TITLES AND ABSTRACTS

Peter Bouwknegt

Title. Lie algebroid gauged sigma models and T-duality

Abstract. In this talk I will discuss the gauging of 2D sigma models with respect to a (possibly non-isometric) Lie algebroid symmetry and its application to T-duality. This talk is based on recent work done in collaboration with Bugden, Klimcik and Wright [arXiv:1705.09254].

Zsuzsanna Dancso

Title. The topological Duflo isomorphism

Abstract. The Duflo isomorphism in Lie theory is an isomorphism between the invariant part of the symmetric algebra of a given Lie algebra, and the centre of its universal enveloping algebra. In 2003, Bar-Natan, Le and Thurston gave a topological proof for metrised Lie algebras. In this talk we give a topological proof in the general case, using a universal finite type invariant for certain knotted tubes in $\mathbb{R}^4$, constructed recently by Bar-Natan and the speaker. (Joint work with Dror Bar-Natan.)

Jarah Evslin

Title. An Introduction to Spherical T-Duality

Abstract. Ordinary T-Duality relates gerbes on pairs of bundles whose fibers are unit spheres in the complex plane, inducing a number of natural isomorphisms. We review just how much of this structure extends to the quaternionic case.

Chi-Kwong Fok

Title. Real K-theory of compact Lie groups

Abstract. Let G be a compact connected Lie group, viewed as a G-space via the conjugation action. A theorem of Brylinski-Zhang's states that the equivariant K-theory of G is the ring of Kähler differentials of its complex representation ring, while a recent deep theorem by Freed-Hopkins-Teleman asserts a canonical isomorphism between the twisted equivariant version and the Verlinde algebra of G. In this talk, I will present generalizations of both results in the context of Atiyah's Real K-theory.

Fei Han

Title. Equivariant cohomology, equivariant Chern character and gauge fields over super points

Abstract. The Borel equivariant cohomology has differential geometric models, the Weil model and the Cartan model; from equivariant K theory to equivariant cohomology, there is a fundamental functor, the (delocalized) equivariant Chern character. In this talk, I will describe super geometric interpretation of these theories by studying gauge fields over super points. These represent our joint work with Schommer-Pries, Stolz, Teichner and joint work with Berwick-Evans.

Keith Hannabuss

Title. T-duality, tensor categories, and algebraic QFT

Abstract. T-duality for C*-algebras is essentially Takai-Takesaki duality for a particular class of algebras (continuous trace algebras), and this often makes sense even when geometric T-duality fails. Examples suggest that some cases, where the T-dual is noncommutative or even nonassociative, can be understood in terms of tensor categories, sharing some algebraic features with quantum groups. This talk will consider a tensor category which also captures analytic features of the theory. Moreover, some of the ideas also provide an interesting perspective on the rapidly developing perturbative Algebraic Quantum Field Theory.

Machiko Hatsuda

Title. Manifestly T-dual formulation of AdS space

Abstract. The low energy effective gravity theory of superstring is characterized by T-duality: the gauge field involves the B field in addition to the gravitational field, and the general coordinate transformation is generated by the Courant bracket. After introducing our recent result on AdS space in the manifestly T-dual formulation, I will review the manifestly T-dual formulation for flat superspace. Then I will explain the manifestly T-dual formulation for curved backgrounds: For group manifolds related by the orthogonal vielbein fields the three form $H = dB$ in the doubled space is universal at least locally. The non-zero commutator of the left and right momenta leads to that the left momentum is in an AdS space while the right momentum is in a dS space. This talk is based on collaboration with K. Kamimura and W. Siegel.

Pedram Hekmati

Title. A quantum refinement of equivariant cohomology

Abstract. I will introduce a refinement of equivariant cohomology based on the affine Kac–Moody vertex algebra. Interestingly this construction only works at the so called critical level. I will show that the extended equivariant cohomology of a point coincides with the Feigin–Frenkel center generated by Segal–Sugawara vectors and discuss a potential jet analogue of the Duflo homomorphism. This is joint work in progress with Andrew Linshaw.

Masoud Kamgarpour

Title. On some connections arising from mirror symmetry

Abstract. In this talk, we consider two examples of algebraic connections on (the trivial bundle) on the projective line: one due to Frenkel and Gross (related to mirror symmetry for flag varieties) and another due to Gorbounov and Smirnov (related to mirror symmetry for quadrics). We shall discuss some interesting properties of these connections and some open questions about them.

