Indo-Japan Web-Workshop on Vector Bundles and Related Topics.

February 22 (Mon) - 24 (Wed), 2021

JST	16:15–16:30	16:30–17:30	17:40–18:40	18:50–19:50
INT	12:45–13:00	13:00–14:00	14:10–15:10	15:20–16:20
Feb. 22	Opening	Slot 1 T. Mochizuki	Slot 2 F. Loray	Slot 3 V. Pingali
JST	13:00–14:00	14:15–15:15	16:30–17:30	17:45–18:45
INT	9:30–10:30	10:45–11:45	13:00–14:00	14:15–15:15
Feb. 23	Slot 4 L.Jeffrey	Slot 5 K.-I. Yoshikawa	Slot 6 P. Pandit	Slot 7 R. Ohkawa
Feb. 24	Slot 8 A. Komyo	Slot 9 M.-a. Inaba	Slot 10 K. Hanumanthu	Slot 11 A. Takahashi

Feb. 22(Mon)

Slot 1 : 16:30 – 17:30 (JST)

Takuro Mochizuki (Kyoto University, RIMS)

Harmonic metrics of cyclic Higgs bundles over non-compact surfaces

Slot 2 : 9:40 – 10:40 (UTC+1)

Frank Loray (Rennes I)

Irregular parabolic bundles.

Slot 3 : 15:20–16:20 (INT)

Vamsi Pritham Pingali (Indian Institute of Science)

Numerical criteria for the solvability of generalised Monge-Ampere equations on projective manifolds.

Feb. 23(Tue)

Slot 4 : (Day-1) 23:00 – 24:00 (EST)

Lisa Jeffrey (Toronto University)

Flat connections and the commutator map

Slot 5 : 14:15 – 15:15 (JST)

Ken-Ichi Yoshikawa (Kyoto University)

Degeneration of Riemann surfaces and small eigenvalues of Laplacian

Slot 6 : 13:00 – 14:00 (INT)

Pranav Pandit (Tata, ICTS)

Balanced filtrations and gradient flows

Slot 7 : 17:45 – 18:45 (JST)

Ryo Ohkawa (Kobe University)

(-2) blow-up formula

Feb. 24(Wed)

Slot 8 : 13:00 – 14:00 (JST)

Arata Komyo (Kobe University)

Description of generalized isomonodromic deformations of rank two linear differential equations using apparent singularities

Slot 9 : 14:15 – 15:15 (JST)

Michi-aki Inaba (Kyoto University)

Moduli of ramified connections and generalized isomonodromic deformation

Slot 10 : 13:00 – 14:00 (INT)

Krishna Hanumanthu (Chennai Mathematical Institute)

Bounded negativity and Harbourne constants for algebraic surfaces.

Slot 11 : 17:45 – 18:45 (JST)

Atsuhi Takahashi (Osaka University)

Maximally-graded matrix factorizations and the Gamma integral structure for an invertible polynomial of chain type

Organizers

Indranil Biswas (Tata Institute of Fundamental Research)
Takuro Mochizuki (RIMS, Kyoto University)
A.J. Parameswaran (Tata Institute of Fundamental Research)
Masa-Hiko Saito (Kobe University)

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URL

http://www2.kobe-u.ac.jp/∼ mhsaito/events/indo_kobe2102/

Titles and Abstracts

Frank Loray (Rennes I)
Title: Irregular parabolic bundles.
Abstract: When studying irregular connections on curves and their moduli space, it is natural to introduce the concept of irregular parabolic structure. In a work in progress with A. Komyo and M.-H. Saito, we investigate the moduli spaces of irregular rank 2 parabolic bundles on P^1, and their relation with degenerate Garnier systems. We generalize some previous results previously obtained with M.-H. Saito in the logarithmic case, namely that the bundle map is Lagrangian and transversal to the apparent map. In the 5 pole case, confluence of poles correspond to degeneration of Del Pezzo surfaces of degree 4.

Michi-aki Inaba (Kyoto University)
Title: Moduli of ramified connections and generalized isomonodromic deformation
Abstract: I will talk about the generalized isomonodromic deformation on the moduli space of ramified connections on smooth projective curves. It is done by Bremer and Sage in the case of ramified connections on the trivial bundle on the projective line. In a general case, we will need a careful consideration of the formulation of the moduli space.

Lisa Jeffrey (Toronto University)
Title: Flat connections and the commutator map
Abstract: We study the topology of the $SU(2)$-representation variety of the compact oriented surface of genus 2 with one boundary component about which the holonomy is a generator of the center of $SU(2)$.
(Joint work with Nan-Kuo Ho, Paul Selick and Eugene Xia)
arXiv:2005.07390 Oxford Quarterly J. of Mathematics, to appear

Krishna Hanumanthu (Chennai Mathematical Institute)
Title: Bounded negativity and Harbourne constants for algebraic surfaces.
Abstract: Let X be a nonsingular projective surface. Bounded negativity conjecture predicts that there is an integer b(X), depending only on X, such that the self-intersection C^2 is at least b(X) for every integral curve C on X. While the statement is false in positive characteristic, it is open in characteristic zero, except in easy cases. Harbourne constants were defined in an attempt to tackle this problem. I will introduce these ideas in detail and then talk about some recent results with Aditya Subramaniam on bounding Harbourne constants on ruled surfaces.

