricci flows on a family of compact Kähler varieties with singular fibers. Also we consider the Kähler-Ricci flows on a singular Kähler varieties. We apply the results to prove the invariance of plurigenera for compact Kähler varieties under certain conditions.

Yoshinori Hashimoto (Tokyo Institute of Technology)

Title: Expected centre of mass of the random Kodaira embedding Adiabatic limits of Kähler-Ricci flows

abstract: Suppose that X is a smooth projective variety embedded in a projective space of dimension $N-1$ by the Kodaira embedding. We can displace the image of the Kodaira embedding by the linear action of $GL(N)$, and to each displaced embedding we can associate a hermitian matrix called the centre of mass, which captures subtle yet interesting geometric properties of X . We prove that, with respect to an appropriate class of probability measures on $GL(N)$, the expectation of the centre of mass is a constant multiple of the identity matrix for any embedded smooth projective variety.

Shunsuke Saito (Tokyo University of Science)

Title: Algebro-geometric stabilities for polarized toric varieties

abstract: This talk is based on a joint work with Yasufumi Nitta. We study relations between algebro-geometric stabilities for polarized toric varieties. In this talk, we introduce several stronger versions of (relative) K-stability such as uniform stability and K-stability tested by more objects than test configurations, and show that these approaches are all equivalent. As an application, we prove the asymptotic Chow stability of (uniformly) K-stable polarized toric surfaces.