Kazuya Kawasetsu

Title. The intermediate vertex subalgebras of the lattice vertex operator algebras

Abstract. In this talk, we introduce a notion of intermediate vertex subalgebras of lattice vertex operator algebras, as a generalization of the notion of principal subspaces. We give bases and the graded dimensions of such subalgebras. As an application, we show that the characters of some modules of an intermediate vertex subalgebra between E_7 and E_8 lattice vertex operator algebras satisfy some modular differential equations. This result is an analogue of the result concerning the "hole" of the Deligne dimension formulas and the intermediate Lie algebra between the simple Lie algebras E_7 and E_8.

Tony Licata

Title. Symplectic duality from a mathematical viewpoint

Abstract. There is a close relationship between Seiberg-Intrilligator 3D mirror duality, discovered and studied by physicists in the 1990s, and symplectic duality, discovered and studied independently by mathematicians during the last ten years. The goal of this talk will be to describe and motivate the mathematics of symplectic duality, and explain some of the recent developments and open problems in the subject.

David Ridout

Title. sl(3) weight modules and higher-rank logarithmic CFT

Abstract. Rational conformal field theories (CFTs), such as the Wess–Zumino–Witten (WZW) models, are generally constructed from irreducible highest-weight modules. On the other hand, logarithmic CFTs are constructed from modules that are not all irreducible but also need not be highest-weight.

Non-highest-weight modules appear, in particular, for the logarithmic analogues of the WZW models, sometimes called the fractional level WZW models. Recently, we have obtained a fairly complete picture of the modules arising for fractional level sl(2) models. In this talk, I will try to outline this picture and discuss current work that aims to extend this to the sl(3) case.

Meng-Chwan Tan

Title. Higher AGT Correspondences, W-algebras, and Higher Quantum Geometric Langlands Duality from M-Theory

Abstract. I will present a purely physical M-theoretic derivation of a 5d and 6d AGT correspondence for arbitrary compact Lie groups and ALE spaces, as well as identities between the ordinary, q-deformed and elliptic affine W-algebras associated with the 4d, 5d and 6d AGT correspondences which underlie a quantum geometric Langlands duality and its higher analogs first defined by Frenkel-Reshetikhin. As an offshoot, I will elucidate the sought-after connection between the gauge-theoretic realization of the geometric Langlands correspondence by Kapustin-Witten and its algebraic CFT formulation by Beilinson-Drinfeld, where Wilson and 't Hooft/Hecke line operators in gauge theory can be understood as monodromy loop operators in CFT, for example. I will also explain why the higher analogs of the geometric Langlands correspondence for simply-laced Lie (Kac-Moody) groups G (KMG), ought to relate the quantization of circle (elliptic)-valued G Hitchin systems to circle (elliptic)-valued LG-bundles over a complex curve on one hand, and the transfer matrices of a G (KMG)-type XXZ/XYZ spin chain on the other, where LG is the Langlands dual of G.

Kate Turner

Title. Persistent homology rank function

Abstract. Persistent homology is a tool for capturing how topological features evolve over an increasing family of spaces. Commonly these spaces are taken to be the unions of balls of increasing radii about some finite set of points. Using this scaling parameter we can summarise geometric information as a topological summary statistic. In this talk I will introduce persistent homology and define the persistent homology rank function which, as a functional summary lying in a Hilbert space, enables us to perform statistical analysis such as principal component analysis. I will present some applications including testing complete spatial randomness of spatial point patterns, and comparing experimental sphere packings and colloid data under different temperatures. This talk is based on work with Vanessa Robins.

Bryan Wang

Title. L^2-symplectic vortice on a punctured Riemann surface

Abstract. In this talk, I will discuss joint work with Bohui Chen and Rui Wang on L^2-symplectic vortice on a punctured Riemann surface with cylindrical/Euclidean end metrics associated to a Hamiltonian G-manifold X. The asymptotic limit map on the moduli space of L^2-symplectic vortices takes values in the symplectic reduction $X//G$. Virtual technique can be applied to define a new quantum product on the Chen–Ruan cohomology of $X//G$ which is related to the quantum product on the Chen–Ruan cohomology of $X//G$.

