Workshop on Moduli Spaces in Algebraic Geometry and Mathematical Physics

September 14 - 18, 2015

Chern Institute of Mathematics
Nankai University, Tianjin, China

Scientific Committee

Chengming Bai (Nankai University, Tianjin, China)

Ugo Bruzzo (SISSA, Trieste, Italy)

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Chern Institute of Mathematics, Nankai University, China

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Foundation Compositio Mathematica

SISSA, Trieste, Italy

PRIN "Geometry of Algebraic Varieties"

Program At A Glance

<table>
<tr><th></th><th>September 13</th><th>September 14</th><th>September 15</th><th>September 16</th><th>September 17</th><th>September 18</th><th>September 19</th></tr>
<tr><td>Chair</td><td rowspan="15">Registration</td><td>Bruzzo</td><td>Kim</td><td>Perroni</td><td>Kashani-Poor</td><td>Markushevich</td><td rowspan="15">Departure</td></tr>
<tr><td>9:00 – 9:30</td><td>Opening</td><td rowspan="2">Rubtsov</td><td rowspan="2">Kim</td><td rowspan="2">Nakajima</td><td rowspan="2">Kashani-Poor</td></tr>
<tr><td>9:30 – 10:00</td><td rowspan="2">Klemm</td></tr>
<tr><td>10:00 – 10:30</td><td colspan="4">Coffee Break</td></tr>
<tr><td>10:30 – 11:00</td><td>Coffee Break</td><td>Zhou</td><td>Solis</td><td>Boralevi</td><td>Sun</td></tr>
<tr><td>11:00 – 11:30</td><td>Ross</td><td rowspan="2">Negut</td><td rowspan="2">Carlet</td><td rowspan="2">Carlsson</td><td rowspan="2">Yang</td></tr>
<tr><td>11:30 – 12:00</td><td>Su</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>12:00 – 14:30</td><td>Lunch</td><td>Lunch</td><td>Lunch</td><td>Lunch</td><td>Lunch</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Chair</td><td>Klemm</td><td>Ruan</td><td rowspan="6">Free Afternoon</td><td>Nakajima</td><td>Rubtsov</td></tr>
<tr><td>14:30 – 15:00</td><td rowspan="2">Brini</td><td>Barik</td><td>Young</td><td>Mahmood</td></tr>
<tr><td>15:00 – 15:30</td><td>van Garrel</td><td>Lanza</td><td>Chowdhury</td></tr>
<tr><td>15:30 – 16:00</td><td colspan="2">Coffee Break</td><td colspan="2">Coffee Break</td></tr>
<tr><td>16:00 – 16:30</td><td rowspan="2">Davison</td><td rowspan="2">Cavalieri</td><td rowspan="2">Rossi</td><td rowspan="2">Markushevich</td></tr>
<tr><td>16:30 – 17:00</td></tr>
<tr><td>17:00 – 17:30</td><td></td><td></td><td></td><td>Young Scientist Award Ceremony</td></tr>
</table>

Program

September 13, Sunday

10:00-20:00 Registration at Mingzhu Yuan Hotel, Nankai University

September 14, Monday

Lecture Hall 216, Shiing-Shen Building
Chair: Ugo Bruzzo (SISSA, Trieste, Italy)
9:00 – 9:30 Opening Speech and Photo
9:30 – 10:30 Albrecht Klemm (Universitaet Bonn, Germany).
Elliptically fibered Calabi-Yau manifolds and the ring of weak Jacobi forms
10:30 – 11:00 Coffee Break
11:00 – 11:30 Dustin Ross (University of Michigan, USA).
Donaldson-Thomas Theory and Crepant Resolutions
11:00 – 12:00 Changjian Su (Columbia University, USA).
Quantum cohomology of cotangent bundles of homogeneous spaces

12:00 Lunch

Chair: Albrecht Klemm (Universitaet Bonn, Germany).
14:30 – 15:30 Andrea Brini (CNRS and University of Montpellier, France).
Quantum topology and curve counting invariants
15:30 – 16:00 Coffee Break
16:00 – 17:00 Ben Davison (EPFL, Switzerland).
Cohomological Hall algebras and generalized Yangians

