Moduli Space, Conformal Field Theory and Matrix Models (MCM2015)

Venue: OIST, C209, C210

March 16 (Mon)

9:10 (from Rizzan hotel to OIST, 2 taxi)

9:40 Opening （C209)

10:00 -11:00 Tadokoro (Kisarazu)

11:10- 12:10 Obitsu (Kagoshima Univ.)

12:15- 13:30 Lunch

13:30- 14:30 Kawazumi (Univ. Tokyo)

15:00- 16:00 Tsuji (Univ. Tokyo)

16:30- 17:30 Sakasai(Univ. Tokyo)

18:00- 19:30 Dinner （Restaurant in OIST)

20:00 - （taxi to Rizzan hotel)

March 17 (Tue)

9:30 (from Rizzan hotel to OIST, 2 taxi)

10:00- 11:00 Tessler (Hebrew Uni.) I （C210)

11:10- 12:10 II （C210)

12:15- 13:30 Lunch

13:30- 14:30 Alexandrov (ITEP) I

14:40- 15:40 II

16:00- 17:00 Xu (Pittsburgh) I

17:10- 18:10 II

18:30- 20:00 Dinner (Banquet at restaurant in OIST)

20:00 – (taxi to Rizzan hotel)

March 18 (Wed)

9:30 (from Rizzan hotel to OIST, 2 taxi)

10:00- 11:00 Eguchi (Rikkyo Univ.)

11:10- 12:10 Oda (Univ. Tokyo)

12:15- 13:30 Lunch

13:30- 14:30 Itoyama (Osaka City Univ.)

14:40- 15:40 Hikami (OIST)

16:00 (1 taxi to Rizzan hotel)

18:00- Dinner (Restaurant in Rizzan Hotel)

Titles and abstracts of talks:

Yuuki Tadokoro, (Kisarazu)

Title: The period matrix of the hyperelliptic curve w^2=z^{2g+1}-1

Abstract: The period matrix of a compact Riemann surface is a well known complex analytic invarant. For generic genus, few explicit examples of period matrices are known. Our talk consists of two parts. First, we explicitly obtain the period matrix of the hyperelliptic curve defined by the affine equation w^2=z^{2g+1}-1, its entries being elements of the (2g +1)-st cyclotomic field. Second, we introduce an algorithm for obtaining the period matrix for a compact Riemann surface, which is a p-cyclic covering of CP^1 branched over 3 points.

Kunio Obitsu (Kagoshima Univ.)

Title: Several aspects of the Takhtajan-Zograf metric

 Abstracts: In the late 80's, Takhtajan and Zograf found a new metric on Teichmüller space of punctured Riemann surfaces, so called the Takhtajan-Zograf metric, when they tried to extend the index theorem for Teichmüller space of closed Riemann surfaces to the punctured case. We will review what a role the Takhtajan-Zograf metric plays in the geometry of moduli space of Riemann surfaces, and discuss some conjectural properties of the metric.

Nariya Kawazumi (University of Tokyo)

Title: A flat connection on the Teichmuller space and the Goldman-Turaev Lie bialgebra

Abstract: This talk is divided into 2 parts. In the first part we construct a canonical flat vector bundle on the Teichmuller space whose monodromy is the totality of the Johnson homomorphisms. From the flat connection one can derive a real valued modular function on the Teichmuller space called the Kawazumi-Zhang invariant. The construction gives a family of symplectic expansions of the fundamental group of a compact oriented surface with connected boundary, in the sense of G. Massuyeau. In the second part we show that any symplectic expansion gives a Lie algebra isomorphism of the completed Goldman

Lie algebra onto the symplectic derivation Lie algebra. If time permits, we discuss how a symplectic expansion describes the Turaev cobracket, which seems to suggest us some relation of symplectic expansions to the Kashiwara-Vergne problem.

Shunsuke Tsuji (University of Tokyo)
Title: The logarithms of Dehn twists on non-orientable surfaces
Abstract: We introduce a Lie algebra associated with a non-orientable surface, which is an analogue for the Goldman Lie algebra of an oriented surface. As an application, we deduce an explicit formula of the Dehn twist along an annulus simple closed curve on the surface as in Kawazumi-Kuno and Masseyeau-Turaev.

