String Math 2023

July 10-14
University of Melbourne
Peter Hall Building

http://stringmath2023.sciencesconf.org

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Contents

String Math 2023 Schedule (as of 10 July)

	10 Monday	11 Tuesday	12 Wednesday	13 Thursday	14 Friday	
9:00-9:15	Registration					
9:15-9:30	Opening					
9:30-10:15	M. Mariño	N. Paquette*		Q. Chen	10:00-10:45	H. Ooguri*
10:15-10:45	Coffee break			Coffee break	10:45-11:15	Coffee break
10:45-11:30	M. Varghese	J. Teschner		X. de la Ossa	11:15-12:00	F. Han
11:35-12:20	M. Kim*	J. Yagi		M. Cheng*	12:00-13:40	Lunch break
12:20-14:30	Lunch break			Lunch break	13:40-14:25	M. van Beest
14:30-15:15	M. Gaberdiel	C. Teleman		S. Gukov	14:30-15:15	A. Alexandrov
15:15-15:45	Coffee break			Coffee break	15:15-15:45	Coffee break
15:45-16:30	N. Sheridan	M. Kool		T. Grimm*	15:45-16:30	R. Donagi
		Public lecture S. Gukov (17:30-18:30) Reception (18:30-20:00)		Conference dinner University House (18:00-)		

Parallel sessions (9:30-13:00)

*=Zoom talk.

Place:

Mon, Tue, Thu, Fri afternoon: JH Michell Theatre.

Fri morning: Russell Love Theatre.

Wed (Parallel sessions): JH Michell Theatre and Russell Love Theatre.

Plenary Talks – Titles and Abstracts

Monday-Thursday and Friday afternoon, all plenary talks take place in the *JH Michell Theatre* of the Peter Hall building. On Friday morning, talks take place in the *Russell Love Theatre*.

- **Alexander Alexandrov** (IBS-CGP)
  Title: KP integrability of triple Hodge integrals
  Abstract: Enumerative geometry invariants have a strong connection to integrable systems. It is quite surprising how often the generating functions of these invariants turn out to be tau-functions of integrable hierarchies of KP type. In my talk, I will discuss how the generating function of triple Hodge integrals satisfying the Calabi-Yau condition can be identified as a tau-function of the KP hierarchy. This identification relies on the significant involvement of an infinite-dimensional group that acts on the solutions of the KP hierarchy. The corresponding cubic cut-and-join description serves as an illustrative example of the broader construction for semi-simple cohomological field theories.

- **Marieke van Beest** (SCGP)
  Title: Monopoles, Scattering, and Generalized Symmetries
  Abstract: In this talk, we will discuss the problem of electrically charged, massless fermions scattering off magnetic monopoles. The interpretation of the outgoing states has long been a puzzle, as they can carry fractional quantum numbers. We argue that such outgoing particles live in the twisted sector of a topological co-dimension 1 surface, which ends on the monopole. This surface is often non-invertible, and as such the outgoing radiation not only carries unconventional flavor quantum numbers, but is often trailed by a topological field theory, which is a new prediction.

- **Qile Chen** (Boston College)
  Title: Quantum Lefschetz via logarithmic Gauged Linear Sigma Models
  Abstract: I will report an on-going project with Felix Janda and Yongbin Ruan on studying logarithmic compactifications of Gauged Linear Sigma Models. These compactifications admit two different perfect obstruction theories, the canonical theory and the reduced theory. The reduced theory recovers the Gromov-Witten invariants of complete intersections on the virtual cycle level up to signs. A further localization calculation exhibits a class of invariants, called effective invariants, which serve as correction terms to high genus quantum Lefschetz in Gromov-Witten theory. As examples, we show that in many interesting cases of Calabi-Yau three-fold complete intersections, the number of effective invariants matches the number of free parameters from the BCOV B-model.

