

Conference on Algebraic Geometry, Representation theory and Mathematical Physics

April 29 - May 1, 2019



Monday, April 29

Time	Speaker	Title/Abstract
8:30 - 9:00am	Breakfast	
9:00 - 10:00am	Wei Zhang, MIT	<p>Title: The arithmetic fundamental lemma for diagonal cycles</p> <p>Abstract: I'll recall the Gross--Zagier theorem and a high dimensional generalization, the arithmetic Gan-Gross-Prasad conjecture, which relates the height pairing of arithmetic diagonal cycles on certain shimura varieties to the first order derivative of certain L-functions. The arithmetic fundamental lemma conjecture arises from the relative trace formula approach to this conjecture. I will recall the statement of the arithmetic fundamental lemma and outline a proof.</p>
10:00 - 10:30am	Break	
10:30 - 11:30am	Yuri Tschinkel, NYU	<p>Title: Equivariant birational geometry and modular symbols</p> <p>Abstract: We introduce new invariants in equivariant birational geometry and study their relation to modular symbols and cohomology of arithmetic groups (joint with M. Kontsevich and V. Pestun).</p>
11:30 - 1:30pm	Lunch	
1:30 - 2:30pm	Alexander Efimov, Moscow	<p>Title: Torsionness for regulators of canonical extensions</p> <p>Abstract: I will sketch a generalization of the results of Iyer and Simpson arXiv:0707.0372 to the general case of a normal-crossings divisor at infinity.</p>
2:30 - 3:00pm	Break	
3:00 - 4:00pm	Amin Gholampour, Maryland	<p>Title: Euler Characteristics of punctual quot schemes on threefolds</p> <p>Abstract: Let F be a homological dimension 1 torsion free sheaf on a nonsingular quasi-projective threefold. The first cohomology of the derived dual of F is a 1-dimension sheaf G supported on the singular locus of F. We prove a</p>

		wall-crossing formula relating the generating series of the Euler characteristics of $\text{Quot}(F, n)$ and $\text{Quot}(G, n)$, where $\text{Quot}(-, n)$ denotes the quot scheme of length n quotients. We will use this relation in studying the Euler characteristics of the moduli spaces of stable torsion free sheaves on nonsingular projective threefolds. This is a joint work with Martijn Kool.
4:00 - 4:30pm	Break	
4:30 - 5:30pm	Maksym Fedorchuk, BC	<p>Title: Stability of one-parameter families of weighted hypersurfaces</p> <p>Abstract: We define a notion of stability for fibrations over a curve with generic fibers being weighted hypersurfaces (in some weighted projective space) generalizing Kollár's stability for families of hypersurfaces in a projective space. The stability depends on a choice of an effective line bundle on the parameter space of weighted hypersurfaces and different choices pick out different birational model of the total space of the fibration. I will describe enumerative geometry that goes into understanding these stability conditions, and, if time permits, examples where this machinery can be used to produce birational models with good properties. Joint work with Hamid Ahmadinezhad and Igor Krylov.</p>

Tuesday, April 30

Time	Speaker	Title/Abstract
8:30 - 9:00am	Breakfast	
9:00 - 10:00am	Brendan Hassett, Brown	<p>Title: Rationality for geometrically rational threefolds</p> <p>Abstract: We consider rationality questions for varieties over non-closed fields that become rational over an algebraic closure, like smooth complete intersections of two quadrics. (joint with Tschinkel)</p>
10:00 - 10:30am	Break	
10:30 - 11:30am	Dennis Gaitsgory, Harvard	<p>Title: The Fundamental Local Equivalence in quantum geometric Langlands</p> <p>Abstract: The Fundamental Local Equivalence is statement that relates the q-twisted Whittaker category of the affine Grassmannian for the group G and the category of modules over the Langlands dual "big" quantum group. The non-triviality of the statement lies in the fact that the relationship between the group and its dual is combinatorial, so to prove the FLE one needs to express both sides in combinatorial terms. In the talk we will indicate the proof of a related statement for the "small" quantum group. The combinatorial link is provided by the category of</p>

