

## Seminar & Events Bulletin: Geometry & Physics

01-01-2013 to 06-30-2013

Monday, January 14, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Steffen Marcus (Utah) <i>Computations and comparisons for double ramification classes on the moduli space of curves</i> -- 4088 East Hall
Monday, January 21, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Tudor Dimofte (IAS) <i>3-Manifolds and 3d Gauge Theories</i> -- 4088 East Hall
Monday, January 28, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Huazhong Ke (Tsinghua Univ/Michigan) <i>Quantum McKay correspondence via gauged linear sigma model</i> -- 4088 East Hall
Monday, February 04, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Zhengyu Zong (Columbia) <i>The two-leg orbifold Gromov-Witten vertex</i> -- 4088 East Hall
Monday, February 11, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Todor Milanov (IPMU) <i>The local Eynard-Orantin recursion in Gromov-Witten theory</i> -- 4088 East Hall
Monday, February 18, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Yongbin Ruan (UM) <i>Gromov-Witten theory of quotient of quintic 3-fold</i> -- 4088 East Hall
Monday, February 25, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Huai-Liang Chang (HKUST) <i>On algebraic geometric construction of enumerative invariants</i> -- 4088 East Hall
Wednesday, February 27, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Jun Li (Stanford) <i>Categorification of DT invariants and GV numbers (Joint with Algebraic geometry seminar)</i> -- 3088 East Hall
Monday, March 11, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Si Li (BU) <i>Landau-Ginzburg B-model at higher genus</i> -- 4088 East Hall
Tuesday, March 12, 2013		
2:00pm-3:30pm	<b>Geometry &amp; Physics</b>	-- Kentaro Hori (IPMU) <i>D-brane (FRG Special Lectures)</i> -- Randall Lab 4404
Thursday, March 14, 2013		
2:00pm-3:30pm	<b>Geometry &amp; Physics</b>	-- Kentaro Hori (IPMU) <i>D-brane (FRG Special Lectures)</i> -- Randall Lab 4404
Monday, March 18, 2013		
4:00pm-6:00pm	<b>Geometry &amp; Physics</b>	-- Simon Rose (Queens University) <i>Counting Hyperelliptic curves in Abelian surfaces with Quasi-modular forms</i> -- 4088 East Hall

**Seminar & Events Bulletin: Geometry & Physics**  
01-01-2013 to 06-30-2013

Tuesday, March 19, 2013

2:00pm-3:30pm **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404

Thursday, March 21, 2013

2:00pm-3:30pm **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404

Monday, March 25, 2013

4:00pm-6:00pm **Geometry & Physics** -- Siu-Cheong Lau (Harvard) *Open mirror theorem and crepant resolutions* -- 4088 East Hall

Tuesday, March 26, 2013

2:00pm-3:30pm **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404

Thursday, March 28, 2013

2:00pm-3:30pm **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404

Monday, April 08, 2013

4:00pm-6:00pm **Geometry & Physics** -- Wenxuan Lu (Upenn) *Stability Conditions and Mirror Symmetry of K3 Surfaces in Attractor Backgrounds* -- 4088 East Hall

Wednesday, April 17, 2013

4:00pm-6:00pm **Geometry & Physics** -- Richard Thomas (Imperial College) See(<http://www.math.lsa.umich.edu/~mmustata/Spring.html>)>Spring Lectures in Algebraic Geometry -- 3088 East Hall

**Seminar & Events Bulletin: Geometry & Physics**  
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**Abstracts**

**Geometry & Physics**

**Monday, January 14, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Steffen Marcus (Utah)**

*Computations and comparisons for double ramification classes on the moduli space of curves*

Double Hurwitz numbers can be defined geometrically as a weighted count of covers of the projective line with special ramification conditions. Double ramification classes are Chow classes on the moduli space of curves that give a geometric generalization of these numbers. In this talk I will discuss the two main approaches for constructing these classes. We will see how the two approaches compare, how the classes may be expressed in the tautological ring (thanks to recent work of Hain, and Grushevsky-Zakharov), and how this comparison relates to other results in Hurwitz theory. This is joint and continuing work with Renzo Cavalieri and Jonathan Wise.