- **Miranda Cheng** (U. Amsterdam/Academia Sinica)
  Title: Fun with Groups and Numbers
  Abstract: What do congruent numbers (integral areas of right-angle triangles with

rational lengths) and sporadic groups have to do with each other? And how are class numbers related to modular curves? In this talk I will describe a programme to systematically analyse the relation between finite groups and (mock) modular forms, and explore the possible consequences in arithmetic geometry. This talk is based on joint work with John Duncan and Michael Mertens.

- **Xenia de la Ossa** (U. Oxford)
  Title: On the arithmetic of Calabi-Yau manifolds
  Abstract: In this seminar I will discuss what I know (and don't know) about the arithmetic of Calabi-Yau 3-folds. The main goal is to explore whether there are questions of common interest in this context to physicists, number theorists and geometers. The main quantities of interest in the arithmetic context are the numbers of points of the manifold considered as a variety over a finite field. We are interested in the computation of these numbers and their dependence on the moduli of the variety. The surprise for a physicist is that the numbers of points over a finite field are also given by expression that involve the periods of a manifold. The number of points are encoded in the local zeta function, about which much is known in virtue of the Weil conjectures. I will discuss interesting topics related to the zeta function and the appearance of modularity for one parameter families of Calabi-Yau manifolds. I will report (on joint work with Philip Candelas, Mohamed Elmi and Duco van Straten) on an example for which the quartic numerator of the zeta function factorises into two quadrics at special values of the parameter which satisfy an algebraic equation with coefficients in Q (so independent of any particular prime), and for which the underlying manifold is smooth. We note that these factorisations are due to a splitting of the Hodge structure and that these special values of the parameter are rank two attractor points in the sense of type IIB supergravity. Modular groups and modular forms arise in relation to these attractor points. To our knowledge, the rank two attractor points that were found by the application of these number theoretic techniques, provided the first explicit examples of such points for Calabi-Yau manifolds of full SU(3) holonomy. Time permitting I will discuss also the modularity of Calabi-Yau manifolds with are relevant for flux vacua of typeII string theory (joint work with Philip Candelas, Pyry Kuusela and Joseph McGovern).

- **Ron Donagi** (U. Pennsylvania)
  Title: Twistor Hecke eigensheaves
  Abstract: The Geometric Langlands Conjecture predicts the existence of sheaves on moduli stacks of bundles that transform as eigensheaves under the Hecke operators. I will review a general approach to constructing such eigensheaves using non-abelian Hodge theory, and will discuss recent results carrying this program out in some concrete cases and comparing it with other approaches in the math and physics literature. (Joint work with Tony Pantev and Carlos Simpson.)

- **Matthias Gaberdiel** (ETH Zürich)
  Title: An exact AdS/CFT duality

Abstract: I will review an exact AdS3/CFT2 duality, relating the tensionless string on $AdS3 \times S3 \times T4$ with minimal (k=1) NS-NS flux to the symmetric orbifold of T4. In particular, I will show how the complete single-particle spectrum of the spacetime theory as well as their correlation functions are correctly reproduced from the worldsheet perspective. I will also explain how the picture is modified once R-R flux is switched on.

- **Thomas Grimm** (U. Utrecht)
  Title: Tameness and Complexity in Quantum Field Theories
  Abstract: In this talk we introduce a generalized notion of finiteness and argue that it common to many quantum field theories. The underlying mathematical foundation lies in tame geometry, which is built from o-minimal structures introduced in mathematical logic. After a brief introduction to the subject, we will discuss the tameness of perturbative and non-perturbative results in quantum field theories. We show that perturbative amplitudes are tame functions at each loop-order, while exact non-perturbative results are tame depending on constraints on the UV definition of the theory. We quantify our expectations on the tameness of conformal field theories and effective theories that can be coupled to quantum gravity. Interestingly, we will see in various examples that the o-minimal structures in question are even further constrained and allow for a well-defined notion of complexity associated to sets and functions.

