Trends in Differential and Complex Geometry
31 August-4 September 2026
L3

Abstracts

Tom Bridgeland (University of Sheffield)

Title: Bundles on elliptic curves, del Pezzo surfaces and q-difference equations

Abstract: There is a variant of the Hitchin moduli space in which flat connections are replaced by q-difference connections. This talk is about the analogue of the character variety or Betti moduli space in this setting. It parameterises vector bundles on an elliptic curve C equipped with two filtrations whose factors are semistable of ascending slope. The numerical type of such an object is encoded by a convex lattice polygon. In the case that this polygon is reflexive we identify the Betti moduli space with the universal family of complements Z \ C, where Z is a del Pezzo surface of fixed topological type, and C \subset Z is an anti-canonical embedding. This is joint work with Pierrick Bousseau and Luca Giovenzana.

Simon Donaldson (Imperial College London)

Title: Multivalued harmonic functions and twistor geometry.

Abstract. Solutions of elliptic partial differential equations which are “multivalued” in the sense that they are sections of flat bundles over the complement of a codimension 2 submanifold have appeared in several areas of differential geometry over the past decade. The talk will begin by recalling some of this background and then focus on the construction of explicit solutions over Euclidean spaces. We will explain how twistor methods can be used to describe solutions in 3-dimensions, branched over ellipses, which were obtained using other methods by Dashen Yan, and discuss possible extensions of these constructions in dimensions 3 and 4. There are interesting connections with work of Hurtubise from the 1980’s, studying the asymptotics of Bogomolny monopoles.

Camilla Felisetti (University of Modena and Reggio Emilia)

Title: A Parabolic approach to Intersection Theory on singular moduli spaces of vector bundles

Abstract: Moduli spaces of semistable vector bundles of fixed rank and degree on curves are fundamental objects in algebraic geometry. When rank and degree are coprime. the stability and semistability conditions coincide and the corresponding moduli space is a smooth projective variety whose geometry, topology and intersection theory have been studied extensively over the past several decades. When we drop the coprimality assumption, singularities appear and this has historically posed significant challenges for computing intersection pairings.

In this talk we present a recent work in collaboration with Olga Trapeznikova, which introduces a novel and more accessible methodology for tackling this problem. The core strategy involves realizing the intersection cohomology of the singular moduli space as a canonical subspace of the cohomology of a smooth moduli space of parabolic bundles.

We will show how this parabolic approach enables the calculation of intersection pairings by leveraging the Hecke correspondence and the Jeffrey-Kirwan residue formula. By comparing this methodology to the standard Jeffrey-Kirwan-Kiem-Woolf blow-up construction, we will discuss how this framework not only provides a computationally efficient alternative but also offers a clear geometric interpretation for arbitrary rank r.

Ana Ferreira (Universidade do Minho, Portugal)

Title: Completeness of left-invariant geodesic flows

Abstract: We will discuss the geometry of the geodesic flow of Lie groups with left-invariant pseudo-Riemannian or holomorphic-Riemannian metrics. As well as recalling some beautiful and seminal classical theory, we will present some recent developments in this topic. This talk will be based on a series of joint works with S. Chaib, A. Elshafei, H.Reis, M. Sanchez and A. Zeghib.

Laura Frederickson (University of Oregon)

Title: ALG(*) Gravitational Instantons vs. 4d Hitchin Moduli Spaces

Abstract: Gravitational instantons are defined as non-compact, non-flat, complete hyperkähler 4-manifolds with L^2 curvature decay. They have been recently classified, and all arise as bubbling limits of K3 surfaces. The Modularization Conjecture posits that any gravitational instanton arises as the moduli space of gauge-theoretic equations.

In this talk, I'll focus on a special kind of gravitational instanton: ALG-D_4 gravitational instantons. These can be conjecturally realized as moduli spaces of Hitchin's equations, a system of gauge-theoretic equations on a Riemann surface that is recognized as a central object in mathematics. In joint work (arXiv:2603.17020) and ongoing work with Rafe Mazzeo, Jan Swoboda, and Hartmut Weiss, we prove the Modularization Conjecture in this case.

Oscar García-Prada (ICMAT, Madrid)

Title: Three papers of Nigel Hitchin on Higgs bundles

Abstract: In this talk, I will give a personal account on how three papers of Nigel on Higgs bundles have motivated and inspired a lot of my past and current work.

Michael Groechenig (University of Toronto)

Title: Chi-independence via arithmetic properties of the Hitchin fibration

Abstract: This talk will be centred around the fascinating geometric and arithmetic properties of the Hitchin fibration and how they can be utilised in the study of moduli problems beyond Higgs bundles on curves. We will see that these properties, in combination with the techniques provided by p-adic integration, imply degree-independence phenomena for certain cohomological invariants of moduli spaces arising in Donaldson-Thomas theory. This is joint work with Wyss and Ziegler.