September 15, Tuesday

Lecture Hall 216, Shiing-Shen Building
Chair: Bumsig Kim (KIAS, Korea)
9:00 – 10:00 Vladimir Rubtsov (Angers University, France).
Painlevé transcendents, character varieties and Calabi-Yau algebras
10:00 – 10:30 Coffee Break

10:30 – 11:00 Zijun Zhou (Columbia University, USA).
Relative orbifold Donaldson-Thomas theory and the degeneration formula
11:00 – 12:00 Andrei Negut (MIT, USA).
Laumon spaces and Nekrasov partition functions

12:00 Lunch

Chair: Yongbin Ruan (University of Michigan, USA).
14:30 – 15:00 Pabitra Barik (IITM, Chennai, India).
Hitchin pairs on a singular curve
15:00 – 15:30 Michel van Garrel (KIAS, Korea).
Relative BPS state counts for del Pezzo surfaces
15:30 – 16:00 Coffee Break
16:00 – 17:00 Renzo Cavalieri (Colorado State University, USA).
Open invariants and crepant transformations

September 16, Wednesday

Lecture Hall 216, Shiing-Shen Building
Chair: Fabio Perroni (University of Trieste, Italy).
9:00 – 10:00 Bumsig Kim (KIAS, Korea).
Mirror theorem for elliptic quasimap invariants
10:00 – 10:30 Coffee Break
10:30 – 11:00 Pablo Solis (California Institute of Technology, USA).
Compactification of Reductive Groups and Moduli Spaces
11:00 – 12:00 Guido Carlet (Amsterdam University, Netherlands).
Bihamiltonian cohomology and deformations of Poisson pencils

12:00 Lunch

Free Afternoon

September 17, Thursday

Lecture Hall 216, Shiing-Shen Building
Chair: Amir-Kian Kashani-Poor (Ecole Normale Supérieure, France).
9:00 – 10:00 Hiraku Nakajima (RIMS, Kyoto University, Japan).
Coulomb branches and refined DT invariants
10:00 – 10:30 Coffee Break
10:30 – 11:00 Ada Boralevi (Technische Universiteit Eindhoven, Netherlands).

Orthogonal instantons and skew-Hamiltonian matrices
11:00 – 12:00 Erik Carlsson (Harvard University, USA).
A proof of the shuffle conjecture

12:00 Lunch

Chair: Hiraku Nakajima (RIMS, Kyoto University, Japan).
14:30 – 15:00 Matthew Young (The University of Hong Kong, China).
Cohomological Hall modules and Donaldson-Thomas theory with classical structure groups
15:00 – 15:30 Valeriano Lanza (IMECC, Campinas, Brazil).
Hilbert schemes of points of the total space of O(-n) as quiver varieties
15:30 – 16:00 Coffee Break
16:00 – 17:00 Paolo Rossi (University of Burgundy, France).
Double ramification cycle and integrability

September 18, Friday

Lecture Hall 216, Shiing-Shen Building
Chair: Dimitri Markushevich (University of Lille 1, France).
9:00 – 10:00 Amir-Kian Kashani-Poor (Ecole Normale Supérieure, France).
Pure N=2 Super Yang-Mills and Exact WKB
10:00 – 10:30 Coffee Break
10:30 – 11:00 Chuang Sun (University of Oxford, UK).
Symmetries of CY hyper-surfaces in toric varieties
11:00 – 12:00 Di Yang (SISSA, Trieste, Italy).
N-point functions of the KdV hierarchy and higher Weil-Petersson volumes

12:00 Lunch

Chair: Vladimir Rubtsov (Angers University, France).
14:30 – 15:00 Iirfan Mahmood (University of the Punjab, Pakistan).
Some integrable aspects of NC Painlevé second equation
15:00 – 15:30 Syed Chowdhury (Nankai University, China).
On exotic gauge invariant observables and the Goldman bracket between them for G_2 gauge group
15:30 – 16:00 Coffee Break
16:00 – 17:00 Dimitri Markushevich (University of Lille 1, France).
On components of moduli space of sheaves on $\boldsymbol{P}^3$ whose generic points represent non-locally-free sheaves
17:00 – 17:30 Young Scientist Award Ceremony

September 19, Saturday

Departure Day

Thank you very much and welcome to visit the Chern Institute of Mathematics again!