- **Sergei Gukov** (Caltech/Dublin IAS)
  Title: Going to the other side in algebra, topology, and physics

- **Fei Han** (National University of Singapore)
  Title: Graded T-duality with H-flux for 2d sigma models
  Abstract: T-duality in string theory can be realised as a transformation acting on the worldsheet fields in the two-dimensional nonlinear sigma model. Bouwknegt-Evslin-Mathai established the T-duality in a background flux for the first time upon compactifying spacetime in one direction to a principal circle by constructing the T-dual maps transforming the twisted cohomology of the dual spacetimes. In this talk, we will describe our recent work on how to promote the T-duality maps of Bouwknegt-Evslin-Mathai in two aspects. More precisely, we will introduce (1) graded T-duality, concerning the graded T-duality maps of all levels of twistings; (2) the 2-dimensional sigma model picture, concerning the double loop space of spacetimes. This represents our joint work with Mathai.

- **Minhyong Kim** (ICMS/KIAS)
  Title: Refining Weil's Trichotomy
  Abstract: The analogy between function fields and number fields is sometimes extended to a trichotomy that includes meromorphic functions on a compact Riemann surface. It is well-known that this trichotomy is not quite right. It is also well-known how to fix it. In this talk, I will give a discussion of this from the point of view of

dimensions, the analogy between primes and knots, and topological quantum field theory.

- **Martijn Kool** (U. Utrecht)
  Title: Sheaves on Calabi-Yau 4-folds and virtual invariants - a survey
  Abstract: Gromov-Witten and Donaldson-Thomas invariants on 3-folds play a crucial role in string theory and supersymmetric Yang-Mills theory. Recently Borisov-Joyce and Oh-Thomas defined virtual sheaf counting invariants for Calabi-Yau 4-folds X. These contain all previous invariants in lower dimensions, and more. Point counting on X recovers Nekrasov's Magnificent Four. Curve counting on X recovers the Gromov-Witten invariants of X (by work of Cao-Maulik-Toda). In a joint work with Bae-Park, we adapt the Oh-Thomas virtual class and make it suitable for counting complex surfaces on Calabi-Yau 4-folds. This involves connections with the variational Hodge conjecture.

- **Marcos Mariño** (U. Geneva)
  Title: Non-perturbative topological strings
  Abstract: Topological strings are well understood in perturbation theory, but their non-perturbative structure has been the subject of much work and speculation. A useful approach to this problem, which has been successfully used in quantum field theory, is to unveil the non-perturbative sectors of the theory by looking at the large order behavior of the perturbative series. This approach can be formulated in a mathematically rigorous way by using the theory of resurgence. In this talk I review the basic ideas behind this approach and I show that it can be successfully applied to topological string theory on arbitrary Calabi-Yau threefolds. The methods of the theory of resurgence lead, not only to explicit non-perturbative topological string amplitudes, but also to new invariants of Calabi-Yau threefolds which are conjecturally related to BPS invariants.

- **Hirosi Ooguri** (Caltech/Kavli IPMU)
  Title: Symmetry Resolution at High Energy
  Abstract: The density of states of a unitary quantum field theory is known to have a universal behavior at high energy. In two dimensions, this behavior is described by the Cardy formula. When the theory has symmetry, it is interesting to find out how the Hilbert space is decomposed into irreducible representation of the symmetry. In this talk, I will derive universal formulas for the decomposition of states at high energy with respect to both internal global symmetry and spacetime symmetry. The formulae are applicable to any unitary quantum field theory in any spacetime dimensions. As a byproduct, we resolve one of the outstanding questions on the stability of non-abelian black holes. We will also derive the high energy asymptotic behavior of correlation functions. (Based on work with Nathan Benjamin, Daniel Harlow, Monica Kang, Jaeha Lee, Sridip Pal, David Simmons-Duffin, Zhengdi Sun, and Zipei Zhang.)

