

Birational Geometry and Quantum Invariants: October 30-November 3, 2023

Events for:
Monday, October 30th - Friday, November 3rd

Monday, October 30th

9:00am **Workshop: Breakfast - SCGP Cafe**

Title: Breakfast

9:30am **Workshop: Ludmil Katzarkov - SCGP 102**

Speaker: Ludmil Katzarkov

Title: Interpretations of spectra

Abstract: In this talk we will discuss different interpretations of spectra and their applications to Birational Geometry

10:30am **Workshop: Coffee Break - SGCP Cafe**

Title: Coffee Break

11:00am **Workshop: Konstantin Aleshkin - SCGP 102**

Speaker: Konstanin Aleshkin

Title: Wall-crossing and mirror symmetry for abelian GLSM

Abstract: GLSM are Gromov-Witten type curve-counting theories that capture enumerative geometry of critical loci in GIT quotients. I plan to discuss genus zero quasimap invariants of abelian GLSM. I will explain that particular generating series of invariants associated to a matrix factorization have multiple integral representations. These power series are believed to be related to central charges. We use one representation to show wall-crossing with respect to the GIT stability condition of the target and another to show the mirror symmetry.

12:00pm **Workshop: Lunch - SCGP Cafe**

Title: Lunch

2:30pm **Workshop: Rachel Webb - SCGP 102**

Speaker: Rachel Webb

Title: Hasset moduli stacks of twisted curves

Abstract: A stable n -marked curve is a nodal curve with n distinct marked points and finitely many automorphisms. If we choose rational numbers a_1, \dots, a_n in the interval $(0, 1]$, then a weighted stable n -marked curve is a generalization where the marks are allowed to coincide as long as the total weight at any point is at most one. Moduli of weighted stable curves were first constructed by Hassett. On the other hand, a twisted stable n -marked curve is a tame stack whose coarse moduli space is a stable n -marked curve, such that stacky structure is concentrated at nodes and markings and has a specific local description. I will discuss a modification (using log geometry) of the moduli of twisted stable curves where the markings are allowed to coincide, analogous to Hassett's construction for representable curves. This is a joint work with Martin Olsson.

3:30pm **Workshop: Tea Time - SCGP Cafe**

Title: Tea Time

4:00pm **Workshop: Y.P. Lee - SCGP 102**

Speaker: Y.P. Lee

Title: A blowup formula in quantum cohomology

Abstract: Let Y be a blowup of a smooth projective variety X along a smooth center Z , we present a formula which gives the quantum cohomology ring of X in terms of the quantum cohomology of Y . This formula also implies that, in a weak sense, quantum cohomology of Y is determined by those of X and of Z .

Tuesday, October 31st

9:00am **Workshop: Breakfast - SCGP Cafe**

Title: Breakfast

9:30am **Workshop: Johanna Knapp - SCGP 102**

Speaker: Johanna Knapp

Title: Genus-0 invariants of Calabi-Yau hybrid models via GLSMs

Abstract: Hybrid models are a class of Landau-Ginzburg orbifolds fibered over some base manifold. They naturally arise in limiting regions of the stringy Kahler moduli spaces of Calabi-Yaus and as phases of the associated gauged linear sigma models (GLSMs). We compute genus zero correlators for hybrids with one and two Kahler parameters. These correlators are generalisations of GW/FJRW invariants. We use GLSM techniques, combined with the physics formulation of hybrids, to extract the invariants from I/J-functions. This is joint work with D. Erking.

10:30am **Workshop: Coffee Break - SGCP Cafe**

Title: Coffee Break

11:00am **Workshop: Paul Seidel - SCGP 102**

Speaker: Paul Seidel

Title: The small quantum D-module and its relatives

Abstract: I'm still stuck in the early 1990s not understanding Gromov-Witten theory. However, in the case of a Fano manifold containing a smooth anticanonical divisor, results and conjectures arising from the work of Borman-Sheridan-Varolgunes allow one to carry over questions to ones about the symplectic cohomology of the divisor complement, and there we have a well-behaved Fukaya category (much better than the situation for the Fukaya category of the Fano itself). That means one can bring to bear algebraic techniques which do not, at the moment, have geometric counterparts. This is joint work with Dan Pomerleano.