TITLES AND ABSTRACTS

Pabitra Barik (IITM, Chennai, India).

Title: Hitchin pairs on a singular curve.

Abstract: In this talk,we present the moduli problem of rank 2 torsion free Hitchin pairs of fixed Euler characteristic χ on a reducible nodal curve. We describe the moduli space of the Hitchin pairs. We define the analogue of the classical Hitchin map and describe the geometry of general Hitchin fibre.

Andrea Brini (CNRS and University of Montpellier, France).

Title: Quantum topology and curve counting invariants.

Abstract: In a series of papers, Gopakumar, Ooguri and Vafa proposed the existence of a duality between two quantum mechanical models: a topological gauge theory - $SU(N)$ Chern-Simons theory on the three-sphere - on one hand, and a topological string theory - the topological A-model on the so-called "resolved conifold" - on the other. From a physical point of view, the duality provides a concrete instance of the gauge/string correspondence, and one where exact computations can be performed in detail. Mathematically, this connection puts forward a triangle of striking, conjectural relations between quantum invariants (Reshetikhin-Turaev-Witten) of knots and 3-manifolds, curve-counting invariants (Gromov-Witten/Donaldson-Thomas) of some local Calabi-Yau 3-folds, and the Eynard-Orantin topological recursion for a specific class of spectral curves. In this talk I will present a proof of a B-model version of the correspondence for spherical 3-manifolds, and outline its implications. This is joint work with Gaetan Borot (MPIM Bonn).

Ada Boralevi (Technische Universiteit Eindhoven, Netherlands).

Title: Orthogonal instantons and skew-Hamiltonian matrices.

Abstract: Let $\mathcal{M}(r,n)$ be the moduli space of stable vector bundles on $\mathbb{P}^2$ of rank $r \geq 2$ and Chern classes $(\mathrm{c}_1, \mathrm{c}_2) = (0,n)$. An element E of $\mathcal{M}(r,n)$ is called orthogonal (symplectic) if it is isomorphic to its dual via a symmetric (skew-symmetric) map. In 1980 Hulek proved that the space $\mathcal{M}(r,n)$ is smooth irreducible; using similar techniques, in 2007 Ottaviani showed that the same holds true for the moduli space of symplectic elements of $\mathcal{M}(r,n)$. In my talk I will explain an irreducibility result for orthogonal bundles on $\mathbb{P}^2$, obtained in joint work with R. Abuaf (Imperial College). Among the techniques that we used are some interesting properties of skew-Hamiltonian matrices and the study of special hyperplane sections of determinantal varieties. I will also illustrate possible generalizations of our work.

Guido Carlet (Amsterdam University, Netherlands).

Title: Bihamiltonian cohomology and deformations of Poisson pencils.

Abstract: The relation between intersection theory over the moduli space of pointed curves (and more generally of maps to a target space) and integrable hierarchies has been the subject of intense investigation. In a large number of cases, where the genus zero theory is described by a conformal Frobenius manifold, the associated hierarchy is endowed with two compatible Poisson structures, i.e., it is bihamiltonian. I will review the problem of existence and classification of equivalence classes of such structures under a natural group of extended diffeomorphisms. More specifically, I will report on our recents results, in collaboration with H. Posthuma and S. Shadrin, on the use of spectral sequence methods in the computation of the bihamiltonian cohomology groups that describe deformations and obstructions of Poisson pencils of Dubrovin-Novikov type.

Erik Carlsson (Harvard University, USA).

Title: A proof of the shuffle conjecture.