- **Natalie Paquette** (U. Washington)
  Title: Burns space and holography
  Abstract: We describe a top-down holographic duality, engineered within topological string theory, wherein the semiclassical bulk spacetime is a 4d asymptotically flat, self-dual Kähler geometry known as Burns space. The bulk theory includes an open string sector comprising a 4d WZW model and a closed string sector called "Mabuchi gravity" capturing fluctuations of the Kähler potential. Starting with the type I topological B-model on the twistor space of flat space, we obtain the twistor space of Burns space from the backreaction of a stack of N coincident D1 branes, while the 2d chiral algebra dual is obtained from (a twist of) the brane worldvolume theory. We will discuss some features and consequences of this duality. This work is in collaboration with Kevin Costello and Atul Sharma.

- **Nick Sheridan** (U. Edinburgh)
  Title: Quantum cohomology as a deformation of symplectic cohomology
  Abstract: Let M be a compact symplectic manifold, and D a normal-crossings symplectic divisor in M. When M is a Fano variety and D is anticanonical, mirror symmetry suggests that the quantum cohomology of M should be a deformation of the symplectic cohomology of $M\backslash D$. We give a broader criterion under which this result holds, and show that the skeleton of $M\backslash D$ has strong symplectic rigidity properties (e.g., it intersects all Floer-theoretically non-trivial Lagrangians in X) in this context. As we will explain, the result cannot hold in general, but we will explain some results and conjectures about what happens when our criterion does not apply. Along the way we hope to give a brief introduction to Varolgunes' 'relative symplectic cohomology', which is the key technical tool used to prove our symplectic rigidity results, but which is of far broader significance in symplectic topology and mirror symmetry as it makes the computation of quantum cohomology 'local'. This is joint work with Strom Borman and Umut Varolgunes.

- **Constantin Teleman** (UC Berkeley)
  Title: 3D gauge theory and applications
  Abstract: The base example of 3-dimensional Mirror symmetry describes the topological sector of pure ($N = 4$) gauge theory in terms of the Toda space of the Langlands dual group. I will quickly indicate some applications of this picture, namely the construction of Coulomb branches and the (recently partially proven) Quantum GIT conjecture. The latter is joint work with Dan Pomerleano.

- **Jörg Teschner** (U. Hamburg)
  Title: Quantum analytic Langlands correspondence
  Abstract: The analytic Langlands correspondence can be regarded as a variant of the geometric Langlands correspondence imposing additional conditions of analytic nature. It predicts a correspondence between opers with real holonomy and eigenfunctions of the quantised Hitchin system. We will propose a one-parameter

deformation of this correspondence called quantum analytic Langlands correspondence. This deformation has natural relations to $N = 4$ supersymmetric Yang-Mills theory, the AGT-correspondence, complex Chern-Simons theory and conformal field theory. A key role is played by the Verlinde line operators. These operators represent a quantum deformation of the grafting operation creating eigenstates of the quantum Hitchin system from a cyclic vector. This is joint work with D. Gaiotto.

- **Mathai Varghese** (U. Adelaide)
  Title: T-duality for loop spaces, or equivalently for the 1D sigma model
  Abstract: We define exotic twisted S^1-equivariant cohomology for the loop space LZ of a smooth manifold Z via the invariant differential forms on LZ with coefficients in the (typically non-flat) holonomy line bundle of a gerbe, with differential given by an equivariantly flat superconnection. We introduce the twisted Bismut-Chern character form, a loop space refinement of the twisted Chern character form, which represent classes in the completed periodic exotic twisted S^1-equivariant cohomology of LZ. We establish a localisation theorem for the completed periodic exotic twisted S1-equivariant cohomology for loop spaces and apply it to establish T-duality in a background flux in type II String Theory from a loop space perspective.Finally we reinterpret these results as T-duality for the 1D sigma model. This is joint work with Fei Han.

