Titles and Abstracts

Pacific Rim Complex and Symplectic Geometry Conference, Kyoto, 2022

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.

Yohsuke Imagi (Shanghai Tech University)
Title: Calabi–Yau Metrics on Nodal 3-folds
Abstract: I will discuss Calabi–Yau (Ricci-flat Kahler) metrics on compact nodal Calabi–Yau 3-folds (with ordinary double points at worst). In many cases it is known already that the metrics exist with suitable asymptotic decay conditions at the nodes. The glueing constructions are also done for smoothings. But projective small resolutions are not yet dealt with in the literature and I have a proof that I can do the glueing constructions for them. This is of interest in itself and useful for finding special Lagrangians in the resolved Calabi–Yaus. In the talk either I'll be speaking in detail about the metrics or I'll be including special Lagrangians with respect to them.

Takahiro Inayama (Tokyo University of Science)
Title: Singular Demailly-Skoda type theorem
Abstract: Demailly-Skoda's theorem and its generalization due to Berndtsson and Liu-Sun-Yang assert that if a holomorphic vector bundle is Griffiths positive, the tensor product of the symmetric power of the vector bundle and its determinant line bundle is Nakano positive. In this talk, I explain the generalization of the Demailly-Skoda type results to a singular Hermitian vector bundle. I also show its application.

Eunjeong Lee (Chungbuk National University)
Title : Foldings in studying flag manifolds
Abstract: Flag varieties are smooth projective varieties that provide an interesting bridge between geometry and representation theory. For instance, a semisimple algebraic group G, its Borel subgroup B, and a regular dominant integral weight λ, the irreducible representation with highest weight λ can always be expressed as the set of holomorphic sections of a certain line bundle over the flag variety G/B. A string polytope is a rational convex

polytope that sits in the middle of this bridge. The lattice points in a string polytope parametrize a highest weight crystal basis; it also inherits geometric information of a flag variety such as toric degenerations, Newton–Okounkov bodies, Schubert calculus, and so on. In this talk, we study properties of string polytopes in types B and C by providing an explicit description in these types which is analogous to Gleizer–Postnikov's description of string polytopes in type A using the foldings appearing in representation theory. Moreover, we characterize string polytopes in type C which are unimodularly equivalent to the Gelfand–Tsetlin polytope in type C for a specific weight. This talk is based on joint work with Yunhyung Cho and Naoki Fujita.

Lucas Kaufmann (IBS Center for Complex Geometry)
Title: Residue currents for holomorphic foliations
Abstract: Given a holomorphic foliation F on a complex manifold, the celebrated Baum-Bott Theorem associates to each component of the singular set of F a residual cohomology class whose sum satisfy an index theorem. When F is of rank one and has isolated singularities, such Baum-Bott classes can be effectively computed using Grothendieck residues. In the general case, however, no general result is known. In this talk I will show that, for general F, each Baum-Bott class can be naturally represented by a singular current of residue type supported by the singular set. This is a joint work in progress with R. Lärkäng and E. Wulcan.

Dano Kim (Seoul National Univerrsity)
Title: Canonical bundle formula and degenerating families of volume forms
Abstract: Canonical bundle formula and degenerating families of volume forms Abstract: We will talk about a metric version of Kawamata's canonical bundle formula for log Calabi-Yau fibrations, which says that the L^2 metric carries singularity given by the discriminant divisor and the moduli part line bundle admits a singular hermitian metric with vanishing Lelong numbers. Applications to semipositivity theorems and to L^2 extension theorems will be discussed.

Yoosik Kim (Pusan National University)
Title: Disk potential functions of polygon spaces
Abstract: A polygon space is the moduli space of polygons in the Euclidean space with a fixed length, which appears in various branches of mathematics. In this talk, we will discuss the moduli space of polygons in the 3-dimensional Euclidean space from the perspective of Lagrangian Floer theory. In particular, I will talk about Fukaya-Oh-Ohta-Ono's disk potential function of bending torus fiber in smooth and monotone 3D polygon spaces. This is based on joint work with Siu-Cheong Lau and Xiao Zheng.

Toshihiro Nose (Fukuoka Institute of Technology)
Title: Meromorphic continuation and non-polar singularities of local zeta functions in some smooth cases
Abstract: It is known that local zeta functions associated with real analytic functions can

be analytically continued as meromorphic functions to the whole complex plane. However, the above phenomena do not occur in smooth cases generally. In this talk, the cases of some model of smooth functions are treated. In particular, we give the optimality of the lower estimates of a certain quantity concerning with meromorphic continuation of local zeta functions in the smooth model cases. To show the optimality, we investigate asymptotic behavior of local zeta functions associated with certain smooth functions which are not real analytic. In the cases, local zeta functions have singularities different from poles.

Jiayin Pan (University of California, Santa Cruz)
Title: Some examples of open manifolds with positive Ricci curvature
Abstract: We give some examples of open manifolds with positive Ricci curvature. These examples give negative answers to two open problems. One is about the properness of the Busemann function at some point, and the other one regards the singular set of Ricci limit spaces. This is joint work with Guofang Wei.

Fumihiko Sanda (Gakushuin University)
Title: Mirror symmetry of Fano manifolds via toric degenerations
Abstract: Let X be a Fano manifold and L be a monotone Lagrangian in X. Then (a chart of) a Landau-Ginzburg mirror of X is a Laurent polynomial f which is computed by counting holomorphic disks bounded by L. Suppose that X admits a toric degeneration to a normal toric Fano variety X'. In this talk, I will explain that the Newton polytope of f is equal to the fan polytope of X'.