12:00pm **Workshop: Group Photo - SCGP 102**

Title: Group Photo

12:00pm **Workshop: Lunch - SCGP Cafe**

Title: Lunch

1:15pm **Workshop & SCGP Weekly Talk Speaker: Daniel S Halpern-Leistner - SCGP 102**

Speaker: Daniel S Halpern-Leistner

Title: Quantum cohomology and derived categories

Abstract: I will review some conjectures and some theorems about the relationship between the quantum invariants of birationally equivalent projective manifolds, and how they lift to categorical statements about derived categories of coherent sheaves. I will then discuss a new framework for studying the structure of derived categories of coherent sheaves using Bridgeland stability conditions. This perspective gives a more concrete relationship between quantum invariants and derived categories: the quantum differential equation defines certain canonical flows on the space of stability conditions, which we conjecture lead to canonical semiorthogonal decompositions of the derived categories. Well-known conjectures, such as the D-equivalence conjecture and Dubrovin's conjecture, emerge naturally from this perspective.

2:30pm **Workshop: Hsian-Hua Tseng - SCGP 102**

Speaker: Hsian-Hua Tseng

Title: Crepant resolutions and Gromov-Witten invariants

Abstract: Following suggestions from String Theory, it has been conjectured that Gromov-Witten theory of an orbifold and its crepant resolutions should be equivalent. In this talk, we will discuss precise formulations of this "crepant resolution conjecture" and survey some recent results.

3:30pm **Workshop: Tea Time - SCGP Cafe**

Title: Tea Time

Wednesday, November 1st

9:00am **Workshop: Breakfast - SCGP Cafe**

Title: Breakfast

9:30am **Workshop: Hiroshi Iritani - SCGP 102/ZOOM**

Speaker: Hiroshi Iritani

Title: A formal decomposition of quantum cohomology D-modules of blowups

Abstract: I will discuss a formal decomposition of the quantum (cohomology) D-module of a blowup along a smooth subvariety. A smooth projective variety X and its blowup X' can be realized as different GIT quotients of another variety W with C^* action. I use an idea of Teleman and identify the quantum D-modules of X and X' as Fourier transforms of the C^* -equivariant quantum D-module of W .

10:30am **Workshop: Coffee Break - SGCP Cafe**

Title: Coffee Break

11:00am **Workshop: Andrei Okounkov - SCGP 102**

Speaker: Andrei Okounkov

Title: TBA

Abstract: TBA

12:00pm **Workshop: Lunch - SCGP Cafe**

Title: Lunch

2:30pm **Workshop: John Pardon - SCGP 102**

Speaker: John Pardon

Title: Universally counting curves in Calabi--Yau threefolds

Abstract: Enumerating curves in algebraic varieties traditionally involves choosing a compactification of the space of smooth embedded curves in the variety. There are many such compactifications, hence many different enumerative invariants. I will propose a "universal" (very tautological) enumerative invariant which takes values in a certain Grothendieck group of 1-cycles. It is often the case with such "universal" constructions that the resulting Grothendieck group is essentially uncomputable. But in this case, the cluster formalism of Ionel and Parker shows that, in the case of threefolds with nef anticanonical bundle, this Grothendieck group is freely generated by local curves. This reduces the MNOP conjecture (in the case of nef anticanonical bundle and primary insertions) to the case of local curves, where it is already known due to work of Bryan--Pandharipande and Okounkov--Pandharipande.

3:30pm **Workshop: Tea Time - SCGP Cafe**

Title: Tea Time

4:00pm **Workshop: Guangbo Xu - SCGP 102**

Speaker: Guangbo Xu

Title: Fukaya category of point blowups

Abstract: (joint with Venugopalan and Woodward) From the example of the behavior of Fukaya categories of toric manifolds under minimal model program (MMP) transitions, one can predict the change of Fukaya categories under birational transformations on general symplectic manifolds. The first progress was due to Charest-Woodward, who constructed new split generators of the Fukaya category near the exceptional divisor. Recently, we proved the Fukaya category before the blowup embed (with a bulk deformation) into the Fukaya category after the blowup. In addition, if a collection of Lagrangian branes satisfy Abouzaid-Ganatra generation criterion, then their embedding images, together with the new generators near the exceptional divisor, shall also split generate the Fukaya category after the blowup. This result categorifies Bayer's theorem stating that the semisimplicity of quantum cohomology is preserved under point blowup. In my talk, I will also try to address some technical issues, such as how to achieve transversality under the rationality assumption, the change of the bulk parameter under the blowup, and the correspondence between critical values of the potential function and eigenvalues of quantum multiplication by c_1 when bulk deformation and weakly bounding cochain are included.

6:00pm **Workshop: Banquet Dinner - SCGP Cafe**

Title: Banquet

Thursday, November 2nd

9:00am **Workshop: Breakfast - SCGP Cafe**

Title: Breakfast

9:30am **Workshop: Alexander Kuznetsov - SCGP 102/ZOOM**

Speaker: Alexander Kuznetsov

Title: Categorical absorption of singularities

Abstract: Resolution of singularities from the categorical point of view is an operation that replaces the derived category of a singular variety by a bigger smooth and proper triangulated category. Absorption of singularities, on a contrary, replaces the derived category of a singular variety by a smaller smooth and proper triangulated category. In the talk I will introduce P-infinity objects and show how they can be used to absorb singularities of nodal varieties.