Abtract: I will present a proof of the well-known "shuffle conjecture," of Haglund, Haiman, Loehr, Remmel, and Ulyanov, which predicts a combinatorial formula for the Frobenius character of the ring of diagonal coinvariants, that was recently discovered by Anton Mellit and myself at the ICTP. This conjecture and its generalizations have found connections to knot invariants, DAHAs, and the cohomology of affine Springer fibers, by several authors. I will explain some new algebraic structures that arise in the proof which have a similar appearance to the algebras that have been previously applied to this topic, but which act on a larger vector space. If there is time, I will then explain potential applications to some remarkable conjectures of Rodriguez-Villegas, Hausel, and Letellier.

Renzo Cavalieri (Colorado State University, USA).

Title: Open invariants and Crepant Transformations.

Abstract: The question that the Crepant Resolution Conjecture (CRC) wants to address is: given an orbifold X that admits a crepant resolution Y, can we systematically compare the Gromov-Witten theories of the two spaces? That this should happen was first observed by physicists and the question was imported into mathematics by Y. Ruan, who posited it as the search for an isomorphism in the quantum cohomologies of the two spaces. In the last fifteen years this question has evolved and found different formulations which various degree of generality and validity. Perhaps the most powerful approach to the CRC is through Givental's formalism. In this case, Coates, Corti, Iritani and Tseng propose that the CRC should consist of the natural comparison of geometric objects constructed from the GW potential fo the space. We explore this approach in the setting of open GW invariants. We formulate an open version of the CRC using this formalism, and make some verifications. Our approach is well tuned with Iritani's approach to the CRC via integral structures, and it seems to suggest that open invariants should play a prominent role in mirror symmetry.

Syed Chowdhury (Nankai University, China).

Title: On exotic gauge invariant observables and the Goldman bracket between them for G_2 gauge group.

Abstract: We model space-time with noncompact 3 manifold $\Sigma \times \mathbb{R}$ with space being a compact Riemann surface Σ and time taking values in $\mathbb{R}$. For a given gauge group G, the space of connection 1-forms form an infinite dimensional phase space endowed with a symplectic structure given by Atiyah-Bott brackets. Writing the Chern-Simons action functional, one immediately see that the underlying connections are indeed flat. The moduli space of these flat connections (under conjugation by g) is finite dimensional and traces of monodromy around closed loops on Σ, a. k. a., Wilson loops in the Physical literature, are considered natural candidates of gauge invariant observables. For classical gauge groups, e.g. $\mathrm{GL}(n,\mathbb{R})$, $\mathrm{GL}(n,\mathbb{C})$, $\mathrm{GL}(n,\mathbb{H})$, $\mathrm{SL}(n,\mathbb{R})$, $\mathrm{SL}(n,\mathbb{C})$, $\mathrm{SL}(n,\mathbb{H})$, $\mathrm{O}(p,q)$, $\mathrm{O}(n,\mathbb{C})$, $\mathrm{Sp}(2n,\mathbb{H})$, $\mathrm{U}(p,q)$, $\mathrm{Sp}(2n,\mathbb{R})$, $\mathrm{Sp}(p,q)$, $\mathrm{Sp}(2n,\mathbb{C})$ and $\mathrm{SU}(p,q)$, Goldman computed the Poisson brackets between traces of monodromy matrices computed along transversally intersecting loops on Σ and thus found a remarkable Lie algebra structure of the underlying gauge invariant observables. The analogous computation for the exceptional gauge groups G_2, F_4, E_6, E_7 and E_8 remains open. In an earlier paper [arXiv:1310.4519], we made an attempt to exploit Hamiltonian formulation of Soliton theory to give a general formula of the Poisson bracket between traces of monodromy matrices. Based on this formula, an exotic gauge invariant observable was obtained for G_2 gauge group. In this talk, I will show that an infinite set of these exotic gauge invariant observables can be obtained using the general formula derived in [arXiv:1310.4519] for G_2 gauge group.

Ben Davison (EPFL, Switzerland).

Title: Cohomological Hall algebras and generalized Yangians.

Abstract: I will report on recent progress in understanding the cohomological Hall algebra associated to an arbitrary quiver with potential, in joint work with Sven Meinhardt. It turns out that these algebras carry a perverse filtration, and after taking the associated graded they become universal enveloping algebras. This proves the refined integrality conjecture regarding these algebras (which I will explain), as well as providing a wealth of new (and some old) quantum groups.