**Geometry & Physics**

**Monday, January 21, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Tudor Dimofte (IAS)**

*3-Manifolds and 3d Gauge Theories*

By starting with the 6d (2,0) superconformal field theory on a space-time of the form  $M \times \mathbb{R}^3$ , where  $M$  is a 3-manifold, one obtains an effective 3-dimensional field theory on  $\mathbb{R}^3$  --- thus establishing a correspondence between 3-manifolds  $M$  and 3d theories  $T[M]$ . The correspondence encodes many beautiful relations between geometry and physics, which I will discuss in the first part of the talk. Ultimately,  $T[M]$  should provide a categorification of Chern-Simons theory (i.e. quantum topological invariants) on  $M$ .

In the second part of the talk, I will discuss how  $T[M]$  (and its partition functions) can actually be computed from ideal triangulations of a large class of 3-manifolds with boundary. Mathematically, this involves studying moduli spaces of framed flat  $SL(K)$  connections on tetrahedra and how they glue together.

## Seminar & Events Bulletin: Geometry & Physics

01-01-2013 to 06-30-2013

### Geometry & Physics

**Monday, January 28, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Huazhong Ke (Tsinghua Univ/Michigan)**

*Quantum McKay correspondence via gauged linear sigma model*

In the early 90's, Witten introduced the gauged linear sigma model (GLSM) to study the phase change phenomenon in string theory. Mathematically, we can interpret GLSM as a symplectic reduction, in which charge vectors play an important role. For a local Calabi-Yau  $3$ -fold, we can use its charge vectors to describe the moduli space of mirror curves, and hence determine the genus-zero (closed) Gromov-Witten invariants. Similar picture also holds for open string invariants. It is observed that for different limit points in the K\"ahler moduli of  $3$ -fold, it is better to use different charge vectors, which are all  $\mathbb{Q}$ -bases of the lattice of invariants. Following this idea, we have proved the quantum McKay correspondence for disc invariants of effective outer legs in semi-projective toric Calabi-Yau  $3$ -orbifolds, using the recent result of Bohan Fang, Mellisa Liu and Hsian-Hua Tseng. This is joint work with Jian Zhou.

### Geometry & Physics

**Monday, February 04, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Zhengyu Zong (Columbia)**

*The two-leg orbifold Gromov-Witten vertex*

For toric Calabi-Yau  $3$ -orbifolds, the orbifold GW theory is obtained by gluing the orbifold GW vertex, a generating function of cubic abelian Hurwitz-Hodge integrals. So the orbifold GW vertex can be viewed as the building block of the orbifold GW theory of toric Calabi-Yau  $3$ -orbifolds. In this talk, I will give a formula of the  $2$ -leg orbifold GW vertex. After computing the effective and gerby  $1$ -leg orbifold GW vertex, the computation of the  $2$ -leg orbifold GW vertex can be reduced to the  $1$ -leg cases. I will also talk about the combinatorial aspects (in particular, the Gromov-Witten/Donaldson-Thomas correspondence) of both the  $1$ -leg and  $2$ -leg cases. This work is joint with Dustin Ross.

## Seminar & Events Bulletin: Geometry & Physics

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### Geometry & Physics

**Monday, February 11, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Todor Milanov (IPMU)**

*The local Eynard-Orantin recursion in Gromov--Witten theory*

The Eynard--Orantin recursion was discovered first in the settings of matrix models. It turns out that the recursion holds in Gromov--Witten theory as well, which in particular provides a very powerful tool for computing Gromov--Witten invariants for manifolds whose quantum cohomology is semi-simple. My plan is first to introduce the recursion and then using Givental's higher genus reconstruction to explain how one can prove the relations via the well known Virasoro constraints for the intersection numbers of the Delign--Mumford moduli space of curves.

### Geometry & Physics

**Monday, February 18, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Yongbin Ruan (UM)**

*Gromov-Witten theory of quotient of quintic 3-fold*

### Geometry & Physics

**Monday, February 25, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Huai-Liang Chang (HKUST)**

*On algebraic geometric construction of enumerative invariants*

For the first half of the talk we explain Li-Tian/Behrend-Fantechi's algebraic construction of virtual cycle in Gromov Witten theory, and its comparison with symplectic construction. For the second half of the talk we discuss its analogue in Landau-Ginzburg type theory, which uses Kiem-Li's cosection localization. As examples we discuss the KP4 case(Guffin-Sharpe) and the  $C^n$  case (Fan-Jarvis-Ruan).