- **Junya Yagi** (YMSC)
  Title: 3D integrability in supersymmetric gauge theories and M-theory
  Abstract: The Zamolodchikov tetrahedron equation is a fundamental relation for the integrability of 3D lattice models in statistical mechanics, playing a role similar to the Yang-Baxter equation in 2D lattice models. I will discuss recent developments in which new solutions of the tetrahedron equation were constructed with use of quantum cluster algebras and related to 3D supersymmetric gauge theories, and a well-known solution was argued to arise from a brane system in M-theory.

Public lecture

- **Time**: Tuesday 11 July 2023 at 5:30-6:30pm.
- **Location**: JH Michell Theatre, Peter Hall building.
- **Speaker**: Sergei Gukov
- **Title**: Will AI disrupt the way we do mathematical research?

Sergei Gukov is the John D. MacArthur Professor of Theoretical Physics and Mathematics at California Institute of Technology and a Senior Professor at the Dublin Institute for Advanced Study. A renowned scientist working at the interface between the two disciplines he made profound contributions to our understanding of the nature of fundamental interactions, the geometry of space-time as well as the classification of knots.

Parallel Sessions

	Session 1 JH Mitchell Theatre	**Session 2** Russell Love Theatre
09:30–09:55	Cassia	Bourgine
09:55–10:20	Scheidegger	Zhang
10:20–10:45	Schimannek	Matsuo
10:45–11:15	Coffee Break and Poster Session	
11:15–11:40	Bies	Maxwell
11:40–12:05	Fasquel	Anagnostou
12:05–12:30	Chauhan	Davis
12:30–12:55	Dedushenko	

- **Lukas Anagnostou** (University of Melbourne)
  Title: Moduli spaces of hyperbolic surfaces with cone points
  Abstract: The moduli space of hyperbolic surfaces of genus g with n cusps has a natural compactification corresponding to the Deligne-Mumford compactification of the moduli space of algebraic curves. It can be shown that the same is true if one replaces cusps with geodesic boundary components. A famous result by Mirzakhani expresses volumes of these moduli spaces as polynomials of even degree in boundary lengths, with coefficients given by intersection numbers of the Deligne-Mumford compactificatied moduli space. By letting boundary geodesics take on purely imaginary values, one obtains crude formulas for volumes of hyperbolic surfaces with cone points of arbitrary cone angle. Such formulas have been proven successful for particular cases of small cone angles, however, for larger cone angles these formulas can lead to a variety of contradictions. In this talk, we discuss when these volume formulas hold. Based on work from Hassett, I will also discuss how one obtains meaningful volumes outside of the regions where Mirzakhani's results hold. In this general setting, volume formulas are determined in a space of stability conditions, consisting of chambers separated by walls.

- **Martin Bies** (RPTU Kaiserslautern Landau)
  Title: From FTheoryTools to F-theory Standard Models without vector-like exotics
  Abstract: F-theory describes a non-perturbative regime of string theory. In this domain, the physics is encoded in a singular elliptic fibration. Because of our ignorance and the lack of alternative techniques, it is standard to resolve the singularities and work-out the physics from a resolved space. Many papers have detailed this technical step for many different F-theory constructions. The software F-theoryTools (https://docs.oscar-system.org/dev/Experimental/FTheoryTools/introduction/) aims to provide convenient tools for such resolutions. Recently, this software has been integrated into the computer algebra system OSCAR. We anticipate, that this software

will help researchers in F-theory - but also more broadly within algebraic geometry - to conduct cutting-edge research. As an example - and if time permits - I shall be more than happy to outline the recent developments towards the construction of F-theory Standard Models without vector-like exotics (cf. https://arxiv.org/abs/2303.08144 for an overview).