Victoria Hoskins (University Duisberg-Essen)

Title: Nilpotent quiver varieties for quivers with multiplicities

Abstract: There is a long and rich history relating the representation theory of a quiver and an associated symmetric Kac-Moody algebra, where various quiver moduli spaces geometric realise the representation theory. Representations of a quiver with multiplicities are representations of a quiver over truncated polynomial rings, and are connected to the larger class of symmetrisable Kac-Moody algebras. After surveying the important rôle that the nilpotent cone plays in the Higgs world, I will pass to the analogous situation for quivers. I will outline Nakajima's nilpotent quiver varieties, and then describe an analogous construction for quivers with multiplicities, which involves quotienting by non-reductive groups. If there is time, I will explain some applications to representation theory. This is joint work with J. Jackson and T. Vernet.

Jacques Hurtubise (McGill University)

Title: Quasi-monopoles

Abstract: It has been understood for a while that the ends of the moduli space of charge k $SU(2)$-monopoles in $\mathbb R^3$ decompose into regions where one has a glueing of well-separated monopoles

of charges $k_1, .., k_s, \sum_ik_i= k$, giving us a particle description. This approximation is rather rough, in that comparing the metrics only gives an approximation to order 1/R, where R is the separation parameter. Any further improvement requires some form of interaction between the particles. We define spaces of quasi-monopoles, with a separate spectral curve for each charge, and an interaction through their intersection divisors. The spaces of these quasi-monopoles are hyperk\”ahler, and approximate the monopole metric to order $e^{−cR}$. They also have torus actions, which allow a way of finalising Segal-Selby’s proof of the Sen conjecture in the coprime case.

The proof exploits much of Nigel Hitchin’s 1983 paper, and so the talk will begin by recalling some of the salient features of that landmark work. With Roger Bielawski and Sergey Cherkis.

Ailsa Keating (University of Cambridge)

Title: Homological mirror symmetry for K3 surfaces

Abstract: Joint with Paul Hacking. We outline a proof of the homological mirror symmetry conjecture of Kontsevich for K3 surfaces in the following form. Let X be a K3 surface equipped with a Kahler form $ \omega$ such that the lattice $L:=[\omega]^{\perp} \cap H^2(X,{\mathbb Z})$ has signature $(2,r-2)$ and contains a copy of the hyperbolic plane $U=\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$. Then there is a projective K3 surface Y defined over a Novikov field and a quasi-equivalence of A_∞ categories between the Fukaya category of (X,ω) and the derived category of coherent sheaves on Y. (Note that the condition on the lattice L is necessary, e.g. by considering numerical K-theory.) Our work builds on prior work of Seidel, Gross--Siebert, Sheridan, Lekili--Ueda, and Ganatra--Pardon--Shende, among others.

Frances Kirwan (University of Oxford)

Title: Degenerate Morse theory and higher quivers

Abstract: Classical Morse theory studies the topology of a compact manifold M (often equipped with a Riemannian metric) using a smooth real-valued function f on M with nondegenerate (and therefore isolated) critical points. Since its beginning nearly a century ago, Morse theory has been extended to relax the nondegeneracy assumptions further and further.

The aim of this talk is to describe firstly an extension of the theory of quiver representations to 2-quivers, secondly a version of degenerate Morse theory which applies without any nondegeneracy assumptions provided that the compact manifold, its Riemannian metric and the function f are real analytic, and finally how these might be combined to study the classification of smooth real-valued functions on compact Riemannian manifolds. It is based on previous joint work with G Penington and ongoing joint work with V Nanda.

Marina Logares (Universidad Complutense de Madrid)

Title: Geometry and topology of parabolic Higgs bundles

Abstract: In this talk I shall review some aspects of the geometry and topology of moduli spaces of parabolic Higgs bundles. I shall then focus on parabolic SU(2,1)-Higgs bundles and discuss some ongoing work on their moduli spaces.

Marta Mazzocco (ICREA and UP Catalunya)

Title: Categorical approach to Decorated Betti moduli spaces

Abstract: The focus of this talk le is the study of moduli spaces of representations of fundamental groups of surfaces S with boundaries with values in GL(,n C). In absence of marked points on the boundary, this moduli space is realized in many equivalent ways: as the moduli space of linear local systems on S, as the moduli space of representations of the fundamental groupoid, as the moduli space of monodromy data and as character variety. By adding marked points to the boundary of S in order to capture irregular singularities,

the Betti moduli space has been generalized in several ways by many authors. Although it is clear that these different approaches describe essentially the same spaces of mathematical objects, exactly how they fit together has not yet been established. In this talk, I will develop a categorical framework that allows for a clear and systematic definition of the decorated Betti moduli space designed to specialize to the different points of view encountered in the literature.