Arata Komyo (Kobe University)
Title: Description of generalized isomonodromic deformations of rank two linear differential equations using apparent singularities
Abstract: In this talk, we consider the generalized isomonodromic defo rmations of rank two irregular connections on the Riemann sphere. We introdu ce Darboux coordinates on the parameter space of a family of rank two irregu lar connections by apparent singularities. By the Darboux coordinates, we de scribe the generalized isomonodromic deformations as Hamiltonian systems.

Takuro Mochizuki (RIMS, Kyoto University)
Title: Harmonic metrics of cyclic Higgs bundles over non-compact surfaces
Abstract: A cyclic Higgs bundle is attached to an r-differential on a Riemann surface. A harmonic metric of the cyclic Higgs bundle has been studied in relation with various interesting subjects such as Toda equations, minimal surfaces, integrable systems, etc. If the Riemann surface is compact, it is classically well known that such a harmonic metric is essentially unique in most cases.

Recently, we studied the non-compact case, and obtained the following two results: (i) the existence and the uniqueness of a "complete solution", (ii) the classification of the solutions under some mild assumptions on the isolated singularity of the r-differential. For example, let $P(z)$ be a non-zero polynomial, and we consider r-differentials $q_1 = P(z)\sin(z)(dz)^r$ and $q_2 = P(z)\exp(z)(dz)^r$ on the complex plane. Then, the cyclic Higgs bundle associated to q_1 has a unique solution, and the cyclic Higgs bundle associated to q_2 has a family of harmonic metrics parameterized by the growth orders.

This is a joint work with Qiongling Li.

Ryo Ohkawa (Kobe University)
Title: (-2) blow-up formula
Abstract: In this talk, we will introduce the Nekrasov partition function defined from the A_1 singularity. This is a generating function whose coefficient is the integral over the moduli of the framed coherent sheaves on resolutions of the singularity. We consider two resolutions, the minimal resolution and a stacky resolution, that is, a quotient stack of the projective plane by the cyclic group of order 2. We show functional equations between Nekrasov partition functions defined from these two resolutions. One is proposed by Ito-Maruyoshi-Okuda, and I want to propose the other as (-2) blow-up formula. I will omit the details of the proof, but explain wall-crossing formulas developed by Takuro Mochizuki using simple examples such as Grassmann manifolds.

Pranav Pandit (Tata, ICTS)
Title: Balanced filtrations and gradient flows
Abstract: I will introduce a refinement of the Harder-Narasimhan filtration, and discuss its relation to certain dynamical systems. This is based on joint work with F. Haiden, L. Katzarkov and M. Kontsevich.

Vamsi Pritham Pingali (Indian Institute of Science)
Title: Numerical criteria for the solvability of generalised Monge-Ampere equations on projective manifolds.
Abstract: Generalised Monge-Ampere equations are a family of PDE that contain inverse Hessian equations like the J-equation, and special cases of the deformed Hermitian-Yang-Mills equation. I shall describe a couple of results about them. Firstly, these equations can be solved on projective manifolds if and only if Nakai-Moizeshon / Demailly-Paun-style intersection numbers are positive. This result improves a recent theorem of Gao Chen (who assumed uniform strict-positivity), and settles a conjecture of Lejmi-Szkelyhidi in the projective case. Secondly, assuming uniform strict-positivity, an equivariant version of the same result holds. Thus, earlier results due to Collins-Szekelyhidi are recovered. This work is joint with Ved Datar.

Atsushi Takahashi (Osaka University)
Title: Maximally-graded matrix factorizations and the Gamma integral structure for an invertible polynomial of chain type
Abstract: An invertible polynomial of chain type is a weighted homogeneous polynomial having nice combinatorial properties. Motivated by the Orlik - Randell conjecture and the homological mirror symmetry conjecture, we construct a full exceptional collection in the category of maximally graded matrix factorizations. As an application, we show that the Gamma integral structure defined through the full exceptional collection is isomorphic to the natural one from the homology group of the Milnor fiber of its mirror dual (Berglund-Huebsch transpose). This talk is based on my joint work with Daisuke Aramaki and the one with Takumi Otani.

Ken-ichi Yoshikawa (Kyoto University)
Title: Degeneration of Riemann surfaces and small eigenvalues of Laplacian
Abstract: Let f : X âĂŞ> S be a one parameter family of compact Riemann surfaces over a curve. Assume that X is a compact Kaehler surface. Then the fibers of f are endowed with the metric induced from the Kaehler metric on X. If the singular fiber of f is not irreducible, then some eigenvalues of the Laplacian of the regular fiber converge to zero as the regular fiber approaches the singular fiber. We call such eigenvalues small eigenvalues. Here the Laplacian means the one acting on the functions of each regular fiber. In this talk, when the singular fiber is reduced, I explain the asymptotic behavior of the " product " of all small eigenvalues of Laplacian. This is a joint work with Xianzhe Dai.