Weimin Sheng (Zhejiang University)
Title: Positive mass theorem with low-regularity Riemannian metrics
Abstract: In this talk, I would like to introduce our recent results with W. Jiang and H. Zhang on positive mass theorem and scalar curvature lower bounds with low-regularity Riemannian metrics. We first consider asymptotically flat Riemannian manifolds endowed with a continuous metric and the metric is smooth away from a compact subset with certain conditions. I will show the positive mass theorem is true if the metric is Lipschitz and the scalar curvature is nonnegative away from a closed subset with $(n-1)$-dimensional Hausdorff measure zero. On compact manifolds with a continuous initial metric, I will show the scalar curvature lower bound is preserved along the Ricci flow if the initial metric has a scalar curvature lower bound in distributional sense. As an application, we use this result to study the relation between Yamabe invariant and Ricci flat metrics.

Yoshihiro Sugimoto (Tokyo Metropolitan University)
Title: On the number of periodic orbits in Hamiltonian dynamics
Abstract: The number of periodic orbits and fixed points of Hamiltonian diffeomorphisms is one of the most important problems in symplectic topology. In this talk, I will talk about the problem of the existence of infinitely many periodic orbits for Hamiltonian diffeomorphisms. Hamiltonian diffeomorphisms tend to have infinitely many periodic orbits.

Yuya Takeuchi (University of Tsukuba)
Title: I'-curvatures and the Hirachi conjecture
Abstract: The Deser-Schwimmer conjecture deals with conformally invariant integrals of Riemannian scalars, which was proved by Alexakis. Hirachi posed a CR analogue of this conjecture, called the Hirachi conjecture. In this talk, we introduce the I'-curvatures and prove that these produce counterexamples to the Hirachi conjecture. This talk is based on joint work with Jeffrey S. Case.

Yuuji Tanaka (Kyoto University)
Title: On a blowup formula for sheaf-theoretic virtual enumerative invariants on projective surfaces
Abstract: To consider a blowup formula in the theory of Donaldson's polynomial invariants has a big advantage not only in calculating more examples or widening the accesible range of the invariants, but also in revealing intriguing structures in the theory, such as the modular expression of the wall-crossing terms by Goettsche and Goettsche-Nakajima-Yoshioka, and the fascinating structure theorem for the generating series of Donaldson invariants by Kronheimer-Mrowka and Fintushel-Stern, since a blowup formula provides an alternative way of computing the invariants.

On the other hand, there has been a number of exciting progress and prosperity in studies on *virtual enumerative invariants*, i.e., analogues of the Donaldson invariants in Algebraic Geometry and Representation theory, such as Gromov-Witten invariants e.g. on projective varieties, Donaldson-Thomas ones on Calabi-Yau threefolds, Mochizuki's virtual Donaldson invariants, and Vafa-Witten invariants on projective surfaces, etc., where one can use virtual techniques founded by Behrend-Fantechi, Li-Tian and others to define these deformation invariants out of the moduli problems.

We establish a blowup formula for sheaf-theoretic virtual enumerative invariants on projective surfaces, including Mochizuki's ones, virtual Euler characterisctics and chi_y genera, which are thought of as the instanton part and a refinement of that of the Vafa-Witten invariants, and other interesting generalisations of the Donaldson invariants such as virtual Segre and Verlinde numbers, of the moduli spaces of (semi)stable sheaves on projective surfaces.

We use Nakajima-Yoshioka's m-stable sheaves on a projective surface, which nicely interpolates the moduli spaces of (semi)stable sheaves on the blowup and the original one, but with perfect obstruction theories. Our blowup formula turns out to be universal, so, e.g. we obtain a blowup formula for the generating series of the virtual chi_y genera and the Euler characteristics of the moduli spaces by studying them in the case for framed sheaves on the projective plane.

This talk is based on joint work arXiv:2107.08155 with Nikolas Kuhn and arXiv:2205.12953 with Nikolas Kuhn and Oliver Leigh.

Jun Zhang (University of Science and Technology of China, IGP)
Title: Triangulated persistence category in symplectic geometry
Abstract: In this talk, we will introduce a new algebraic structure called triangulated persistence category (TPC). A TPC combines the persistence module structure (from topological data analysis) and the classical triangulated structure so that a meaningful measurement, via cone decomposition, can be defined on the set of objects. Moreover, a TPC structure allows us to define non-trivial pseudo-metrics on its Grothendieck group. Finally, we will illustrate several unexpected properties of a TPC via its supporting example in symplectic geometry, the derived Fukaya category. In particular, we can distinguish objects in a derived Fukaya category from a quantitative perspective.

Yang Zhou (Fudan University)
Title: K-theoretic quasimap wall-crossing and applications
Abstract: The K-theoretic Gromov-Witten invariants virtually count holomorphic curves in smooth projective manifolds or orbifolds, using K-theory as an intersection theory. They are interesting due to their connections to 3d gauge theories and representation theory.

For a large class of GIT quotients, the quasimap invariants are analogous to the Gromov-Witten invariants, defined using the moduli of epsilon-stable quasimaps as an alternative compactification of the space of holomorphic maps from smooth domain curves. As epsilon varies, there is a wall-crossing phenomenon, and recovering the Gromov-Witten theory as epsilon tends to infinity.

In this talk, I will talk about the quasimap wall-crossing of K-theoretic Gromov-Witten invariants and its applications. It is similar to the quasimap wall-crossing for cohomological Gromov-Witten invariants, but the permutation-equivariant structure and some orbifold subtleties lead to interesting new phenomena for the K-theoretic invariants.

This is a joint work with Ming Zhang.