Ngô Bao Châu (University of Chicago)

Title: Kostant bundle and root cover

Abstract: For linear groups, Beauville-Narasimhan-Ramanan (BNR) provided a description also called abelianization, of Hitchin fibers in terms of the compactified Jacobian of spectral curves. Although there were case-by-case generalization of BNR correspondence for classical groups, we lacked a uniform abelianization of Hitchin fibers that applies to exceptional groups. In this joint work with Rajarshi Ghosh we provided such an abelianization for simply laced root systems, which should generalize to all root systems. As a byproduct, we also derived a new construction of simply laced simple Lie algebras.

Ana Peón Nieto (Universidade de Santiago de Compostella)

Title: A journey through wobbliness

Abstract: The name “wobbly”, introduced by Donagi--Pantev in relation to their programme on the geometric Langlands conjecture via Higgs bundles, refers to the complement of the very stable locus in the moduli space of bundles. These objects define a divisor expected (and, in some cases, proven) to play a major role in the definition of the Hecke eigensheaves predicted by geometric Langlands.

In this talk I will review some recent results on wobbly bundles, more precisely relating to Drinfeld's conjecture for higher fixed points (known to fail, but to what extent?), the description of (\mathbb C^*)-flows, and the case of general Lie groups.

This is based on joint work with A. Früh, Z. Ouaras, S. Pal, C. Pauly, and G. Wilkin.

Simon Salamon (Kings College London)

Title: Tournaments, flags, and spinors

Abstract: Artacho and Semmelmann introduced the problem of determining the dimension of the space of G-invariant spinors on the full flag manifold G/T. This talk will extend their analysis, but only in the unitary case G=SU(n) in which n is necessarily odd. It is based on joint work with Diego Conti. We exploit the bijective correspondence between invariant almost complex structures on SU(n)/T and tournaments with n players, previously used in the context of harmonic maps.

José Seade (Universidad Nacional Autonoma de Mexico)

Title: Discrete groups of projective automorphisms.

Abstract: We will speak about the geometry and dynamics of discrete groups of automorphisms of the complex projective plane CP^ 2.

Jörg Teschner (DESY)

Title: Analytic versions of the (quantum) geometric Langlands correspondence

Abstract: The Analytic Langlands Correspondence describes the spectra of quantized Hitchin systems in terms of certain holomorphic connections called opers with real holonomy.

In the first half of my talk I will outline the proof strategy based on the Separation of Variables Method from the theory of integrable models, as successfully implemented for G=PSL(2), and n-punctured Riemann spheres in joint work with F. Ambrosino. It reveals that square-integrability follows from single-valuedness conditions on the solutions of the differential equations appearing in this context.

The second half of my talk will then outline a deformation of this correspondence, replacing the Hitchin eigenvalue equations by the KZB-equations from conformal field theory. This deformation arises naturally in complex Chern-Simons theory, and conjectures by Gaiotto and myself relate a deformed version of the analytic Langlands correspondence to the canonical quantization of the character varieties, representing examples of what we called Schur-quantization of holomorphic symplectic varieties.

Richard Thomas (Imperial College London)

Title: The MNOP conjecture and commuting vector fields

Abstract: f a connected abelian Lie group A acts on a compact manifold M, we can sometimes localise the characteristic classes of M – particularly its Euler class – to the fixed locus of the action.

- If dim A=1 we can apply the Poincaré-Hopf theorem to the resulting vector field on M.
- If A is compact (i.e. a torus) we can use Atiyah-Bott-Berline-Vergne localisation in equivariant cohomology.
- If M is complex Baum-Bott-Illusie localise to the locus in M where the A-action drops rank, rather than the smaller locus where the rank drops to zero.

Bonatti has solved the problem for real analytic actions with rank A=2 and dim M≤4.
The general case seems to be underappreciated and wide open. I will explain an approach in the complex case, and some virtual motivation from the Maulik-Nekrasov-Okounkov-Pandharipande conjecture in enumerative algebraic geometry.

Different parts of this project are joint work with Francesca Carocci, Yifan Zhao and Maurício Corrêa.

Anna Wienhard (MPIM)

Higher Teichmüller spaces, positivity, and non-commutative cluster coordinates

In 1992 Nigel Hitchin introduced the Teichmüller component, now called the Hitchin component. This was the starting point for the study of higher Teichmüller spaces. In this talk I will describe a unifying framework, and show how this leads to generalizations of Fock-Goncharov coordinates for all higher Teichmüller spaces.