Takuya Sakasai (The University of Tokyo)
Title: Computations of integral Euler characteristics in graph homologies
Abstract: We make explicit computations in the formal symplectic geometry of Kontsevich and determine the integral Euler characteristics of the three types (commutative, Lie and associative) of graph homologies up to certain weights. We discuss their applications to the cohomology groups of moduli spaces of curves and metric graphs. This is joint work with Shigeyuki Morita and Masaaki Suzuki.

Masaaki Suzuki (Meiji Univ.)

Ran Tessler,
Title: Intersection theory on Moduli of open surfaces, KdV and Virasoro.
Abstract: In a recent paper with Rahul Pandharipande and Jake Solomon a theory of descendent integration on the moduli spaces of pointed disks is defined and fully calculated. It is conjectured that the theory can be extended for all genera, and that the open open partition function should be a tau function for an integrable hierarchy similar to KdV.

In my talk we shall describe that work. If time permits we shall also define the high genus theory (a joint work with Solomon) and shortly describe the proof of the conjecture (a joint work with Alexandr Buryak).

Alexander Alexandrov

Title:Enumerative geometry, matrix models and integrability

Abstract: My talk is directly related to the talks by Ran Tessler and Shinobu Hikami. In particular, in my talk I will focus on a family of matrix models, which describes the generating functions of intersection numbers on moduli spaces both for open and closed Riemann surfaces. Linear (Virasoro\W-constraints) and bilinear (KP\MKP integrable hierarchies) equations follow from the matrix model representation.

Hao Xu,

Title: r-spin numbers and Gelfand-Dikii hierarchy

Abstract: r-spin numbers are certain intersection numbers of tautological classes on moduli spaces of curves with r-spin structure. We derive structure theorems about r-spin numbers from properties of pseudo-differential operators and Witten's conjecture relating r-spin numbers to the Gelfand-Dikii hierarchy. In particular, it gives ways to compute them effectively. We will talk about the relation of our work (with K. Liu and R. Vakil) and the work of Brezin-Hikami on matrix integral approach to intersection numbers.

Tohru Eguchi, (Rikkyo University)

Title: Mathieu Moonshine and K3 Surface

Abstract: Four years ago, while studying the string theory compactified on K3 surface, we discovered a curious phenomenon; when the elliptic genus of K3 is expanded in terms of the characters of N=4 superconformal algebra (which is the symmetry of string theory compactified on K3) expansion coefficients are given by the sums of dimensions of irreducible representations of Mathieu group M24. This phenomenon is somewhat analogous to the famous monstrous moonshine and is now called as the Mathieu moonshine. Since then more examples of the type of Mathieu moonshine have been discovered. However, basic understanding of their origin and mechanism is still lacking. I

will report the present status of these moonshine phenomena.

Takayuki Oda (Univ. Tokyo)
Title: Cohomology groups of certain arithmetic quotients and their relations with spherical functions.
Abstract: The contents of the talk will consists of two themes: (1) To know the Fourier expansions of harmonic automorphic forms for some modular varieties associated to semisimple Lie groups of rank 2; (2) To know some modular embedding associated with affine symmetric pairs of   a semisimple Lie group G and its reductive subgroups H.

Hiroshi Itoyama (Osaka City University)
Title: q-Virasoro/W Block at Root of Unity, Parafermions and 2d-4d Connection
 Abstract: We propose and demonstrate a limiting procedure in which, starting from the q-lifted version of the (W)AGT conjecture, the Virasoro/W block is generated in the r-th root of unity limit in q in the 2d side, while the same limit automatically generates the projection of the five dimensional instanton partition function onto that on the ALE space R^4/Z_r. We demonstrate the appearance of parafermions and   the proper value of the central charge of the coset model $sl(n)_r \oplus sl(n)_{m-n}/ sl(n)_{m-n+r}$ is given from the parafermion construction of the block in the limit.

Shinobu Hikami (OIST graduate university)
Title: Random matrix and open/close intersection numbers
Abstract: Gaussian random matrix model with an external source is solvable and it provides interesting topological invariants. As applications, Kontsevich-Penner model, intersection numbers for moduli space of p-spin curves and CP1 model are discussed.