Michel van Garrel (KIAS, Korea).

Title: Relative BPS state counts for del Pezzo surfaces.

Abstract: In the most general mirror construction up to date, Gross and Siebert construct mirrors to log Calabi-Yau pairs with maximal boundary. In dimension 2, we consider instead the related case of log Calabi-Yau surface pairs with smooth boundary. Associated to it are relative BPS state counts, its A-model invariants. We show how these are related via loop quiver DT invariants to the local BPS state counts (the A-model invariants of the corresponding local Calabi-Yau threefold). This is joint work with T. Wong and Gj. Zaimi.

Amir-Kian Kashani-Poor (Ecole Normale Supérieure, France).

Title: Pure $\mathcal{N} = 2$ Super Yang-Mills and Exact WKB

Abstract: The link between two dimensional conformal field theory and four dimensional supersymmetric gauge theory (the AGT correspondence) permits calculating the NS limit of the Nekrasov

partition function of pure $\mathcal{N} = 2$ super Yang-Mills theory via a WKB analysis of the Mathieu equation. In this talk, we will explore the non-perturbative information beyond the epsilon expansion of the partition function that can be extracted from this equation by using exact WKB methods.

Bumsig Kim (KIAS, Korea).

Title: Mirror Theorem for Elliptic Quasimap Invariants.

Abstract: We present a mirror theorem for the elliptic quasimap invariants for smooth Calabi-Yau complete intersections in projective spaces. The theorem combined with the wall-crossing formula appeared in paper (arXiv:1308.6377) implies mirror theorems of Zinger and Popa for the elliptic Gromov-Witten invariants for those varieties. This result and the wall-crossing formula provide a unified framework for the mirror theory of rational and elliptic Gromov-Witten invariants. This is a joint work with Hyeonho Lho.

Albrech Klemm (Universitaet Bonn, Germany).

Title: Elliptically fibered Calabi-Yau manifolds and the ring of weak Jacobi forms.

Abstract: We give evidence that the all genus amplitudes of topological string theory on compact elliptically fibered Calabi-Yau manifolds can be written in terms of meromorphic Jacobi forms whose weight grows linearly and whose index grows quadratically with the base degree. The denominators of these forms have a simple universal form with the property that the poles of the mero- morphic form lie only at torsion points. The modular parameter corresponds to the fibre class while the role of the string coupling is played by the elliptic parameter. This leads to very strong all genus results on these geometries, which are checked against results from curve counting.

Valeriano Lanza (IMECC, Campinas, Brazil).

Title: Hilbert schemes of points of the total space of $\mathcal{O}_{\mathbb{P}^1}(-n)$ as quiver varieties.

Abstract: In the paper "Monads for framed sheaves on Hirzebruch surfaces" (Adv. Geom. 15 (2015) 55-76), Bartocci, Bruzzo, and Rava provide a description of moduli spaces of framed sheaves on Hirzebruch surfaces in terms of monads. Specializing this description to the rank one case, we obtain ADHM data for Hilbert schemes of points of the total space of $\mathcal{O}_{\mathbb{P}^1}(-n)$. These linear data can be interpreted also within the theory of quiver representations, so that our Hilbert schemes turn out to be isomorphic to suitable moduli spaces of semistable representations of certain "framed" quivers.

Iirfan Mahmood (University of the Punjab, Pakistan).

Title: Some integrable aspects of NC Painlevé second equation.

Abstract: My recent work on NC Painlevé II equations involves the derivation its Darboux transformations (DT) and also for the non-commutative Toda solutions at $n = 1$ with the help of linear systems whose compatibility condition yields zero curvature representation of associated systems of non-linear differential equations. I also derive the quasideterminant solutions of the non-commutative Painlevé II equation by taking the Toda solutions at $n = 1$ as a seed solution in its Darboux transformations. Further by iteration, I generalize the Darboux transformations of the seed solutions to N-th form.

Dimitri Markushevich (University of Lille 1, France).

