11w5114: NEW RECURSION FORMULAE AND INTEGRABILITY
FOR CALABI-YAU SPACES
Oct 16 - Oct 21, 2011

Program (Revised)

All lectures take place in the Main Lecture Hall of the *TransCanada Pipelines Pavilion.*

Monday		**Tuesday**		**Wednesday**	
09:00–09:20	Organizational	09:00–10:00	Eynard	09:00–10:00	Ross
09:20–10:20	Bryan	10:00-10:30	Coffee	10:00–11:00	Xu
10:20–10:40	Coffee	10:30–11:30	Norbury	11:00–11:10	Coffee
10:40–11:40	Cavalieri	11:30	Group Photo	11:10–12:10	Coates
Lunch		Lunch		Lunch	
1:00–1:45	Banff Center Tour				
2:00–3:00	Liu	2:00–3:00	Mariño	Free Time	
3:00–3:30	Coffee	3:00–3:30	Coffee		
3:30–4:30	Alim	3:30-4:30	Manabe		
4:45–5:45	Sułlkowski	4:45–5:45	Fuji		
Dinner		Dinner		Dinner	
7:30–	Social				

Thursday		**Friday**	
09:00–10:00	Kashani-Poor	09:00–10:00	Rossi
10:00–10:30	Coffee	10:00–10:30	Coffee
10:30–11:30	Klemm	10:30–11:30	Chiodo
Lunch		Lunch	
2:00–3:00	Kimura		
3:00–3:30	Coffee		
3:30–4:30	Brini		
4:45–5:45	Shadrin		
Dinner			
7:30–	Integrable System Night		

List of Talks

- Murad Alim: BPS Quivers

    Abstract: I will describe how quivers can be used to study BPS spectra of $N = 2$ quantum field theories in four dimensions. All the BPS states in the spectrum of theories admitting a BPS quiver can be understood as bound-states of a set of fundamental BPS states. Using quivers, wall-crossing can be understood and the spectrum of a large class of theories can be computed. Furthermore, the superpotential of the effective gauge theory associated to the BPS states can be obtained.

- Andrea Brini: A crepant resolution conjecture for open strings

    Abstract: We propose a Crepant Resolution Conjecture in the context of open Gromov-Witten theory. The content of this talk is based on arXiv:1102.0281 and on previous joint work with Renzo Cavalieri (arXiv:1007.0934).

- Jim Bryan: Counting hyperelliptic curves on Abelian surfaces via quasi-modular forms.

    Abstract: Curves of geometric genus g on a polarized Abelian surface move in a $g - 2$ dimensional family up to translation. Thus one expects a finite number of hyperelliptic curves (up to translation) and one can count them. We show, assuming the Crepant Resolution Conjecture for Gromov-Witten theory, that the generating function for this counting problem (and its refinements) are given by q-expansions of certain explicit quasi-modular forms. This is based on the thesis of my student, Simon Rose.

- Renzo Cavalieri: A geometric view on polynomiality in Hurwitz theory

    Abstract: Hurwitz numbers have been interesting objects of study both because of their intrinsic structure and their interactions with diverse mathematical theories. It was observed by Goulden and Jackson that single Hurwitz numbers are (essentially) polynomial in the entries of the special ramification profile. This observation was proven via the ELSV formula that exibhits single Hurwitz numbers as intersection numbers on the moduli space of curves. A similar story developed for double Hurwitz numbers, where Goulden-Jackson-Vakil, Shadrin-Shapiro-Vainshtein and Cavalieri-Johnson-Markwig developed a thorough combinatorial understanding of the piecewise-polynomial structure of double Hurwitz numbers and their wall crossings. Now we seek to make sense of this behavior from a geometric point of view. In particular, can double Hurwitz numbers be recovered as intersection numbers on some appropriate family of moduli spaces? Is there a formula similar to the ELSV that explains the polynomiality behavior, and are there geometric wall crossing explaining the combinatorial ones? This talk will be mostly about ideas, dreams and speculations and work in progress, hopefully supported by a good amount of evidence.

- Alessandro Chiodo: Global mirror symmetry, Landau-Ginzburg model, and level curves

    Abstract: I will place the mirror symmetry statement within a global framework emerging natuarally from recent literature on this subject. One corner of this framework is the Landau-Ginzburg (LG) model, which still lacks a precise mathematical interpretation. In collaboration with Yongbin Ruan, Hiroshi Iritani I have carried out a study of the enumerative geometry of the LG model using moduli of curves with level structures. These are geometrical objects interesting in their own right, we will provide an introduction to the geometry of their moduli spaces (work in progress with Gavril Farkas).

