Conference on Gromov–Witten theory

Institut Fourier, Grenoble, July 4th - 8th, 2011

Abstracts of talks

Denis AUROUX
UC Berkeley

Title: Mirror symmetry for noncompact Riemann surfaces

Abstract: Mirror symmetry predicts a correspondence between "mirror" pairs of manifolds, whereby the symplectic geometry of one manifold can be reformulated in terms of the complex algebraic geometry of the other and vice-versa. This phenomenon has been studied in detail for Calabi-Yau manifolds, and subsequently for Fano manifolds; however it was recently shown that it also extends to varieties of general type. In this talk we focus on the case of punctured Riemann surfaces (for instance the sphere minus 3 points, or higher genus surfaces), and discuss the relation between their symplectic geometry (wrapped Floer homology and Fukaya category) and the algebraic geometry of their mirrors (complex 3-dimensional Landau-Ginzburg models). (This is joint work with Mohammed Abouzaid, Alexander Efimov, Ludmil Katzarkov and Dmitri Orlov).

Renzo CAVALIERI
Colorado State University

Title: Open Orbifold GW Invariants

Abstract: Open GW theory refers to the study of maps from Riemann Surfaces with boundary into a target manifold, where the boundary is constrained to map to a fixed Lagrangian submanifold. The physical theory of open strings gives several predictions for virtually enumerative invariants related to these kind of problems. I will discuss a computational (mathematical) framework to make sense of open GW invariants in the case of a toric orbifold target, and present some results, applications, speculations and work in progress in joint work with Andrea Brini (Geneva) and Dusty Ross (CSU).

Alessandro CHIODO
Institut Fourier, Grenoble

Title: Landau-Ginzburg/Calabi-Yau correspondence and Iritani's Z-structures

Abstract: Despite much effort and progress both in physics and in mathematics Gromov-Witten invariants of Calabi-Yau hypersurfaces $(f = 0)$ in $\mathbb{P}^n$ remain unknown. Via geometric invariant theory one can rely the geometry of $(f = 0)$ in $\mathbb{P}^n$ to that of the singularity at the origin of $\mathbb{C}^{n+1}$. In 1993, Witten has stated the idea that these models - the Calabi-Yau hypersurface and the singularity - are "two phases of the same theory". This correspondence admits a formulation in terms of Gromov-Witten invariants. It has been proven in genus zero in collaboration with Yongbin Ruan at it has been been relied to Orlov equivalence and Iritani's Z-structures in collaboration with Iritani and Ruan.

Hiroshi IRITANI
Kyoto University

Title: Quantum cohomology and periods

Abstract: Under mirror symmetry, quantum cohomology of a symplectic manifold X is identified with the variation of Hodge structure of a mirror complex manifold Y. We construct solutions to the quantum differential equation associated to a vector bundle, via the Gamma class, and show that they coincide with periods of the mirror manifold Y for a class of complete intersections in toric varieties. Thereby we identify the natural Z-structure of quantum cohomology with the K-group of the manifold. Using the global nature of the mirror complex moduli, we apply this Z-structure to the study of analytic continuation of Gromov-Witten theory. The application includes the LG/CY correspondence (joint work with Alessandro Chiodo and Yongbin Ruan) and the modularity of the Gromov-Witten potential of local $\mathbb{P}^2$ (joint work with Tom Coates).

Albrecht KLEMM
Physics Institute, Bonn

Title: Omega backgrounds and generalized holomorphic anomaly equation

Abstract: We derive an anomaly equation which incorporates the general Omega background in the B-model. We discuss applications to topological string theory on Calabi-Yau backgrounds and N = 2 gauge theory with massive flavors. Using geometric engineering on the Enriques Calabi-Yau we derive Seiberg-Witten curves for the conformal cases, which are comptabible with Nekrasovs partition function.

Andrew KRESCH
Institut für Mathematik, Zürich

Title: Maps from curves with ramification conditions

Abstract: We describe a space of maps from pointed curves to a nonsingular complex projective variety with prescribed ramification indices at the points, constructed in joint work with B. Kim and Y.-G. Oh. It gives a new compactification of the space of general maps from curves.

Yuan-Pin LEE
University of Utah

Title: Invariance of quantum cohomology under ordinary flops

Abstract: I will explain how to show that the quantum cohomology is invariant, after a prescribed analytic continuation, under ordinary flops. This is our ongoing project of studying crepant transformation conjecture for projective varieties with non-explicit exceptional loci.

This is a joint project with H.W. Lin and C.L. Wang.

Jun LI
Stanford University

Title: Application of cosection localized virtual cycle to GW-invariants of quintics

Abstract: After recalling the cosection localized virtual cycles, we will present three applications: one is the algebraic treatment of FJRW-invariants; the second is the GW-invariants of stable maps with fields and its equivalence with the ordinary GW-invariants of the quintic Calabi-Yau threefolds; the third is an algebro-geometric proof of Li-Zinger's formula relating the genus one GW-invariants of quintic with its reduced version. The three applications are joint work with Chang, Huai-liang.

Laurent MANIVEL
Institut Fourier, Grenoble

Title: The Satake correspondence in quantum cohomology

Abstract: The Satake isomorphism identifies the irreducible representations of a semisimple algebraic group with the intersection cohomologies of the Schubert varieties in the affine Grassmannian of the Langlands dual group. In the very special case where the Schubert varieties are smooth, one gets an identification between the so-called minuscule representations and the cohomology of the so-called minuscule homogeneous spaces. I will explain how this extends to quantum cohomology.