Title: On components of moduli space of sheaves on $\mathbb{P}^3$ whose generic points represent non-locally-free sheaves.

Abstract: This is a joint work with Marcos Jardim and Alexander Tikhomirov. We construct new components of the moduli space $\mathcal{M}(n)$ of rank two stable sheaves on $\mathbb{P}^3$ with Chern classes $(\mathrm{c}_1, \mathrm{c}_2, \mathrm{c}_3) = (0, n, 0)$, $n \geq 2$. The generic sheaves from these components are obtained by two types of elementary transformations from (semi)stable reflexive rank-2 sheaves with $\mathrm{c}_2 \leq n$ and $\mathrm{c}_3 \geq 0$, which provide a number of irreducible components growing to infinity as $n \to \infty$. For $n = 3$, our construction gives 5 such components, besides the two known ones which generically represent vector bundles. Conjecturally, these are all the 7 components of $\mathcal{M}(3)$.

Hiraku Nakajima (RIMS, Kyoto University, Japan).

Title: Coulomb branches and refined DT invariants.

Abstract: I will briefly explain my proposal of a mathematical definition of Coulomb branches of 3-dimensional gauge theories in arXiv:1503.03676. Then I explain how their Hilbert series are related to refined DT invariants of certain Calabi-Yau 3-folds, say the resolved conifold.

Andrei Negut (MIT, USA).

Title: Laumon spaces and Nekrasov partition functions.

Abstract: In geometric representation theory, a certain Nekrasov partition function was interpreted by Braverman as the generating function $\mathcal{Z}$ of integrals of the tangent bundle to affine Laumon spaces. We will present a framework that allows one to perform computations on such spaces (as well as other quiver varieties) with the goal of relating $\mathcal{Z}$ with $\widehat{\mathfrak{gl}}_n$ intertwiners.

Dustin Ross (University of Michigan, USA).

Title: Donaldson-Thomas Theory and Crepant Resolutions.

Abstract: For a fixed Calabi-Yau threefold X, Donaldson-Thomas (DT) theory, roughly, is the study of certain Euler characteristics of Hilbert schemes of curves in X. If X is an orbifold with crepant resolution Y, Bryan, Cadman, and Young conjectured that the DT theory of X and Y should be related in a simple way. We prove this conjecture in the toric setting. In this talk, I'll begin by describing the basic notions of DT theory and motivate them through the concrete example of toric varieties. I'll explain how these notions generalize to orbifolds and describe some of the techniques used in the proof of the correspondence.

Paolo Rossi (University of Burgundy, France).

Title: Double ramification cycle and integrability.

Abstract: In a series of papers with A. Buryak (and more recently with B. Dubrovin and J. Guéré) we studied the intersection theory of the double ramification cycle in the moduli space of curves. The double ramification cycle consists of those marked Riemann surfaces whose marked points support a principal divisor. The intersection numbers of such cycle with other natural tautological classes

and with a given cohomological field theory can be arranged into generating functions that are directly interpreted as Hamiltonians of a (quantum or classical) integrable hierarchy. A. Buryak further conjectured that the classical double ramification hierarchy is related to Dubrovin-Zhang's one by a natural change of coordinates. We were able to prove such conjecture in a number of cases, hence providing in particular previously unknown quantizations of the KdV, Toda, ILW, Gelfand-Dickey and other famous hierarchies.

Vladimir Rubtsov (Angers University, France).

Title: Painlevé transcendents, character varieties and Calabi-Yau algebras.

Abstract: We study the monodromy varieties of confluented Painlevé transcendants and propose an interpretation of it in terms of "decorated" character varieties. This interpretation leads to some flat coordinates on the monodromy varieties providing a "good" (PBW) quantization. The families of quantum quadratic -linear-constant algebras (for generic parameter values) belongs to the class of 3-Calabi-Yau algebras constructing by a superpotential. Generalized algebras of Sklyanin type and superpotentials from $\mathcal{N} = 4$ SUSY quantum field theory are among them.

Pablo Solis (California Institute of Technology, USA).