		factorization modules over a certain factorization algebra, which in itself is a geometric device that concisely encodes the root data.
11:30 - 1:00pm	Lunch	
1:00- 2:00pm	Andrei Negut, MIT	<p>Title: AGT relations in geometric representation theory" and abstract:</p> <p>Abstract: I will survey a program that seeks to translate the Alday-Gaiotto-Tachikawa correspondence (between gauge theory on R^4 and conformal field theory) into the language of algebraic geometry. The objects of study become moduli spaces of sheaves on surfaces, and the goal is to connect them with the W-algebra of type gl_n.</p>
2:00 - 2:15pm	Break	
2:15 - 3:15pm	Dan Abramovich, Brown	<p>Title: Resolution in characteristic 0 using weighted blowing up</p> <p>Abstract: Given a variety X, one wants to blow up the worst singular locus, show that it gets better, and iterate until the singularities are resolved.</p> <p>Examples such as the Whitney umbrella show that this iterative process cannot be done by blowing up smooth loci - it goes into a loop.</p> <p>We show that there is a functorial way to resolve varieties using <i>weighted</i> blowings up, in the stack-theoretic sense. To an embedded variety $X \subset Y$ one functorially assigns an invariant (a_1, \dots, a_k), and a center locally of the form $(x_1^{a_1}, \dots, x_k^{a_k})$, whose stack-theoretic weighted blowing up has strictly smaller invariant under the lexicographic order.</p> <p>This is joint work with Michael Tëmkin (Jerusalem) and Jaroslaw Włodarczyk (Purdue), a side product of our work on functorial semistable reduction. A similar result was discovered by G. Marzo and M. McQuillan.</p>
3:15 - 3:30pm	Break	
3:30 - 4:30pm	Fedor Bogomolov, NYU	<p>Title: On the base of a Lagrangian fibration for a compact hyperkahler manifold.</p> <p>Abstract: In my talk I will discuss our proof with N. Kurnosov that the base of such fibration for complex projective manifold hyperkahler manifold of dimension $4g$ is always a projective plane P^2. In fact we show that the base of such fibration can not have a singular point of type E_8. It was by the theorem of Matsushita and others that only quotient singularities can occur and if the base is smooth then the it is isomorphic to P^2. The absence of other singularities apart from E_8 has been already known and</p>

		we show that \mathbb{E}^8 can not occur either. Our method can be applied to other types of singularities for the study of Lagrangian fibrations in higher dimensions More recently similar result was obtained by Huybrechts and Xu.
4:30 - 4:45pm	Break	
4:45 - 5:45pm	Dawei Chen, BC	<p>Title: Volumes and intersection theory on moduli spaces of Abelian differentials</p> <p>Abstract: Computing volumes of moduli spaces has significance in many fields. For instance, Witten's conjecture regarding intersection numbers on moduli spaces of Riemann surfaces has a fascinating connection to the Weil-Petersson volume, which motivated Mirzakhani to give a proof via Teichmueller theory, hyperbolic geometry, and symplectic geometry. In this talk I will introduce an analogue of Witten's intersection numbers on moduli spaces of Abelian differentials to compute the Masur-Veech volumes induced by the flat metric associated with Abelian differentials. This is joint work with Moeller, Sauvaget, and Zagier (arXiv:1901.01785).</p>

