

Collapsing Calabi-Yau Manifolds workshop

Talk Schedule

Events for:
Monday, August 31st - Friday, September 4th

Monday, August 31st

10:00am **Dave Morrison - SCGP 102**

Title: The singular fibers in an SYZ fibration

Abstract:

11:00am **Coffee - SCGP 102**

11:30am **Helge Ruddat - SCGP 102**

Title: Analyticity and Versality of Gross-Siebert families

Abstract: In a joint work with Siebert, I prove that the mirror map is trivial for the canonical formal families of Calabi-Yau varieties constructed by Gross and Siebert. In other words, the natural coordinate in a canonical Calabi-Yau family is a canonical coordinate in the sense of Hodge theory. This implies that the higher weight periods directly carry enumerative information with no further gauging necessary as opposed to the classical case. As a consequence, the canonical formal families lift to analytic families that are versal. We compute the relevant period integrals explicitly. The cycles to integrate over are constructed from tropical 1-cycles in the intersection complex of the degenerate Calabi-Yau

12:30pm **Lunch - SCGP Cafe**

2:15pm **Kwok Wai Chan - SCGP 102**

Title: SYZ mirror symmetry and semi-classical analysis

Abstract: In 2005, Fukaya described an approach to SYZ mirror symmetry by relating both the A-model on a space and the B-model on its mirror to Witten-Morse theory of certain multi-valued functions on the base of a Lagrangian torus fibration. In this talk, I will report on progress towards this approach, based on recent joint work (some in progress) with Conan Leung and Ziming Ma. Our main assertion is that semi-classical limits (or leading order terms) of solutions of the relevant Maurer-Cartan equation would produce tropical data such as scattering diagrams and counting of tropical disks, which should correspond to holomorphic curves on the A-side.

3:15pm **Tea**

4:00pm **Xiaowei Wang - SCGP 102**

Title: Moduli space of Fano Kahler-Einstein manifolds

Abstract: In this talk, we will discuss our construction of compact Hausdorff Moishezon moduli spaces parametrizing smoothable K-stable Fano varieties. The solution relies on the recent solution of Yau-Tian-Donaldson conjecture by Chen-Donaldson-Sun and Tian. In particular, we prove the uniqueness of the degeneration of Fano Kahler-Einstein manifolds and more algebraic properties that are needed to construct an algebraic moduli space. (This is a joint work with Chi Li and Chenyang Xu).

Tuesday, September 1st

10:00am **Andrew Macpherson - SCGP 102**

Title: Skeletons and retracts of rigid analytic spaces

Abstract: Non-Archimedean analytic spaces can be understood in terms of deformation retracts onto certain polyhedral complexes called skeletons. I'll describe a 'geometric' construction of skeletons that refines and generalises work of Berkovich.

11:00am **Coffee - SCGP 102**

11:30am **Johannes Nicaise - SCGP 102**

Title: The essential skeleton of a degeneration of algebraic varieties

Abstract: I will survey my joint work with Mircea Mustata and Chenyang Xu on the relations between the topology of Berkovich spaces and degenerations of algebraic varieties. Studying non-archimedean weight functions attached to pluricanonical forms, we defined the essential skeleton of the Berkovich analytification of a smooth and proper variety X over the field of complex Laurent series. This generalizes a construction of Kontsevich and Soibelman for Calabi-Yau varieties. It turns out that the essential skeleton can be canonically identified with the dual complex of the special fiber of any minimal dlt-model of the degeneration; then it follows from work of Berkovich and de Fernex-Kollár-Xu that the essential skeleton is a strong deformation retract of the analytification of X . If time permits, I will also present an application to the theory of Igusa zeta functions in number theory (proof of Veys's conjecture on poles of maximal order).

12:30pm **Lunch - SCGP Cafe**

2:15pm **Mattias Jonsson - SCGP 102**

Title: Degenerations of Calabi-Yau manifolds and Berkovich spaces

Abstract: Kontsevich and Soibelman have given a conjectural description of the Gromov-Hausdorff limit of a maximally degenerate family of polarized Calabi-Yau manifolds in terms of the Berkovich space attached to the degeneration. Motivated by this, Mustata, Nicaise and Xu recently studied the essential skeleton of this Berkovich space, which is a natural realization of the dual complex of a minimal model of the degeneration. I will present joint work with Sebastien Boucksom, in which we show that the volume form induced by a holomorphic form of top degree on a fiber converges, in a suitable sense, to an explicit Lebesgue type measure on the essential skeleton.

3:15pm **Tea**

4:00pm **Paul Hacking - SCGP 102**

Title: Degenerations of K3 surfaces and mirror symmetry

Wednesday, September 2nd

10:00am **Song Sun - SCGP 102**

Title: Singularities and stability

Abstract: We will focus on NON-COLLAPSED limit spaces of polarized Kahler-Einstein manifolds. The main question we are interested in is the meaning of the metric tangent cones in terms of algebraic geometry. Our study also suggests a possible notion of stability for local algebraic singularities. This talk is based on recent joint work with Simon Donaldson.