Title: Compactification of Reductive Groups and Moduli Spaces.

Abstract: Many important varieties in algebraic geometry come in some way from algebgraic groups. Examples include abelian varieties, toric varieties, flag varieties or more generally spherical varieties. An important example of the latter is the so called wonderful compactification of a semisimple adjoint group. In this talk I will discuss a compactification of a Kac-Moody group associated to a loop group that in many ways generalized the wonderful compactification of a semisimple group. Time permitting I'll discuss application to the moduli of principal bundles on a curve.

Changjian Su (Columbia University, USA).

Title: Quantum cohomology of cotangent bundles of homogeneous spaces.

Abstract: In this talk, I will first introduce stable basis for $T^*(G/P)$ defined by Maulik and Okounkov. Then we determine the quantum multiplication by divisors in terms of the stable basis. Using the restriction formula for the stable basis, we get quantum connection formula for $T^*(G/P)$, which is conjectured by Braverman.

Chuang Sun (University of Oxford, UK).

Title: Symmetries of CY hyper-surfaces in toric varieties.

Abstract: Freely-acting symmetries of Calabi-Yau (CY) manifolds play a crucial role in heterotic model building. For this reason, it would be interesting to classify freely-acting symmetries of CY three-folds. The largest known class of such manifolds are CY three-folds defined as hyper-surfaces in four-dimensional ambient toric varieties. To date, for the roughly half a billion such manifolds of the Kreuzer-Skarke(KS) list, only 16 are known to have freely-acting symmetries. These 16 cases, found by Batyrev and Kreuzer, are the ones whose quotients by the freely-acting symmetry also have a toric description, namely both the manifold itself and its quotient space reside in KS list, which might not

be true for a generic toric CY space. Therefore, our task is to clarify the method of computing freely acting symmetries for toric CY spaces, leading to a general classification. For now, this is practical for symmetries which act linearly on the coordinates of the ambient space. Hopefully this will be the starting point for string model buildings on toric CYs. The classification is a challenging enterprise which requires both serious theoretical preparation and a substantial computation effort. In this talk, I will be collecting some ideas in setting up the theoretical background for such a classification, and a few examples of non-trivial freely acting symmetries.

Di Yang (SISSA, Trieste, Italy).

Title: N-point functions of the KdV hierarchy and higher Weil–Petersson volumes.

Abstract: We derive closed formulae of N-point functions for an arbitrary tau function of the KdV hierarchy. By using this formulation and by applying the well-known results of Kaufmann–Manin–Zagier and Liu–Xu, we obtain explicit formulae of N-point functions of higher Weil–Petersson volumes in terms of Faber–Zagier series. The work is joint with Marco Bertola and Boris Dubrovin.

Matthew Young (The University of Hong Kong, China).

Title: Cohomological Hall modules and Donaldson-Thomas theory with classical structure groups.

Abstract: Given a complex reductive group G, there is expected to be a generalization of Donaldson-Thomas theory whose goal is to count, in an appropriate sense, stable principal G-bundles over a Calabi-Yau threefold. The standard Donaldson-Thomas theory arises when G is a general linear group. I will present some recent results on such a generalization when G is a classical group using the framework of quiver representations. The main new tool is a representation of Kontsevich and Soibelman's cohomological Hall algebra which is constructed from the cohomology of moduli stacks of quiver theoretic G-bundles. This representation is a model for the space of BPS states in an orientifolded string theory. Conjecturally, the desired G-Donaldson-Thomas invariants are encoded in degrees of the generators of this representation. I will describe a number of situations where this conjecture has been confirmed.

Zijun Zhou (Columbia University, USA).

Title: Relative Orbifold Donaldson-Thomas Theory and the Degeneration Formula.

Abstract: In this talk I will introduce the generalization of Donaldson-Thomas theory to 3-dimensional smooth DM stacks. We adopt Jun Li's construction of expanded pairs and degenerations and prove an orbifold DT degeneration formula. I'll also talk about the application in the case of local gerby curves, and its relationship to the work of Okounkov-Pandharipande and Maulik-Oblomkov.