- **Jean-Emile Bourgine** (University of Melbourne)
  Title: Shifted quantum groups and matter multiplets in SUSY gauge theories
  Abstract: I will review the "algebraic engineering" method to realize observables of SUSY gauge theories as algebraic quantities in the representation theory of quantum groups. This technique is inspired by the "geometric engineering", and associates to each brane defining the geometric background in string theory a module of the quantum group. This construction highlights the non-perturbative symmetries of the gauge theories which play an essential role in several correspondences (BPS/CFT, Bethe/gauge,...). In the presence of fundamental hypermultiplets, it is useful to introduce the notion of shifted quantum groups and the corresponding representations. I will briefly present new results on the construction of a class of observables in $3D$ $N = 2$ gauge theories using the (shifted) quantum affine $sl(2)$ algebra, and relate them to $5D$ $N = 1$ gauge theories observables using an algebraic reinterpretation of Higgsing.

- **Luca Cassia** (University of Melbourne)
  Title: An equivariant approach to local mirror symmetry
  Abstract: In this talk I will introduce the notion of equivariant quantum volumes for toric Calabi-Yau threefolds and I will discuss their relation to both open and closed string invariants in genus zero. I will argue that equivariance is the fundamental tool that allows to regularize the divergencies due to the non-compactness and I will elaborate on its meaning in the mirror geometry. Based on 2211.13269 and upcoming work with Pietro Longhi and Maxim Zabzine.

- **Sachin Chauhan** (IIT Bombay)
  Title: GPPV conjecture for $SU(N)/Z_m$
  Abstract: Motivated by our earlier work on $\hat{Z}$-invariant for $SO(3)$ and $OSp(1|2)$ case[arXiv:2209.00095] and also with the result of[arXiv:2107.14238], we study the $\hat{Z}$-invariant for $SU(N)/Z_m$ quotient group where m is some factor of N. We find that $\hat{Z}$ invariant does not depend on m. The dependence of m comes as an overall factor to the WRT invariant.

- **Dougal Davis** (University of Melbourne)
  Title: Mixed Hodge modules and unitary representations
  Abstract: I will give an update on an ongoing program, joint with Kari Vilonen, that aims to make progress towards the classification of unitary representations of real reductive Lie groups using tools from Hodge theory and algebraic geometry. Our main result (in preparation) is that unitarity is completely controlled by a geometrically

defined filtration, the Hodge filtration. This fact was originally conjectured by Schmid and Vilonen over 10 years ago.

- **Mykola Dedushenko** (SCGP)
  Title: From QFT to generalized cohomology and back
  Abstract: Geometric constructions dealing with generalized cohomology theories often have natural realization as BPS sectors of supersymmetric quantum field theories. This talk will focus on a line of developments concerning (K-theoretic or cohomological) vortex counting on the one end, and R-matrices and quantum algebras (acting in cohomology/K-theory/elliptic cohomology) on the other. Physically, these are embedded in theories with four or eight supercharges in 1d/2d/3d, and I will review how various BPS observables realize, and possibly generalize, known mathematical constructions.

- **Justine Fasquel** (University of Melbourne)
  Title: Dualities of W-algebras and inverse Hamiltonian reduction
  Abstract: Recently, Gaiotto and Rapcak found a large family of isomorphisms of vertex algebras coming from the four-dimensional gauge theory. Among these isomorphisms, we recover the Feigin-Frenkel and the Feigin-Semikhatov dualities. The former states an isomorphism of principal W-algebras whereas the latter connects subregular W-algebras with principal W-superalgebras. On the other hand, inverse hamiltonian reduction consists in the construction of embeddings of W-algebras corresponding to different nilpotent elements of the same Lie algebra. In this talk, we discuss how inverse hamiltonian reduction relates the previously mentioned dualities.

- **Yutaka Matsuo** (University of Tokyo)
  Title: Minimal Models from Affine Yangian/Quantum Toroidal Algebra
  Abstract: It is well-known that the representation space of the affine Yangian of $gl(1)$ is labeled by the plane partition with the asymptotic Young diagrams. In this talk, we will describe how to obtain the minimal models of various chiral algebras from the affine Yangian by including "two pits" in the plane partition. We will also discuss the connection with the Burge condition and the cyclic partition, proposed some years ago by Foda and Welsh.

