THE FIELDS INSTITUTE
FOR RESEARCH IN MATHEMATICAL SCIENCES

ABSTRACTS 1.2

MINA AGANAGIC
UC Berkeley

Black holes, quantum Yang-Mills theory and non-perturbative topological strings

JIM BRYAN
UBC

The local Gromov-Witten theory of curves

I will describe the recent solution (Bryan-Pandharipande) to the local theory of curves. That is, the equivariant Gromov-Witten theory whose target is the total space of a rank two bundle over a curve. This theory turns out to have surprising connections with many other theories from both mathematics and physics. In physics, Aganagic, Ooguri, Saulina, and Vafa have found relations between the local theory of curves and (1) q-deformed 2D Yang-Mills theory, (2) Black hole entropy and (3) Chern-Simons theory of circle bundles over a curve. In mathematics, the local theory of curves is equivalent to (1) the equivariant quantum cohomology of the Hilbert scheme of points in the plane (Okounkov-Pandharipande), (2) the equivariant orbifold quantum cohomology of the symmetric product of points in the plane (Bryan-Graber), and conjecturally (3) the equivariant Donaldson-Thomas theory of rank two bundles over a curve. I will describe and explain some of these connections.

CHEOL-HYUN CHO
Northwestern University

A-infinity structure of open-closed map in A-model

We will explain how open-closed map interwines homotopy infinity structures of quantum cohomology (closed case) and Fukaya category (open case) of a symplectic manifold.

KEVIN COSTELLO
Imperial College London

Topological conformal field theories and Calabi-Yau categories

I'll describe the various flavours of topological conformal field theory: open, closed, and open-closed. The category of open TCFTs is equivalent to that of Calabi-Yau A-infinity categories. For each open TCFT there is an associated universal closed TCFT, whose homology is the Hochschild homology of the A-infinity category. This allows us to construct the TCFT part of the higher genus B model, and to construct the TCFT part of the Gromov-Witten invariants from the Fukaya category (assuming some conjectures in symplectic topology).

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DUILIU EMANUEL DIACONESCU
Rutgers University

Geometric Transitions and Integrable Systems

ROBBERT DIJKGRAAF
Institute for Theoretical Physics, Amsterdam

Topological M-theory, Part II

ALEXANDER GIVENTAL
University of California at Berkeley

Talk 1: Quantum Riemann-Roch for orbifolds and Bernoulli polynomials (after Hsian-Hua Tseng)

ALEXANDER GIVENTAL
University of California at Berkeley

Talk 2: Hirzebruch-Riemann-Roch in Quantum cobordism theory

ELENY-NICOLETA IONEL
Stanford University

Embedded curves and the Gromow-Witten invariants of 3-folds

BUMSIG KIM
KIAS

On connectedness of the space of maps

YON SEO KIM
UCLA

Computing Hodge integrals with one lambda class

Any Hodge integral involving at-most one lambda class is expressed as a polynomial in terms of lower dimensional Hodge integrals with at-most one lambda class. This follows from more general recursion relations between Hodge integrals with one lambda class. The proof is based on virtual localization formula applied to the moduli space of relative stable morphisms with marked points. This gives an algorithm to compute all Hodge integrals with up-to one lambda class of given dimension in terms of lower dimensional ones.

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ABSTRACTS 1.2

ALBRECHT KLEMM
University of Wisconsin, Madison

Open/closed string duality for topological gravity with matter

We calculate the non-perturbative FZZT amplitude for topological gravity coupled to $(p, 1)$ matter in a double scaling limit of the the two matrix model. The generalized Kontsevitch arises in this limit and the system exhibits a very explicite realisation of a open/closed transition. Similar as in the $(2, 1)$ model unphysical branches of the moduli space disappear by Stokes phenomenon.

YUAN-PIN LEE
University of Utah

Invariance of tautological equations

I will explain a technique in Gromov–Witten theory, "invariance of tautological equations", jointly developed with Givental. Several applications and related conjectures will also be described.

JUN LI
Stanford University

Relative stable maps and topological vertex

ANDREI LOSEV
ITEP, Moskow

Homological algebra, BV formalizm and (topological) string theory

It is shown that homotopical algebra structures can be considered as a classical limits of BV master equations. This leads to the notion of quantum homotopical structures. It is shown that BV integral leads to induced quantum homotopical structures and classical limit of this construction are Kadeishvili-type theorems. WDVV equations are considered as a homotopical algebraic structures, and Kodaira-Spenser theory is treated as a version of BV integral. In this way we recover Barannikov-Kontsevich construction of solution to WDVV and generalize it to 1-loop construction obtaining solutions to Getzler equations.

YONG-GEUN OH
University of Wisconsin-Madison

Compactification of the moduli space of holomorphic maps with prescribed singularities

In this talk, I will explain a new compactification of the moduli space of (pseudo)-holomorphic maps from a compact Riemann surface with prescribed singularity types. Main emphasis of the talk will lie on a key component of the compactification; a compactificaiton of the moduli space of rational maps in the projective space relative to the hyperplane at infinity and modulo homothety and translations. This is a joint work with Kenji Fukaya.

ANDREI OKOUNKOV
Princeton

Talk 1: Overview of Gromov-Witten/ Donaldson-Thomas correspondence

ANDREI OKOUNKOV
Princeton

Talk 2: Quantum cohomology of the Hilbert scheme

TAKUYA OKUDA
California Institute of Technology

Calabi-Yau Crystals from Chern-Simons Gauge Theory

We propose new crystal melting models whose statistical partition functions are A-model amplitudes of the resolved conifold, with or without D-branes. The crystal is bounded by two walls whose distance corresponds to the Kahler modulus of the geometry. These statistical models are derived, via geometric transition, from Chern-Simons theory on the three-sphere in a novel matrix model formulation.

HIROSI OOGURI
California Institute of Technology

Black holes and topological string theory

PAN PENG
UCLA

Integrality of the Gopakumar-Vafa invariants on toric Calabi-Yau

I will give a proof of the Gopakumar-Vafa conjecture for general toric Calabi-Yau three-folds. I will also show that Gopakumar-Vafa invariants vanish at large genera with the fixed curve class.

NICOLAI RESHETIKHIN
UC Berkeley

Limit shapes of fluctuating surfaces

LEV ROZANSKY
University of North Carolina at Chapel Hill

Topological theories on a 2d world-sheet foam

This is a joint work with M. Khovanov. We construct toy models for 2d TQFTs, in which the 'strings'are graph-like generalizations of an open string. The egdes of a graph are ordinary open strings living in different 'universes'. The ends of the edges are held together at the vertices of the graph by non-factorizable boundary conditions. We present simple examples of such theories: an A-model with Grassmannian target spaces and a Landau-Ginzburg B-model based on rather simple potentials W. The Hilbert spaces and correlators of the latter model have a complete combinatorial description, and they play an important role in the categorification of the SU(N) HOMFLY polynomial.

RICHARD THOMAS
Imperial College

Constant scalar curvature Kähler metrics and stability of algebraic varieties

I'll review the correspondence between stable holomorphic bundles and Hermitian-Yang-Mills connections, and explain the related conjectures of Yau, Tian, Fujiki Donaldson on stable algebraic varieties and constant scalar curvature Kähler metrics (eg Kähler-Einstein metrics). Finally I'll discuss joint work with Julius Ross attempting to give an intrinsic geometric criterion for stability reminiscent of the slope criterion for stable bundles.

CUMRUN VAFA
Harvard University

Topological M-theory, Part I