

2016 Workshop on Symplectic Geometry and Mathematical Physics

Schedule:

5.23

Monday morning

9:30-10:30 **Alejandro Adem**, Commutativity, Bundles and K-theory

10:45-11:45 **Felix Janda**, Around Pixton's formula for the double ramification cycles

Monday afternoon

2:00-3:00 **Brad Safnuk**, Topological recursion for open intersection numbers

3:30-4:30 **Alexandr Buryak**, Double ramification hierarchies

5.24

Tuesday morning

9:30-10:30 **Jianxun Hu**, Blow-up formula of Welschinger invariants

10:45-11:45 **Ran Tessler**, Intersection theory on moduli of bordered riemann surfaces, and related integrable systems

Tuesday afternoon

2:00-3:00 **Zhengyu Zong**, Torus knots, open Gromov-Witten invariants and topological recursion

3:15-4:15 **Kazushi Ueda**, Residue mirror symmetry for Grassmannians

4:30-5:30 **Gehao Wang**, Virasoro constraints and polynomial recursion for the linear Hodge integrals

5.25

Wednesday morning

9:30-10:30 **Hsian-Hua Tseng**, On Gromov-Witten theory of 1-dimensional stacks

10:45-11:45 **Kwokwai Chan**, Rozansky-Witten theory as a perturbative QFT

5.26

Thursday morning

9:30-10:30 **Mohammed Abouzaid**, Simple homotopy type of nearby Lagrangians

10:45-11:45 **Penka Georgieva**, Real Gromov-Witten theory in all genera

Thursday afternoon

2:00-3:00 **Shanzhong Sun**, Moyal quantization of the cyclic cohomology of Fukaya categories

3:15-4:15 **Timothy Perutz**, From homological to Hodge-theoretic mirror symmetry for Calabi-Yau manifolds

4:30-5:30 **Hai-Long Her**, Fredholmness of operators with degenerate asymptotics

6:30 Banquet

5.27

Friday morning

9:30-10:30 **Bai-Ling Wang**, Virtual K-theoretical fundamental class

10:45-11:45 **Guangbo Xu**, Adiabatic Limits and Open Quantum Kirwan map

We will provide lunch boxes after morning talks.

Title and Abstract:

Alejandro Adem (University of British Columbia)

Commutativity, Bundles and K-theory

In this talk I will describe a new cohomology theory constructed out of commuting unitary matrices. I will discuss its role in bundle theory and homotopy theory. This is joint work with J.Gomez, J.Lind and U. Tillmann.

Felix Janda (IMJ-PRG)

Around Pixton's formula for the double ramification cycles

I am going to report on results concerning the formula and relations of Pixton concerning double ramification cycles on the moduli space of curves. The talk is focused on the study of the tautological relations and computations using Pixton's formula.

Based on joint works with E. Clader, S. Grushevsky, R. Pandharipande, A. Pixton and D. Zvonkine

Brad Safnuk (Central Michigan University)

Topological recursion for open intersection numbers

I will present a topological recursion (also called Eynard-Orantin recursion) formula for calculating open intersection numbers, which were recently given a rigorous treatment by Pandharipande, Solomon and Tessler. I will also discuss a conjectural refinement of the resulting generating function by including a grading parameter that distinguishes contributions from surfaces with different numbers of boundary components.

Alexandr Buryak (ETH Zurich)

Double ramification hierarchies

I will talk about the double ramification (DR) hierarchy -- a new hamiltonian hierarchy associated to an arbitrary cohomological field theory. The DR hierarchy has a rich algebraic structure. It is

tausymmetric, has a natural quantization and also its Hamiltonians satisfy very efficient recursion relations. Moreover, conjecturally, in the case of a semisimple cohomological field theory the DR hierarchy is Miura equivalent to the hierarchy of topological type, which is also called the DubrovinZhang hierarchy. The talk is based on joint works with Boris Dubrovin, Jeremy Guere and Paolo Rossi.

Jianxun Hu (Sun Yat-Sen University)

Blow-up formula of Welschinger invariants

In this talk, I will first introduce Welschinger invariant and real blow-up of symplectic 4-manifolds. Then I talk about the change of Welschinger invariants under real blow-up. This is a joint work with Yanqiao Ding.

Ran Tessler (ETH-ITS Zurich)

Intersection theory on moduli of bordered riemann surfaces, and related integrable systems

We describe a construction of open intersection numbers on the moduli space of Riemann surfaces with boundaries. We define the moduli, line bundles and ψ classes, and discuss the orientation issues. Surprisingly, these numbers turn out to satisfy an open analog of the KdV hierarchy and open Virasoro constraints.

Based on several works, some of which are joined with (some subsets of) A. Buryak, R. Pandharipande and J. Solomon.

Zhengyu Zong (Tsinghua University)

Torus knots, open Gromov-Witten invariants and topological recursion

Recently there have been many studies on the relation between open Gromov-Witten invariants and topological recursion. One of the most interesting cases is the Remodeling Conjecture which was recently proved in arXiv: 1604.07123. The Remodeling Conjecture can be viewed as an all genus mirror symmetry for open Gromov-Witten potentials relative to an Aganagic-Vafa brane in a toric Calabi-Yau 3-orbifold. In the case of the resolved conifold (which is a toric Calabi-Yau 3-fold), an Aganagic-Vafa brane corresponds to the unknot in S^3 under the conifold transition. In this talk, I will consider the lagrangians in the resolved conifold which correspond to torus knots under the conifold transition. Then I will study the all genus open Gromov-Witten theory relative to these lagrangians and study its relation to the topological recursion. This work is joint with Bohan Fang.