11:00am **Coffee - SCGP 102**

11:30am **Siu-Cheong Lau - SCGP 102**

Title: SYZ, space tiling and modularity

Abstract: In this talk we will study the SYZ mirrors of \tilde{A}_n surfaces and their fiber products. These spaces (together with superpotentials) are mirrors of certain general-type varieties. We will see that the generating functions of open Gromov-Witten invariants involve interesting modular forms which deserve further studies. This is a joint work with Atsushi Kanazawa.

12:30pm **Lunch - SCGP Cafe**

2:15pm **Ben Weinkove - SCGP 102**

Title: The Kahler-Ricci flow, Ricci-flat metrics and collapsing limits

Abstract: I will discuss the behavior of collapsing metrics on holomorphic fiber spaces whose generic fiber is Calabi Yau. We consider both the Kahler-Ricci flow and degenerations of Kahler Ricci-flat metrics. In both cases, we obtain uniform metric convergence on compact subsets away from the singular fibers. This is a joint work with Valentino Tosatti and Xiaokui Yang.

3:15pm **Tea**

4:00pm **Yuguang Zhang - SCGP 102**

Title: Collapsing of negative Kahler-Einstein metrics

Abstract: In this talk, we show that for a toroidal degeneration of canonical polarized manifolds with the total space Q -factorial, the Kahler-Einstein metrics on fibers collapse to a lower dimensional complete Riemannian manifold in the pointed Gromov-Hausdorff sense by suitably choosing the base points. Furthermore, the most collapsed limit is a real affine Kahler manifold.

Thursday, September 3rd

10:00am **János Kollár (part I) - SCGP 102**

Title: The dual complex of Calabi--Yau pairs

Abstract: A log Calabi--Yau pair consists of a proper variety X and a divisor D on it such that $KX+D$ is numerically trivial. A folklore conjecture predicts that the dual complex of D is homeomorphic to the quotient of a sphere by a finite group. The main result of the paper shows that the fundamental group of the dual complex of D is a quotient of the fundamental group of the smooth locus of X , hence its pro-finite completion is finite. This leads to a positive answer in dimension ≥ 4 . We also study the dual complex of degenerations of Calabi--Yau varieties. The key technical result we prove is that, after a volume preserving birational equivalence, the transform of D supports an ample divisor.

11:00am **Coffee - SCGP 102**

11:30am **Chenyang Xu (part II) - SCGP 102**

Title: The dual complex of Calabi--Yau pairs

Abstract: A log Calabi--Yau pair consists of a proper variety X and a divisor D on it such that $KX+D$ is numerically trivial. A folklore conjecture predicts that the dual complex of D is homeomorphic to the quotient of a sphere by a finite group. The main result of the paper shows that the fundamental group of the dual complex of D is a quotient of the fundamental group of the smooth locus of X , hence its pro-finite completion is finite. This leads to a positive answer in dimension ≥ 4 . We also study the dual complex of degenerations of Calabi--Yau varieties. The key technical result we prove is that, after a volume preserving birational equivalence, the transform of D supports an ample divisor.

12:30pm **Lunch - SCGP Cafe**

2:15pm **Florin Ambro - SCGP 102**

Title: An injectivity theorem

Abstract: "I will discuss a generalization of the injectivity theorem of Esnault and Viehweg. This is a generalization of Kodaira vanishing, but in the absence of positivity. I will give some applications, including a connectivity property of log Calabi Yau varieties with worse than log canonical singularities."

3:15pm **Tea**

4:00pm **Valentino Tosatti - Colloquium - SCGP 102**

Title:

6:00pm **Banquet**

Friday, September 4th

10:00am **Ludmil Katzarkov - SCGP 102**

Title: Categorical Kaehler Metrics

Abstract:

11:00am **Coffee - SCGP 102**

11:30am **Misha Verbitsky - SCGP 102**

Title: Gromov-Hausdorff limits of hyperkahler metrics

Abstract: Let (M, I) be a holomorphically symplectic Kahler manifold, W the space of all Ricci-flat metrics on birational models of (M, I) , and (M, J) a complex deformation of (M, I) . I will show that the set of Gromov-Hausdorff limits of points in W contains any hyperkahler metric on (M, J) . This is surprising, because dimension of W is $b_2 - 2$, and dimension of its closure is at least $3b_2 - 8$: typically, much bigger. I will try to give a conjectural geometric explanation of this phenomenon, related to hyperkahler SYZ conjecture.

12:30pm **Lunch - SCGP Cafe**

2:15pm **Diego Matessi - SCGP 102**

Title: Deformations of tropical manifolds, mirror symmetry and conifold transitions.

3:15pm **Tea**

4:00pm **Nicolo Sibilla - SCGP 102**

Title: Topological Fukaya category and homological mirror symmetry