Wednesday, May 1

Time	Speaker	Title/Abstract
8:30 - 9:00am	Breakfast	
9:00 - 10:00am	Pavel Etingof, MIT	<p>Title: Short star-products for filtered quantizations</p> <p>Abstract: Let \mathcal{A} be a filtered Poisson algebra with Poisson bracket $\{\cdot, \cdot\}$ of degree -2. A <i>star product</i> on \mathcal{A} is an associative product $*$: $\mathcal{A} \otimes \mathcal{A} \rightarrow \mathcal{A}$ given by $a * b = ab + \sum_{i \geq 1} C_i(a, b)$, where C_i has degree $-2i$ and $C_1(a, b) - C_1(b, a) = \{a, b\}$. We call the product <i>even</i> if $C_i(a, b) = (-1)^i C_i(b, a)$ for all i, and call it <i>short</i> if $C_i(a, b) = 0$ whenever $i > \min\{\deg(a), \deg(b)\}$.</p> <p>Motivated by three-dimensional $N=4$ superconformal field theory, In 2016 Beem, Peelaers and Rastelli considered short even star-products for homogeneous symplectic singularities (more precisely, hyperKähler cones) and conjectured that that they exist and depend on finitely many parameters. We prove the dependence on finitely many parameters in general and existence for a large class of examples, using the connection of this problem with zeroth Hochschild homology of quantizations suggested by Kontsevich.</p> <p>Beem, Peelaers and Rastelli also computed the first few terms of short quantizations for Kleinian singularities of type A, which were later computed to all orders by Dedushenko, Pufu and Yacoby. We will discuss some generalizations of</p>

		<p>these results.</p> <p>This is joint work with Eric Rains and Douglas Stryker.</p>
10:00 - 10:30am	Break	
10:30 - 11:30am	Roman Bezrukavnikov, MIT	<p>Title: Stability conditions and representation theory</p> <p>Abstract: I will recall the concept of real variation of stabilities (introduced in my work with Anno and Mirkovic) and its relation to modular Lie algebra representations. I will also address a potential generalization of that picture to modular representations of affine Lie algebras related to the classical limit of geometric Langlands duality and its local counterpart.</p>
11:30 - 11:45am	Break	
11:45 - 12:45pm	Qile Chen, BC	<p>Title: Counting curves in critical locus via logarithmic compactification</p> <p>Abstract: An R-map consists of a pre-stable map to possibly non-GIT quotient together with sections of certain spin bundles. The moduli of R-maps are in general non-compact. When the target of R-maps is equipped with a super-potential W with compact critical locus, using Kiem-Li cosection localization it has been proved by many authors in various settings that the virtual cycle of R-maps can be represented by the cosection localized virtual cycle which is supported on the proper locus consisting of R-maps in the critical locus of W. Though the moduli of R-maps is equipped with a natural torus action by scaling of the spin bundles, the non-compactness of the R-maps moduli makes such powerful torus action useless.</p> <p>In this talk, I will introduce a logarithmic compactification of the moduli of R-maps using certain modifications of stable logarithmic maps. The logarithmic moduli space carries a canonical virtual cycle from the logarithmic deformation theory. In the presence of a super-potential with compact critical locus, it further carries a reduced virtual cycle. We prove that (1) the reduced virtual cycle of the compactification can be represented by the cosection localized virtual cycle; and (2) the difference of the canonical and reduced virtual cycles is another reduced virtual cycle supported along the logarithmic boundary. As an application, one recovers the Gromov-Witten invariants of the critical locus as the invariants of logarithmic R-maps of its ambient space in an explicit form. The latter can be calculated using the spin torus action.</p> <p>This is a joint work with Felix Janda and Yongbin Ruan.</p>
12:45 - 2:30pm	Lunch	

2:30 - 3:30pm	Si Li, Tsinghua	<p>Title: Semi-infinite Hodge structure: from BCOV theory to Seiberg-Witten geometry</p> <p>Abstract: I will explain how the semi-infinite Hodge theory extends Kodaira-Spencer gravity (Bershadsky-Cecotti-Ooguri-Vafa theory of B-twisted closed topological string field theory) into a full solution of Batalin-Vilkovisky master equation. This allows us to formulate quantum B-model via a rigorous BV quantization method and construct integrable hierarchies arising naturally from the background symmetry. In the second part of the talk, I will explain the recent discovery of the connection between K.Saito's primitive form and 4d N=2 Seiberg-Witten geometry arising from singularity theory.</p>
3:30 - 4:00pm	Break	
4:00 - 5:00pm	Ludmil Katzarkov, Moscow	<p>Title: PDE's non commutative motives and HMS.</p> <p>Abstract: In this talk we will discuss the theory of central manifolds and the new structures in geometry it produces. Application to Bir. Geometry will be discussed.</p>