Kazushi Ueda (University of Tokyo)

Residue mirror symmetry for Grassmannians

Motivated by recent works on localizations in A-twisted gauged linear sigma models, we discuss a generalization of toric residue mirror symmetry by Batyrev-Matsevich to complete intersections in Grassmannians.

This is a joint work with Bumsig Kim, Jeongseok Oh, and Yutaka Yoshida.

Gehao Wang (Peking University)

Virasoro constraints and polynomial recursion for the linear Hodge integrals

The Hodge tau-function of the KP hierarchy is a generating function for the linear Hodge integrals. This tau-function is closely related to the symmetric polynomials appearing in the polynomial recursion formula for the linear Hodge integrals. In this talk, we present the Virasoro constraints for the Hodge tau-function in the explicit form of the Virasoro equations. Using this result, we can deduce a simple version of the Virasoro constraints for the Hodge partition function, where the coefficients are restored from the Gamma function. And we can also prove the equivalence relation between the Virasoro constraints and polynomial recursion formula for the linear Hodge integrals. This is a joint work with Shuai Guo.

Hsian-hua Tseng (Ohio State University)

On Gromov-Witten theory of 1-dimensional stacks

Smooth 1-dimensional Deligne-Mumford stacks are étale gerbes over twisted curves, and twisted curves are obtained from nonsingular curves by root constructions. Motivated by this structural description, there are some recent attempts at solving (relative) Gromov-Witten theory of 1-dimensional stacks. The purpose of this talk is to discuss these attempts, made jointly with Xiang Tang and with Fenglong You.

Kwokwai Chan (Chinese University of Hong Kong)

Rozansky-Witten theory as a perturbative QFT

The Rozansky-Witten model is a 3d sigma model whose target space is a compact hyperkähler manifold; its partition function leads to interesting 3-manifold topological invariants. In this talk, I will explain how to construct this model rigorously as a perturbative quantum field theory (QFT), following Costello's foundational work. This is based on a recent joint work with Conan Leung and Qin Li. My work reported in this talk was substantially supported by a grant from the HKSAR RGC (Project No. CUHK14302015).

Mohammed Abouzaid (Columbia University)

Simple homotopy type of nearby Lagrangians

The study of Fukaya categories of cotangent bundles has yielded a proof that the inclusion of any closed exact Lagrangian is a homotopy equivalence. I will explain a proof (joint with Kragh) that such a Lagrangian is in fact simply homotopic to the base. The main idea is to introduce a notion of Whitehead torsion for a Floer-theoretic equivalence, and show that it agrees with the usual Whitehead torsion in this setting.

Penka Georgieva (IMJ-PRG)

Real Gromov-Witten theory in all genera

We construct positive-genus analogues of Welschinger's invariants for many real symplectic manifolds, including the odd-dimensional projective spaces and the quintic threefold. Our approach to the orientability problem is based entirely on the topology of real bundle pairs over

symmetric surfaces. This allows us to endow the uncompactified moduli spaces of real maps from symmetric surfaces of all topological types with natural orientations and to verify that they extend across the codimension-one boundaries of these spaces. In reasonably regular cases, these invariants can be used to obtain lower bounds for counts of real curves of arbitrary genus. Joint work with A. Zinger.

Shanzhong Sun (Capital Normal University)

Moyal quantization of the cyclic cohomology of Fukaya categories

In our attempts to understand the higher genus version of Fukaya categories of symplectic manifolds, we develop the Moyal quantization of the Lie bialgebra structure on the cyclic cohomology of the Fukaya category. I will report our joint work in progress with X. Chen, Y. Chen and F. Eshmatov in this direction.

Timothy Perutz (University of Texas at Austin)

From homological to Hodge-theoretic mirror symmetry for Calabi-Yau manifolds

I'll outline joint work with Ganatra and Sheridan in which we show how aspects of Hodge-theoretic mirror symmetry for Calabi-Yau manifolds - notably, the relationship between the quantum differential equation and the Gauss-Manin connection - can be deduced as formal consequences of homological mirror symmetry.

Hai-Long Her (Nanjing Normal University)

Fredholmness of operators with degenerate asymptotics

In this talk, we discuss the Fredholm property of a sort of differential operators which are asymptotic to some non-invertible operators. This result may apply to studying problems relevant to moduli space of Morse-Bott type holomorphic curves.

Bai-Ling Wang (Australian National University)

Virtual K-theoretical fundamental class

This talk is based on my joint work with Bohui Chen and Jianxun Hu. We will define a notion of virtual K-theoretical fundamental class associated to an orbifold virtual system $\{V_I, E_I, \sigma_I\}$ and the virtual index theory. As an application, we define K-theory Gromov-Witten invariants and quantum K-theory for any closed symplectic manifold. Some properties, including associativity, will be discussed

Guangbo Xu (Princeton University)

Adiabatic Limits and Open Quantum Kirwan map

This talk is based on a joint project with Dongning Wang, Sushmita Venugopalan and Chris Woodward. We consider the symplectic vortex equation over the disk with Lagrangian boundary condition. As the area of the disk grows to infinity, vortices converges to holomorphic disks in the symplectic quotient, with possible affine vortex bubbles. These affine vortices are solutions to the vortex equation over either the complex plane or the upper half plane. I will explain at least

intuitively, why the counting of affine vortices defines an A-infinity morphism between two versions of Fukaya algebras of a Lagrangian. This morphism can be viewed as an "open quantum Kirwan map". An interesting application of the open quantum Kirwan map is to understand, for toric manifolds, the relation between the Hori-Vafa potential and the Lagrangian Floer disk potential.