- **Katherine Maxwell** (Kavli IPMU)
  Title: Extended super Mumford form on the Sato Grassmannian
  Abstract: The super Mumford form is a canonical horizontal section of a certain line bundle on the moduli space of super Riemann surfaces, which gives rise to the measure in superstring theory. The Sato Grassmannian has been proposed as a possible ambient space for string theory integrals. Based on joint work with A. Voronov, I will discuss possible approaches to extending the super Mumford form to the Grassmannian, including our results on the formula by A. Schwarz.

- **Emanuel Scheidegger** (BICMR Peking University)
  Title: D-brane masses and (quasi)periods of modular forms

Abstract: We explain how the space of certain modular forms can be equipped with a polarized Hodge structure and leads to the notion of (quasi)periods of modular forms. General conjectures from both mathematics and physics allow us to relate these period matrices to period matrices of Calabi-Yau threefolds at special points in their moduli space. Hence, D–brane masses can be given an arithmetic interpretation.

- **Thorsten Schimannek** (CNRS)
  Title: Counting curves on non-Kaehler Calabi-Yau 3-folds with Topological Strings
  Abstract: In general, a Kaehler Calabi-Yau threefold with nodal singularities does not admit a Kaehler small resolution. This happens in particular if the exceptional curves are torsion in homology. However, the presence of torsion also leads to the possibility of turning on a flat, topologically non-trivial B-field that stabilizes the singularities. We argue that the corresponding topological string partition functions encode Gopakumar-Vafa invariants associated to BPS states with discrete charges and that the invariants capture the enumerative geometry of the non-Kaehler small resolutions.

- **Kilar Zhang** (Shanghai University)
  Title: A proof of A_n AGT conjecture at $\beta = 1$
  Abstract: AGT conjecture reveals a connection between 4D $\mathcal{N} = 2$ gauge theory and 2D conformal field theory. Though some special instances have been proven, others remain elusive and the attempts on its full proof never stop. When the Ω background parameters satisfy $-\epsilon_1/\epsilon_2 \equiv \beta = 1$, the story simplifies a bit. A proof of the correspondence in the case of A_1 gauge group was given in 2010 by Mironov et al., while the A_n extension is verified by Matsuo and Zhang in 2011, with an assumption on the Selberg integral of $n+1$ Schur polynomials. Then in 2020, Albion et al. obtained the rigorous result of this formula. In this paper, we show that the conjecture on the Selberg integral of Schur polynomials is formally equivalent to their result, after applying a more complicated complex contour, thus leading to the proof of the A_n case at $\beta = 1$. To perform a double check, we also directly start from this formula, and manage to show the identification between the two sides of AGT correspondence.

Posters

The poster session will take place on Wednesday, July 12, 10:45–11:15 in the *Staff Tea Room*, Peter Hall building.

- **Martin Bies** (RPTU Kaiserslautern Landau)
  Title: From FTheoryTools to F-theory Standard Models without vector-like exotics
  Abstract: F-theory describes a non-perturbative regime of string theory. In this domain, the physics is encoded in a singular elliptic fibration. Because of our ignorance and the lack of alternative techniques, it is standard to resolve the singularities and work-out the physics from a resolved space. Many papers have detailed this technical step for many different F-theory constructions. The software F-theoryTools (https://docs.oscar-system.org/dev/Experimental/FTheoryTools/introduction/) aims to provide convenient tools for such resolutions. Recently, this software has been integrated into the computer algebra system OSCAR. We anticipate, that this software will help researchers in F-theory - but also more broadly within algebraic geometry - to conduct cutting-edge research. As an example - and if time permits - I shall be more than happy to outline the recent developments towards the construction of F-theory Standard Models without vector-like exotics (cf. https://arxiv.org/abs/2303.08144 for an overview).

