CHARACTER VARIETIES AND TOPOLOGICAL QUANTUM FIELD THEORY

17–20 DECEMBER 2018, UNIVERSITY OF AUCKLAND

TITLES AND ABSTRACTS

Program

	Monday	Tuesday	Wednesday	Thursday
9:00-9:30	Registration			
9:30–10:30	**Norbury**	**Engel**	**Jones**	**Wilkin**
10:30–11:00	break	break	break	break
11:00–12:00	**Do**	**Deopurkar**	**Teleman**	**Mandini**
12:00–13:30	lunch	lunch	lunch	lunch
13:30–14:30	**Yang**	Free afternoon	**Sala**	**Han**
14:30-15:00	break		break	break
15:00–16:00	**Zhao**		**Thiel**	
19:00–			dinner	

Titles and Abstracts

Sjoerd Beentjes
University of Edinburgh

Title. *TBA*

Abstract. TBA

Anand Deopurkar
Australian National University

Title. *Geometry of Hurwitz spaces*

Abstract. The Hurwitz space of an algebraic curve is the moduli space of its finite coverings. The Hurwitz space of $\mathbb{P}^1$ is one of the oldest studied moduli spaces in algebraic geometry, and still a source of many outstanding conjectures. I will discuss some of these conjectures, recent progress on them, and a connection with the geometry of moduli spaces of vector bundles on curves.

Norman Do
Monash University

Title. *Hurwitz numbers and topological recursion*

Abstract. Hurwitz numbers enumerate branched covers of the Riemann sphere. Despite being studied as far back as the nineteenth century, the past twenty years have seen new discoveries relating Hurwitz numbers to algebraic geometry and mathematical physics. For example, the ELSV formula expresses them as intersection numbers on moduli spaces of curves. On the other hand, the viewpoint of topological string theory and mirror symmetry led to the observation that Hurwitz numbers are governed by the so-called topological recursion. In this talk, we will tell some of the aforementioned story and report on recent progress towards generalising it to the case of double Hurwitz numbers.

Philip Engel
University of Georgia

Title. *Tilings of Riemann Surfaces*

Abstract. A *k-differential* on a Riemann surface is a nonzero section of the k^{th} tensor power of the canonical bundle. When $k = 3, 4$, or 6 the moduli space of k-differentials contains a natural discrete subset: Surfaces tiled by hexagons, squares, or triangles respectively. Following Eskin and Okounkov, it is possible enumerate these tiled surfaces using Hurwitz theory and Fock space, and in turn compute the volume of the moduli space. If time permits, I will describe recent work joint with P. Smillie on the $k = 5$ case and the enumeration of Penrose tilings.

Fei Han
National University of Singapore

Title. *Modular invariants for proper actions*

Abstract. Witten genus and elliptic genera are modular topological invariants for manifolds, which are closely related to representation of loop groups and the hypothetical index theory on free loop space as well as the elliptic cohomology theory in algebraic topology. They find applications in problems of positive curvature and continuous group action on manifolds. In this talk, we will briefly introduce these invariants and present our joint work with Varghese Mathai on generalizing them to open manifolds with proper actions of open groups.

Vaughan Jones
Vanderbilt University

Title. *Factors and subfactors in one dimensional quantum physics*

Abstract. Factors and subfactors arise as algebras of observables in quantum spin chains and conformal field theory. The subfactors in the two cases appear to be the same up to a type III factor. Whether the CFT subfactors can be obtained as limits of the quantum spin chain ones is a brutal open question. As is the question of which subfactors arise in CFT.

Alessia Mandini
PUC, Rio de Janeiro

Title. *Hyperpolygons and parabolic Higgs bundles*

Abstract. Hyperpolygons spaces are a family of (finite dimensional, non-compact) hyperkaehler spaces, that can be obtained from coadjoint orbits by hyperkaehler reduction. Jointly with L. Godinho, we show that these space are diffeomorphic (in fact, symplectomorphic) to certain families of parabolic Higgs bundles. In this talk I will describe this relation and use it to analyse the fixed points locus of a natural involution on the moduli space of parabolic Higgs bundles. I will show that each connected components of the fixed point locus of this involution is identified with a moduli spaces of polygons in Minkowski 3-space.