Yaping Yang

Title. Monodromy representations of elliptic braid groups

Abstract. In my talk, I will briefly review the representation theoretical construction of conformal blocks attached to an affine Kac-Moody algebra and a smooth algebraic curve with marked points. The space of conformal blocks forms a vector bundle over the configuration space of points on the algebraic curve. This vector bundle carries a canonical flat connection.
I will discuss the cases when the algebraic curve is a Riemann sphere, and an elliptic curve. The corresponding flat connections give rise to, respectively, the Knizhnik-Zamolodchikov (KZ) equation, and, by Felder-Wieczerkowski, the Knizhnik-Zamolodchikov-Bernard (KZB) equation. There are various generalizations of the KZB equations. I will focus on one generalization that constructed by myself and Toledano Laredo recently: the elliptic Casimir connection associated to a semisimple Lie algebra g. It is a holonomic system of differential equations with regular singularities on elliptic curve with marked points, taking values in a deformation of the double current algebra g[u, v] defined by Guay. The monodromy of elliptic Casimir connection leads to interesting representations of the elliptic braid groups.

Maxim Zabzine

Title. Modular double and 3D gauge theories

Abstract. I will discuss the relation between vertex algebras and gauge theories. In particular I will concentrate on the relation between q-Virasoro and 3D gauge theories. I will explain the intriguing construction of modular double in the context of q-Virasoro. If time allows, I will also comment on the relation between 5D theories and q-Virasoro.

STUDENT TALKS

Mark Bugden

Title. Comments on non-isometric T-duality

Abstract. T-duality is a string theory symmetry obtained by gauging isometries of a non-linear sigma model. We discuss a generalisation of this concept called non-isometric T-duality, and explore its relationship to T-duality, focussing heavily on examples.

Michael Cromer

Title. TBA

Abstract. TBA

Michael Hallam

Title. End-periodic K-homology and positive scalar curvature

Abstract. It is well known that index theory is a useful tool for studying positive scalar curvature. For example, the Atiyah-Singer index theorem and the Weitzenbock/Lichnerowicz formula yield obstructions to positive scalar curvature on compact spin manifolds with non-vanishing A-hat genus. The Atiyah-Patodi-Singer index theorem for manifolds with boundary also gives applications to positive scalar curvature, and these can be expressed quite elegantly using geometric K-homology, as per Higson and Roe.

Recently Mrowka, Ruberman and Saveliev proved an index theorem for manifolds having 'periodic ends' which generalises the Atiyah-Patodi-Singer index theorem in the case when the end is cylindrical. In this talk, I will introduce a new analogue of K-homology that is tailored to the setting of manifolds with periodic ends, which is used to give new obstructions to positive scalar curvature on even dimensional manifolds and to study the moduli space of positive scalar curvature metrics modulo diffeomorphism. The work is joint with Mathai Varghese.

Tianshu Liu

Affine ops(1—2) and its coset construction. Affine ops(1—2) and its coset construction

Abstract. Conformal field theory is an essential tool of modern mathematical physics with applications to string theory and to the critical behaviour of statistical lattice models. The symmetries of a conformal field theory include all angle-preserving transformations. In two dimensions, these transformations generate the Virasoro algebra, a powerful symmetry that allows one to calculate observable quantities analytically. The construction of one family of conformal field theories from the affine Kac-Moody algebra sl(2) were proposed by Kent in 1986 as a means of generalising the coset construction to non-unitary Virasoro minimal models, these are known as the Wess-Zumino-Witten models at admissible levels. This talk aims to illustrate, with the example of the affine Kac-Moody superalgebra osp(1—2) at admissible levels, how the representation theory of a vertex operator superalgebra can be studied through a coset construction. The method allows us to determine key aspects of the theory, including its module characters, modular transformations and fusion rules.

Kyle Wright

Title. Gauging sigma models with Lie algebroids

Abstract. Gauge symmetries play an important role in the study of sigma models. Gauging a sigma model usually involves identifying a global symmetry and promoting it to a local symmetry through the introduction of gauge fields. A typical example comes from gauging the isometry group of a sigma model. This talk will discuss the gauging of sigma models under general Lie algebroid symmetries, and describe the relationship to non-isometric gauging. Particular emphasis will be given to the underlying Lie algebroid geometry.