- Tom Coates: Higher genus GW invariants of local $\mathbb{P}^2$ and quasi modular forms (joint work with Iritani)
- Bertrand Eynard: Topological recursion and intersection numbers (tentative)
- Hiroyuki Fuji: The volume conjecture and topological string

    Abstract: In this talk, I will discuss the volume conjecture on the colored Jones polynomial in terms of the open topological B-model. After surveying some aspects of the three dimensional hyperbolic geometry, I will discuss the WKB expansion of the colored Jones polynomial of a hyperbolic knot as the topological string amplitudes. As a final remark, I may mention the colored refined knot invariants of the $SU(2)$ theory (work in progress).
- Amir-Kian Kashani-Poor: Exact expressions for Seiberg-Witten amplitudes in Ω-deformed backgrounds (tentative)
- Takashi Kimura: On orbifold operations in equivariant K-theory

    Abstract: We will introduce some new algebraic structures associated to a smooth variety with a proper action of an algebraic group that are invariants of the associated quotient orbifold. Such algebraic structures arise on their orbifold K-theory ring, a K-theoretic variant of Chen-Ruan orbifold cohomology, and generalize more familiar operations in ordinary K-theory.
- Albrecht Klemm: Worldsheet interpretation of the Omega deformation
- Melissa Liu: Open Gromov-Witten invariants of toric Calabi-Yau 3-folds

    Abstract: In this talk, I will report some progress towards the remodeling conjecture based on joint work with Bohan Fang and Jian Zhou.
- Masahide Manabe: A Surface Operator, Topological B-model, and Topological Recursion

    Abstract: In the context of AGT relation, it has been argued that a half-BPS surface operator in four dimensional supersymmetric gauge theory with eight supercharges corresponds to a degenerate primary operator in two dimensional CFT. By geometric engineering, we discuss and check this correspondence from a viewpoint of topological B-model. The B-model free energies on mirror curve and Seiberg-Witten curve (of Gaiotto form) are obtained by the Eynard-Orantin topological recursion relation. We state a relation between the two types of free energies. (Based on a collaboration with H. Awata, H. Fuji, H. Kanno and Y. Yamada; arXiv 1008.0574 [hep-th])
- Marcos Mariño: Topological strings at strong string coupling
- Paul Norbury: Gromov-Witten invariants of $\mathbb{P}^1$ and Eynard-Orantin invariants

    Abstract: Eynard and Orantin have recently defined invariants of any compact Riemann surface equipped with two meromorphic functions, as a tool for studying enumerative problems in geometry. I will descibe how these invariants bring new insight into the well-studied problem of the Gromov-Witten invariants of $\mathbb{P}^1$.
- Dusty Ross: The Gromov-Witten Orbifold Vertex

    Abstract: This talk will discuss recent work in developing an orbifold topological vertex in Gromov-Witten theory, a basic building block for computing the GW invariants in all genera of toric CY orbifolds of dimension 3. I will begin by reviewing the open GW theory of Katz and Liu in the smooth case, then describe how it generalizes to our setting. I will define the GW orbifold vertex and briefly discuss the gluing algorithm. Finally, I will present some connections and future applications In particular, I plan to discuss how our formalism compares with the DT orbifold vertex of Bryan-Cadman-Young.

- Paolo Rossi: Topological recursion relations in symplectic field theory

  Abstract: One of the main differences between GW theory and SFT is that the latter uses a moduli space of curves carrying special evaluation maps controlling the relative gluing angle of two components of a nodal configuration. This can be used to define new 3-point invariant that was not present in the original theory, but gives an interesting structure that seems to be related to psi-classes and topological recursion and, ultimately, to the integrability propoerties of the SFT infinite dimensional hamiltonian system.
- Sergey Shadrin: Integrable hierarchies and Gromov-Witten theory (tentative)
- Piotr Sułkowski: Topological recursion and quantization

  Abstract: This talk is based on my recent paper with Sergei Gukov.

  (http://arxiv.org/abs/1108.0002)
- Hao Xu: Intersection numbers on moduli spaces of curves

  Abstract: We will give an introduction to intersection numbers on moduli spaces of curves, including descendent integrals, Weil-Petersson volumes, Hodge integrals and r-spin numbers. We will present our current knowledge of ways to compute them. We hope the talk will be helpful to understand the recent work of Eynard of expressing Eynard-Orantin invariants of an arbitrary spectral curve in terms of these intersection numbers.
- Integrable System Night: Informal discussions led by Emma Previato and Francisco Plaza Martín.