10:30am **Workshop: Coffee Break - SGCP Cafe**

Title: Coffee Break

11:00am **Workshop: Maxim Kontsevich - SCGP 102/ZOOM**

Speaker: Maxim Kontsevich

Title: Atoms and their invariants

Abstract: Genus zero Gromov-Witten invariants of a smooth projective variety are encoded in the structure of a Frobenius manifold. Consider the operator of quantum multiplication by the Euler vector field at the generic point of the subvariety of the Frobenius manifold consisting of linear combinations of algebraic classes. Different generic eigenvalues are called atoms of the variety. Recent results of Hiroshi Iritani on quantum cohomology of blowups and fibrations by projective spaces imply that one can identify atoms for different varieties. Even the simplest invariants of atoms (like e.g. isomorphism classes of Hodge structures) give new very strong tools in birational geometry. Hypothetically, the ultimate invariant of an atom is a smooth proper category together with a component of its Bridgeland stability space (similar to the proposal by Daniel Halpern-Leistner). The talk is based on the joint work with Ludmil Katzarkov, Tony Pantev and Tony Yu

12:00pm **Workshop: Lunch - SCGP Cafe**

Title: Lunch

2:30pm **Workshop: Yefeng Shen - SCGP 102**

Speaker: Yefeng Shen

Title: GW/FJRW correspondence for quasi-homogeneous polynomials

Abstract: For a quasi-homogeneous polynomial, we study a correspondence between the genus-zero Gromov-Witten theory of the hypersurface determined by the polynomial and the genus-zero Fan-Jarvis-Ruan-Witten theory of the singularity determined by the polynomial. This generalizes the so-called genus zero Calabi-Yau/Landau-Ginzburg correspondence (or Landau-Ginzburg/Calabi-Yau correspondence), when the hypersurface is Calabi-Yau. The Gamma structures in the GW/FJRW theory play a key role in this story. The talk is based on works joint with Ming Zhang and with Jie Zhou.

3:30pm **Workshop: Tea Time - SCGP Cafe**

Title: Tea Time

4:00pm **Workshop: Denis Auroux - SCGP 102**

Speaker: Denis Auroux

Title: Deformations of Landau-Ginzburg models and their singularity spectra

Abstract: For Fano varieties which are known to admit a mirror Landau-Ginzburg (LG) model, the Katzarkov-Kontsevich-Pantev-Yu proposal for birational invariants from quantum cohomology can be recast as associating a certain 'spectrum' (a collection of rational numbers) to the singularities of the Landau-Ginzburg mirror. There are different procedures for doing this, from mixed Hodge structures (after Steenbrink) to more classical singularity theory (after Varchenko). A more elementary construction can be given for a numerical invariant which can be viewed as the "dimension" of the singularity. The hope is that the behavior of these invariants under deformations gives an obstruction to a LG model being the mirror to a rational variety. Since the behavior of quantum cohomology under birational transformations involves bulk deformations, it seems unclear that all the spaces one wishes to consider have honest LG mirrors. Instead, one needs to also consider deformations of LG models by higher classes in Hochschild cohomology. We show that, even though these are no longer honest Landau-Ginzburg models or even analytic spaces, they have well-defined critical loci and it remains possible to construct a Steenbrink-type spectrum. (This is joint work in progress with Ludmil Katzarkov and Maxim Kontsevich)

Friday, November 3rd

9:00am **Workshop: Breakfast - SCGP Cafe**

Title: Breakfast

9:30am **Workshop: Mauricio Romo - SCGP 102**

Speaker: Mauricio Romo

Title: Computing DT invariants with A-branes

Abstract: I will introduce exponential networks and their uses to define and compute Donaldson-Thomas (DT) invariants of local CY 3-folds given by conic bundles, in two ways: via the so called nonabelianization map and by studying the moduli space of A-branes. The networks play an important role in understanding the latter as they are interpreted as points at the boundary of the moduli space of A-branes. I will present examples of certain mirrors of toric CY 3-folds and 'wild' BPS states associated with moduli spaces of representations of Kronecker quivers.

10:30am **Workshop: Coffee Break - SGCP Cafe**

Title: Coffee Break

11:00am **Workshop: Mohammed Abouzaid - SCGP 102**

Speaker: Mohammed Abouzaid

Title: TBA

Abstract: TBA

12:00pm **Workshop: Lunch - SCGP Cafe**

Title: Lunch

3:30pm **Workshop: Tea Time - SCGP Cafe**

Title: Tea Time