## **Seminar & Events Bulletin: Geometry & Physics**

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### **Geometry & Physics**

**Wednesday, February 27, 2013, 4:00pm-6:00pm**

**3088 East Hall**

**Jun Li (Stanford)**

*Categorification of DT invariants and GV numbers (Joint with Algebraic geometry seminar)*

DT invariants are degrees of the virtual cycles of the moduli of sheaves on Calabi-Yau threefolds. Behrend's function allows to reconstruct these invariants via weighted Euler numbers, thus can define DT-invariants motivically. A categorification of DT invariants search for perverse sheaves on these moduli spaces so the Behrend function is the local Euler numbers of cohomology sheaves of these perverse sheaves. In a joint work with YH Kiem, we construct such perverse sheaves, with MHM structures. As a corollary, we define GV numbers via a double  $sl_2$  representations on 2-branes.

### **Geometry & Physics**

**Monday, March 11, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Si Li (BU)**

*Landau-Ginzburg B-model at higher genus*

Given a quasi-homogeneous polynomial with isolated singularity, I will describe a construction of quantum intersection theory on the Jacobian ring via a rigorous perturbative renormalization of a twisted version of Kodaira-Spencer gauge theory. This gives a mathematical theory of Landau-Ginzburg B-model at higher genus, which is expected to mirror to the FJRW theory of orbifold Landau-Ginzburg A-model at all genera.

### **Geometry & Physics**

**Tuesday, March 12, 2013, 2:00pm-3:30pm**

**Randall Lab 4404**

**Kentaro Hori (IPMU)**

*D-brane (FRG Special Lectures)*

### **Geometry & Physics**

**Thursday, March 14, 2013, 2:00pm-3:30pm**

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**Geometry & Physics**

**Monday, March 18, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Simon Rose (Queens University)**

*Counting Hyperelliptic curves in Abelian surfaces with Quasi-modular forms*

In the first part of this talk I will go over some famous results in the theory of curve counting on surfaces, as well present a formula for the number of hyperelliptic curves in a fixed polarized Abelian surface. In the second part I will go into more detail about this formula and its origins in orbifold Gromov-Witten theory, using results from the first part and the crepant resolution conjecture of Bryan-Graber.

**Geometry & Physics**

**Tuesday, March 19, 2013, 2:00pm-3:30pm**

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**Geometry & Physics**

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**Randall Lab 4404**

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*D-brane (FRG Special Lectures)*

**Geometry & Physics**

**Monday, March 25, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Siu-Cheong Lau (Harvard)**

*Open mirror theorem and crepant resolutions*

In this talk, I will explain the relation of open Gromov-Witten invariants and Seidel representations for toric manifolds. This leads to an open mirror theorem, which expresses the mirror map in terms of open Gromov-Witten invariants. The theorem has a natural generalization to certain toric orbifolds. As a result we can see how the open invariants of a toric orbifold is linked to that of its crepant resolutions. This is a joint work with Chan, Cho, Leung and Tseng.

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### Geometry & Physics

**Tuesday, March 26, 2013, 2:00pm-3:30pm**

**Randall Lab 4404**

**Kentaro Hori (IPMU)**

*D-brane (FRG Special Lectures)*

### Geometry & Physics

**Thursday, March 28, 2013, 2:00pm-3:30pm**

**Randall Lab 4404**

**Kentaro Hori (IPMU)**

*D-brane (FRG Special Lectures)*

### Geometry & Physics

**Monday, April 08, 2013, 4:00pm-6:00pm**

**4088 East Hall**

**Wenxuan Lu (Upenn)**

*Stability Conditions and Mirror Symmetry of K3 Surfaces in Attractor Backgrounds*

We study the space of stability conditions on K3 surfaces from the perspective of mirror symmetry. It is done in the so called attractor backgrounds (moduli) which are selected by the attractor mechanism for certain black holes. We find certain highly non-generic behaviors of stability walls (a key notion in the study of wall crossings) in the space of stability conditions. They correspond via mirror symmetry to some non-generic behaviors of special Lagrangians in an attractor background.

### Geometry & Physics

**Wednesday, April 17, 2013, 4:00pm-6:00pm**

**3088 East Hall**

**Richard Thomas (Imperial College)**

See(<http://www.math.lsa.umich.edu/~mmustata/Spring.html>)>Spring Lectures in Algebraic Geometry</a>)