This is based on joint works with Leonor Godinho and with Indranil Biswas, Carlos Florentino and Leonor Godinho.

Paul Norbury
University of Melbourne

Title. *Quantization and topological recursion*

Abstract. Beginning with the deformation space of a curve inside a Poisson surface, Kontsevich and Soibelman construct a quadratic lagrangian submanifold in an associated infinite dimensional affine symplectic space. The quadratic lagrangian submanifold is equivalent to a so-called Airy structure which gives the initial data for topological recursion. I will give

an introduction to these ideas.

Francesco Sala
IPMU, Tokyo

Title. *2d Cohomological Hall algebra of a curve*

Abstract. Given a curve X, one can associate with it the following abelian categories of homological dimension two: the category of Higgs sheaves on X, the category of vector bundles on X with flat connection, the category of finite-dimensional representations of the fundamental group of X. The corresponding moduli stacks of objects are stacks of coherent sheaves over different "forms" of the curve: the Dolbeaut, de Rham, and Betti form of X. In the present talk, I will introduce convolution algebras associated with such stacks and provide some characterization result and some conjectures relating them. This is based on a joint paper with Olivier Schiffmann and a work in progress with Mauro Porta.

Constantin Teleman
University of California, Berkeley

Title. *TBA*

Abstract. TBA

Ulrich Thiel
University of Sydney

Title. *Minimal models of symplectic quotient singularities*

Abstract. Namikawa associated to any conic symplectic singularity a hyperplane arrangement which is deeply intertwined with its geometry. For example, Bellamy proved that for a symplectic quotient singularity the cohomology of the complement of this arrangement encodes the number of minimal models of the singularity. For the symplectic singularity associated to a complex reflection group we were able to prove that the Namikawa arrangement coincides with the degenericity locus of the number of torus fixed points of the corresponding Calogero-Moser deformation.

This has a series of remarkable consequences, especially it proves a conjecture by Bonnaf and Rouquier. Using representation theory and sophisticated computer algebraic methods, we could compute this arrangement explicitly for several exceptional complex reflection groups. The arrangements seem to be of a new kind, and many more are out there. This is joint work with Gwyn Bellamy (Glasgow) and Travis Schedler (London), and with Cédric Bonnafé (Montpellier).

Graeme Wilkin
National University of Singapore

Title. *Representations of the Heisenberg algebra on a singular Morse complex*

Abstract. Many examples of moduli spaces (such as Higgs bundles and quiver varieties) arise as symplectic quotients of singular spaces. I will describe my previous work to develop a Morse theory in this setting, and how one can interpret the Hecke correspondence Morse-theoretically via spaces of flow lines. For single vertex quivers with complete relations, such as the ADHM quiver, I will show that the Morse function is perfect and that the associated Morse complex admits a representation of a finite-dimensional Heisenberg algebra. The relationship with Nakajima's work on Hilbert schemes of points on $\mathbb{C}^2$ is given by the Morse-theoretic interpretation of the Hecke correspondence.

Yaping Yang
University of Melbourne

Title. *Factorization structures and quantization*

Abstract. In my talk, I will talk about the factorization structures and give two examples. The first example comes from the Beilinson-Drinfeld Grassmannian, and the second is obtained from the cohomological Hall algebra. I will explain a relation of these two examples. As an application, we give a quantization of certain pieces of the Beilinson-Drinfeld Grassmannian. This is based on my joint work with Ivan Mirkovic and Gufang Zhao.

Gufang Zhao
University of Melbourne

Title. *Towards higher loop Grassmannians via fusion*

Abstract. I will talk about a version of factorization spaces over Hilbert scheme of points on a smooth algebraic variety M, as a refinement of Beilinson-Drinfeld factorization spaces. When M is an algebraic surface, an example of factorization space will be given, as a moduli space of torsion free sheaves on M. The factorization structure is constructed building up on the work of Haiman on Hilbert schemes, as well as the work of Feigin-Loktev and Chari-Pressley on local Weyl modules. Global sections of a tautological line bundle on this factorization space yield a local Weyl module of the toroidal algebra, whose characters are given by Macdonald polynomials. This is based on a work in progress, in collaboration with Ivan Mirkovic and Yaping Yang, aiming to construct higher loop Grassmannians.