- **Sachin Chauhan** (IIT Bombay)
  Title: GPPV conjecture for $SU(N)/Z_m$
  Abstract: Motivated by our earlier work on $\hat{Z}$-invariant for $SO(3)$ and $OSp(1|2)$ case[arXiv:2209.00095] and also with the result of[arXiv:2107.14238], we study the $\hat{Z}$-invariant for $SU(N)/Z_m$ quotient group where m is some factor of N. We find that $\hat{Z}$ invariant does not depend on m. The dependence of m comes as an overall factor to the WRT invariant.

- **Saurish Khandelwal** (University of Queensland)
  Title: Curvature-squared invariants of minimal ($N = 1$) supergravity in five dimensions
  Abstract: We review the definition of the minimal ($N = 1$) off-shell two-derivative gauged supergravity in five dimensions (5D) and explore three independent four-derivative superspace invariants defined using the superspace techniques developed in arXiv:1410.8682. These lead to an arbitrary linear combination of the locally supersymmetric extensions of the Einstein-Hilbert term, a cosmological constant, a Riemann tensor squared, a Ricci tensor squared, and a scalar curvature squared. By using algorithms developed in the computer program CADABRA, we obtained for the first time the component fields' actions and the primary equations of motion for all these independent invariants, including fermions. The bosonic component fields' actions for a Weyl tensor squared and for a scalar curvature squared were known. Our

new recent results (contained in arXiv:2302.14295 and work to appear) contribute to a more exhaustive understanding of higher-derivative supergravity theories and have the potential to find applications to the study of quantum-corrected supersymmetric black holes and next-to-leading order tests of the AdS/CFT correspondence.

- **Girish Vishwa** (University of Edinburgh)
  Title: Non-Lorentzian strings from WZW Models
  Abstract: A myriad of WZW models have been extensively studied over the past three decades. In recent years, there has been an increased interest in non-relativistic strings (and non-Lorentzian strings in general) for various reasons. We present a way to construct a class of explicit examples of Galilean strings by starting with a WZW model on a Bargmannian group and performing null chiral gauging. We also discuss the potential implications of this starting point for the construction of Carrollian strings.

- **Kilar Zhang** (Shanghai University)
  Title: A proof of A_n AGT conjecture at $\beta = 1$
  Abstract: AGT conjecture reveals a connection between 4D $\mathcal{N} = 2$ gauge theory and 2D conformal field theory. Though some special instances have been proven, others remain elusive and the attempts on its full proof never stop. When the Ω background parameters satisfy $-\epsilon_1/\epsilon_2 \equiv \beta = 1$, the story simplifies a bit. A proof of the correspondence in the case of A_1 gauge group was given in 2010 by Mironov et al., while the A_n extension is verified by Matsuo and Zhang in 2011, with an assumption on the Selberg integral of $n+1$ Schur polynomials. Then in 2020, Albion et al. obtained the rigorous result of this formula. In this paper, we show that the conjecture on the Selberg integral of Schur polynomials is formally equivalent to their result, after applying a more complicated complex contour, thus leading to the proof of the A_n case at $\beta = 1$. To perform a double check, we also directly start from this formula, and manage to show the identification between the two sides of AGT correspondence.

Useful Information

Wi-Fi

- Eduroam is all over the campus.
- Other wifi avaliable: Please refer to the following information and instructions to access the account.

  Username: stringmath

  Password: c7&Trk

  First name: S

  Last name: tring Math

  Expiration date: 2023-07-14 18:00

  https://wireless.unimelb.edu.au/visitor.html

Conference Dinner (for participants who have paid in advance).
Date and time: 13 July 2023 (Thursday), 6:00pm
Venue: University House
Address: Building 112, Professors Walk, Parkville, Australia 3010.
Direction from JH Michell Theatre, Peter Hall building, to University House: