

Mirror Symmetry and Related Topics 2017

Dates: 11 – 15 December 2017

Venue: Conference Room 127, Department of Mathematics
(Graduate School of Science Bldg no.3), Kyoto University

Talks

Mohammed Abouzaid	<i>Homological Mirror Symmetry without corrections</i>
Renzo Cavalieri	<i>Graph formulas for tautological classes</i>
Emily Clader	<i>Wall-Crossing in Higher-Genus Quasimap Theory</i>
Sheel Ganatra	<i>Liouville sectors and localizing Fukaya categories</i>
Jérémy Guéré	<i>From DR hierarchies to tautological classes</i>
Kentaro Hori	<i>Mirror Symmetry — from 3d to 2d</i>
Bumsig Kim	<i>Virtual cycles via two-periodic localized Chern characters</i>
Tatsuki Kuwagaki	<i>Fukaya category of the projective line and microlocal sheaf theory</i>
Siu-Cheong Lau	<i>Moduli of Lagrangian immersions in pair-of-pants decompositions and mirror symmetry</i>
Kaoru Ono	<i>Anti-symplectic involution and twisted sectors in Lagrangian Floer theory</i>
Thomas Prince	<i>Lagrangian torus fibration models of Fano threefolds</i>
Konstantze Rietsch	<i>Mirror Symmetry for Grassmannians</i>
Dusty Ross	<i>Higher-genus global mirror symmetry</i>
Helge Ruddat	<i>Analyticity of canonical Calabi-Yau families</i>
Nick Sheridan	<i>Symplectic mapping class groups and homological mirror symmetry</i>
Constantin Teleman	<i>Coulomb branches and gauged sigma-models</i>
Dimitri Zvonkine	<i>Witten's r-spin class and the cohomology of $\overline{M}_{g,n}$</i>

Schedule¹

	9:00-9:45	10:00-11:00	11:30-12:30	14:00-15:00	15:30-16:30
Mon	disc	disc	disc	Abouzaid	Ono
Tue	disc	Ganatra	Lau	Sheridan	Kuwagaki
Wed	disc	Rietsch	Teleman	Ruddat	Hori
Thu	disc	Zvonkine	Prince	Clader	Kim
Fri	disc	Guéré	Ross	Cavalieri	disc

Acknowledgments: This conference is supported by JSPS KAKENHI Kiban-S 16H06335 (Atsushi Moriwaki), Kiban-S 16H06337 (Atsushi Takahashi), Kiban-S 25220701 (Shigeru Mukai), Kiban-C 16K05127 (Hiroshi Iritani).

Organizers: Hiroshi Iritani, Yukiko Konishi, Hiraku Nakajima, Atsushi Takahashi.
https://www.math.kyoto-u.ac.jp/iritani/mirrorsymmetry2017/mirrorsymmetry_2017

¹disc=“discussion”

Title and Abstracts

- **Mohammed Abouzaid** (Columbia University)

Title: *Homological Mirror Symmetry without corrections*

Abstract: I will explain how to prove HMS for symplectic manifolds admitting Lagrangian torus fibrations without singularities.

- **Renzo Cavalieri** (Colorado State University)

Title: *Graph formulas for tautological classes*

Abstract: The tautological ring of the moduli space of curves is a subring of the Chow ring that, on the one hand, contains many of the classes represented by “geometrically defined” cycles (i.e. loci of curves that satisfy certain geometric properties), on the other has a reasonably manageable structure. By this I mean that we can explicitly describe a set of additive generators, which are indexed by suitably decorated graphs. The study of the tautological ring was initiated by Mumford in the ’80s and has been intensely studied by several groups of people. Just a couple years ago, Pandharipande reiterated that we are making progress in a much needed development of a “calculus on the tautological ring”, i.e. a way to effectively compute and compare expressions in the tautological ring. An example of such a “calculus” consists in describing formulas for geometrically described classes (e.g. the hyperelliptic locus) via meaningful formulas in terms of the combinatorial generators of the tautological ring. In this talk I will explain in what sense “graph formulas” give a good example of what the adjective “meaningful” meant in the previous sentence, and present a few examples of graph formulas. The original work presented is in collaboration with Nicola Tarasca and Vance Blankers.

- **Emily Clader** (San Francisco State University)

Title: *Wall-Crossing in Higher-Genus Quasimap Theory*

Abstract: Quasimaps are a generalization of stable maps that depend on the additional datum of a positive rational number epsilon. The dependence of the theory on epsilon is encoded in certain wall-crossing formulas, first conjectured by Ciocan-Fontanine and Kim and since proved in many cases, which are intimately related to mirror symmetry. I will discuss an alternative proof of Ciocan-Fontanine–Kim’s wall-crossing theorem for all-genus quasimaps to complete intersections in projective space, which has the advantage that it can be adapted to prove an analogous theorem for more general gauged linear sigma models. This is joint work with Felix Janda and Yongbin Ruan.

- **Sheel Ganatra** (University of Southern California)

Title: *Liouville sectors and localizing Fukaya categories*

Abstract: We introduce a new class of Liouville manifolds-with-boundary, called Liouville sectors, and show they have well-behaved, covariantly functorial Fukaya/Floer theories. Stein manifolds frequently admit coverings by Liouville sectors, which can then be used to study the Fukaya category of the

total space. Our first main result in this setup is a local criterion for generating (global) Fukaya categories. One of our goals, using this framework, is to obtain a combinatorial presentation of the Fukaya category of any Stein manifold. This is joint work with John Pardon and Vivek Shende.

- **Jérémy Guéré** (Université Grenoble Alpes)

Title: *From DR hierarchies to tautological classes*

Abstract: In 2014, Alexandr Buryak constructed, for each cohomological field theory (CohFT), a new integrable hierarchy based on the geometry of the double ramification cycle and called the DR hierarchy. He then conjectured that it is equivalent to a construction of Dubrovin-Zhang for semi-simple CohFTs. In this talk, we recall the main steps of these two constructions and we will see how their conjectural equivalence leads to conjectural relations in the tautological rings of the moduli spaces of stable curves. It is a joint work with Buryak, Dubrovin, and Rossi.

- **Kentaro Hori** (Kavli IPMU)

Title: *Mirror Symmetry — from 3d to 2d*

Abstract: I will talk about an attempt to understand $2d$ mirror symmetry from $3d$ mirror symmetry.

- **Bumsig Kim** (Korea Institute for Advanced Study)

Title: *Virtual cycles via two-periodic localized Chern characters*

Abstract: The localized Chern character of a bounded complex of vector bundles is a bivariant class defined by Baum, Fulton, and MacPherson. They used such classes to prove a general Riemann-Roch theorem for singular varieties. For a two-periodic complex of vector bundles, Polishchuk and Vaintrob have constructed its localized Chern character. This is a generalization of the usual one. We discuss some properties of PV's localized Chern characters. In particular, the cosection localization defined by Kiem and Li can be expressed as a localized Chern character operation. This result is a generalization of the related work by Chang, Li, and Li. The talk is based on joint work with Jeongseok Oh.

- **Tatsuki Kuwagaki** (Kavli IPMU)

Title: *Fukaya category of the projective line and microlocal sheaf theory*

Abstract: For a cotangent bundle T^*X , Nadler-Zaslow showed that the derived Fukaya category is equivalent to the derived category of constructible sheaves over the base X . On the other hand, Guillermou's sheaf quantization produces a sheaf over $X \times \mathbb{R}$ from an exact Lagrangian in T^*X , which is considered as the Novikov-enhanced version of NZ-equivalence (some central ideas are due to Tamarkin). In this talk, I'll report my work in progress constructing a candidate of sheaf quantization of the great circle in the projective line, which exhibits some properties which appear in the Fukaya category of the projective line.

- **Siu-Cheong Lau** (Boston University)

Title: *Moduli of Lagrangian immersions in pair-of-pants decompositions and mirror symmetry*

Abstract: We construct a quantum-corrected moduli of Lagrangian immersions in a pair-of-pants decomposition and study mirror symmetry. The key ingredient is gluing between local moduli constructed in previous works. Novikov ring plays an essential role in the construction, even though the exact Lagrangians only correspond to the complex-valued part. It is a joint work with Cho and Hong.

- **Kaoru Ono** (Kyoto University, RIMS)

Title: *Anti-symplectic involution and twisted sectors in Lagrangian Floer theory*

- **Thomas Prince** (University of Oxford)

Title: *Lagrangian torus fibration models of Fano threefolds*

Abstract: Inspired by the work of Gross on topological Mirror Symmetry we construct candidate Lagrangian torus fibration models for the 105 families of smooth Fano threefolds. In the case the second Betti number is one, we show that the total space of each fibration is homeomorphic to the expected Fano threefold, and show that the numerical invariants coincide for all 105. Our construction relies on a notion of toric degeneration for affine manifolds with singularities, and the correspondence we obtain between polytopes and Fano manifolds is compatible with that appearing in the work of Coates-Corti-Kasprzyk et al. on Mirror Symmetry for Fano manifolds.

- **Konstantze Rietsch** (King's College London)

Title: *Mirror Symmetry for Grassmannians*

Abstract: In joint work with R. Marsh we wrote down a rational function on a Grassmannian, the ‘superpotential’, and showed how it can be used to describe Gromov-Witten invariants of the (Langlands dual) Grassmannian via a Dubrovin/Givental style of mirror symmetry construction. In this talk I will briefly report on these results, and then talk about joint work with L. Williams which makes use of the same superpotential, but in a very different way, to construct a class of Newton-Okounkov convex bodies.

- **Dusty Ross** (San Francisco State University)

Title: *Higher-genus global mirror symmetry*

Abstract: Over ten years ago, Chiodo and Ruan proved a genus-zero global mirror theorem, relating the Gromov-Witten invariants of the quintic threefold to the corresponding Fan-Jarvis-Ruan-Witten invariants. Moreover, they suggested that the genus-zero relationship quantizes to an all-genus statement. In this talk, I'll describe recent work with Shuai Guo and Huailiang Chang to compute higher-genus FJRW invariants and to verify the quantized global mirror theorem.

- **Helge Ruddat** (Johannes Gutenberg Universität Mainz)

Title: *Analyticity of canonical Calabi-Yau families*

Abstract: Gross and Siebert gave an algorithm to produce from toric degeneration data a canonical formal Calabi-Yau family. Siebert and I prove that this family is in fact the completion of an analytic family. In particular, its nearby fibres are decent Calabi-Yau manifolds over the complex numbers. Furthermore, the family is semi-universal, i.e. locally the moduli space of Calabi-Yaus. The key result on the route to analyticity is the computation of canonical coordinates on the base by explicit integration of a holomorphic volume form over topological cycles that we construct from tropical 1-cycles in the base of the SYZ-fibration.

- **Nick Sheridan** (University of Cambridge)

Title: *Symplectic mapping class groups and homological mirror symmetry*

Abstract: I will explain how one can get new information about symplectic mapping class groups by combining two recent results: a proof of homological mirror symmetry for a new collection of $K3$ surfaces (joint work with Ivan Smith), together with the computation of the derived autoequivalence group of a $K3$ surface of Picard rank one (Bayer–Bridgeland). For example, it is possible to give an example of a symplectic $K3$ whose smoothly trivial symplectic mapping class group (the group of isotopy classes of symplectic automorphisms which are smoothly isotopic to the identity) is infinitely-generated. This is joint work with Ivan Smith.

- **Constantin Teleman** (University of Oxford)

Title: *Coulomb branches and gauged sigma-models*

Abstract: There has been a recent increase in interest in constructing “Coulomb branches” for 3-dimensional gauge theory with matter, but the mathematical meaning of these objects seems less widely known. The Coulomb branch for pure gauge theory was constructed by Bezrukavnikov, Finkelberg and Mirkovic, and characterised by the speaker as a classifying space for gauged 2-dimensional topological field theories, specifically gauged quantum cohomology. Given this universal description, the existence of additional Coulomb branches seems mysterious. In this lecture, I will describe the construction of the more general Coulomb branches from the pure one and the gauged mirror of the matter representation, and its related interpretation as a TQFT classifying space.

- **Dimitri Zvonkine** (Versailles University and CNRS)

Title: *Witten’s r -spin class and the cohomology of $\overline{M}_{g,n}$*

Abstract: In the introductory part of the talk I will introduce the tautological cohomology ring of the moduli space $\overline{M}_{g,n}$ of stable curves and its natural generators. Two natural problems arise: what are the relations between these generators and how to express natural cycles in $\overline{M}_{g,n}$ via these generators. I will explain how Witten’s r -spin class helps in solving both problems.