Etienne MANN
Université de Montpellier

Title: Quantum D-module for hypersurfaces

Abstract: Out of the quantum product of a projective smooth variety, we can construct a vector bundle with a flat connection and a pairing, these data are called quantum D-modules. In a recent paper of Iritani, he gives an explicit presentation of this D module for toric varieties. In this talk, we will consider a hypersurface in a toric variety and we give a link between the quantum D module of the ambient variety and the one of the hypersurface. Moreover, in the toric case, we will give a presentation of these D-modules. This is a common work with Thierry Mignon (Montpellier).

Motohico MULASE
UC Davis

Title: Counting the lattice points on the moduli space of curves

Abstract: In this talk I will explain the idea of the Laplace transform that connects a counting problem in the A-model side with a recursion formula based on complex analysis in the B-model side, using a concrete example. The talk is based on my joint work with Chapman, Penkava and Safnuk.

Nicolas PERRIN
Hausdorff Center, Bonn

Title: Quantum K-theory of some homogeneous spaces

Abstract: Quantum K-theory is as quantum cohomology a generalisation of the classical cohomology algebra of a variety X. In this talk I will explain the connection between the geometry of the moduli space of stable maps, in particular rational connectedness properties, and the computation of structure constants for X a rational homogeneous space. This is based on a joint work with A. Buch, P.-E. Chaput and L. Mihalcea.

Aaron PIXTON
IAS, Princeton

Title: The stable pairs equivariant descendent vertex

Abstract: The counting function associated to the moduli space of stable pairs on a 3-fold X is conjectured to give the Laurent expansion of a rational function. For toric X, this conjecture can be proven by a careful grouping of the box configurations appearing in the stable pairs equivariant descendent vertex. I will describe this approach and then say a little about how it might also be used to study the Donaldson–Thomas vertex. This talk presents joint work with Rahul Pandharipande.

Paolo ROSSI
IMJ - Université de Paris 6

Title: Gravitational descendants and topological recursion in moduli spaces with boundary

Abstract: Symplectic Field Theory, by Eliashberg, Givental and Hofer, and many other homological invariants employed by modern symplectic topology, make use of moduli spaces of holomorphic curves whose natural compactification present real codimension 1 boundary strata. In a joint work with O. Fabert we study tautological relations for the analogue of psi-classes in this more general set-up. As in Gromov-Witten theory, they allow to enrich the algebraic structure of such symplectic invariants in an interesting and computationally useful way.

Yonbgin RUAN
University of Michigan

Title: Towards a global mirror symmetry

Abstract: During last twenty years, the mirror symmetry has been a driving force in geometry and physics. Many incredible results have been obtained in mathematics. However, a brief investigation reveals that the current form of mirror symmetry in mathematics is only a "local" form of mirror symmetry concerning about so called large complex structure limit. An interesting problem is if we can gain more information by moving away from large complex structure limit. Namely, is there an interesting theory of "global" mirror symmetry? In this talk, we will cover some of exciting developments in this direction.

Jake SOLOMON
Hebrew University

Title: Entropy of Lagrangian Submanifolds

Abstract: I'll discuss an invariant of a pair of Maslov zero Lagrangian submanifolds in a Calabi-Yau manifold with a given Hamiltonian isotopy between them. The invariant is constructed using moduli of holomorphic disks. It depends only on the homotopy class of the Hamiltonian isotopy. The invariant is analogous under mirror symmetry to the Donaldson-Bott-Chern functional important in the study of stable vector bundles. This is joint work with G. Tian.

Yefeng SHEN
University of Michigan, Ann Arbor

Title: Gromov-Witten theory of elliptic orbifold $\mathbb{P}_1$

Abstract: In this talk, I will explain three aspects for Gromov-Witten theory of elliptic orbifold $\mathbb{P}_1$: the convergence of Gromov-Witten invariants, the Calabi-Yau/Landau-Ginzburg correspondence of all genera and quasi-modularity properties of Gromov-Witten invariants. This is a joint work with Krawitz, Milanov and Ruan.

Constantin TELEMAN
UC Berkeley

Title: Group actions on linear categories

Abstract: I will discuss and illustrate the notion of a (locally-trivial, or A-model) Lie group action on a linear category, and flag a somewhat concealed appearance of the Langlands dual group.

Hsian-Hua TSENG
Ohio State University

Title: Deformation quantization and Gromov-Witten theory of étale gerbes

Abstract: A conjecture from physics states that conformal field theories of an étale gerbe Y are equivalent to conformal field theories of a pair $(\hat{Y}, c)$ constructed explicitly from the gerbe Y. Here $\hat{Y}$ is a disconnected space, and c is a flat $U(1)$-gerbe on $\hat{Y}$. In particular this suggests that Gromov-Witten theory of Y is equivalent to the c-twisted Gromov-Witten theory of $\hat{Y}$. In this talk we will explain details of this conjecture and how to prove its zeroth order approximation, namely at the level of Chen-Ruan orbifold cohomology rings. This proof (joint work with Xiang Tang) uses some sophisticated tools such as deformation quantizations.

Jean-Yves WELSCHINGER
Institut Camille Jordan, Lyon

Title: Do uniruled six-manifolds contain Sol Lagrangian submanifolds?

Abstract: I will use some Gromov–Witten theory combined with symplectic field theory to confirm an expectation of J. Kollár: real Del Pezzo fibrations do not contain any Sol connected component. This is a joint work with Frédéric Mangolte.

Dimitri ZVONKINE
Stanford and IMJ, Paris

Title: Hurwitz numbers and completed cycles

Abstract: Hurwitz numbers count ramified coverings of the sphere with given ramification types over the branch points. Completed cycles are certain linear combinations of ramification types arising naturally in representation theory. We show that Hurwitz numbers with completed cycles inherit many properties of the Hurwitz numbers with simple branch points. We also discuss the relation between completed cycles and algebraic geometry.