New Perspectives on Higgs bundles, branes and quantization Talk Schedule

Events for:
Monday, June 13th - Friday, June 17th

Monday, June 13th

9:00am **Jorgen Ellegaard Andersen - SCGP 102**

Title: Geometric Quantisation of Higgs Moduli Spaces

Abstract: We shall in this talk discuss the geometric quantisation of the moduli space of flat connections both for compact simple, simply-connected groups G and for their complexification $G^{\mathbb C}$. The quantisation of the moduli space for the compact groups G are well studied and it is known how they fit into the Reshetikhin-Turaev TQFT at least for G = SU(n). In particular the dimensions of the finite dimensional Hilbert spaces, which the quantisation provides, are given by the Verlinde formula, which we will present for general such G. We shall further discuss the geometric quantisation of the moduli space for $G^{\mathbb C}$ using the Higgs bundle hyper-K ?ahler structure, which these moduli spaces has by the work of Hitchin. In the end of the of the talk we shall present a Verlinde formula (joint with Gukov and Pei) for the graded dimension of the Hilbert spaces, which arrises as the quantisation, using the hyper-K ?ahler structure on the Higgs bundle moduli space.

10:00am **Coffee Break - SCGP Cafe**

10:30am **Florent Schaffhauser - SCGP 102**

Title: Finite group actions on moduli spaces of vector bundles

11:30am **Short Break - SCGP Cafe**

11:45am **Qiongling Li - SCGP 102**

Title: Minimal Surface for Hitchin Representations

Abstract: Given a reductive representation from surface group into a Lie group G, there exists a equivariant harmonic map from the universal cover of a fixed Riemann surface to the symmetric space G/K associated to G. If the Hopf differential of the harmonic map vanishes, the harmonic map is then conformal and hence minimal. In this talk, we investigate the properties of immersed minimal surfaces inside symmetric space associated to a subloci of Hitchin component: q_n and q_{n-1} case. This is joint work with Song Dai (Tianjin University).

12:45pm **Lunch - SCGP 102**

2:15pm **John Loftin - SCGP 102**

Title: Equivariant Minimal Surfaces in the Complex Hyperbolic Plane and Their Higgs Bundles

3:30pm **Tea Time - Lobby**

4:00pm **Alessia Mandini - SCGP 102**

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. In joint work 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

Tuesday, June 14th

9:00am **Tony Pantev - SCGP 102**

Title: Pushforwards of Parabolic Higgs bundles

10:00am **Coffee Break**

10:30am **Laura Fredrickson - SCGP 102**

Title: A circle action on wild Hitchin moduli spaces

11:30am **Lunch - SCGP Cafe**

1:00pm **SCGP Weekly Talk: Richard Wentworth "Higgs bundles, flat connections, and higher Teichmueller theory" - SCGP 102**

Title: Higgs bundles, flat connections, and higher Teichmueller theory

Abstract: In the first part of this talk, intended for a general audience, I will introduce the moduli space of local systems on Riemann surfaces and its three avatars: Higgs bundles, flat connections, and representations of the fundamental group. The moduli space contains several important subvarieties. One of these is a symplectic submanifold called the Hitchin component, which may be regarded from many points of view as an analog of Teichmueller space for representations to higher rank groups. In the second part of the talk, I will discuss joint work with Francois Labourie that computes variational formulas for certain dynamical quantities defined by the representations in the Hitchin component, such as a version of Gardiner's formula, the hamiltonian vector fields associated to length functions, and the relationship between the pressure metric and holomorphic differentials.

2:15pm **Andy Neitzke - SCGP 102**

Title: New BPS state counts in Hitchin systems

3:30pm **Tea Time - Lobby**

4:00pm **Sergei Gukov - SCGP 102**

Title: Moduli spaces and Categorification of WRT Invariants of 3-manifolds

5:30pm **Banquet**

Wednesday, June 15th

9:00am **Lucas Branco - SCGP 102**

Title: Higgs Bundles, Real Forms and Mirror Symmetry

10:00am **Coffee Break**

10:30am **Steven Bradlow - SCGP 102**

Title: Higgs Spectral Data for Isogenous Lie Groups, and Fiber Products.

11:30am **Short Break - SCGP 102**

11:45am **Marina Logares - SCGP 102**

Title: Character Varieties and the Hodge Monodromy Representation

Abstract: Character varieties have been studied thoroughly in relation with moduli spaces of Higgs bundles. Their topological invariants where studied via the non abelian Hodge correspondence, and recently attention has been focused on the so called e-polynomial, which provides algebraic information on them. I'm going to report on a developing project on formalising the method to compute e-polynomials given in joint work with P. Newstead and V. Muñoz. This formalisation is intended for producing a TQFT, this is a project with A. González and V. Muñoz

12:45pm **Lunch - SCGP Cafe**

2:15pm **Jacques Hurtubise - SCGP 102**

Title: Real G-bundles on a Curve

3:30pm **Tea Time - Lobby**

4:00pm **Szilard Szabo - SCGP 102**

Title: Spectral representation of irregular parabolic Higgs bundles on curves

Abstract: We give a variant of the classical spectral sheaf representation adapted to irregular parabolic Higgs bundles on curves, and we apply it to describe the geometry of some 2-dimensional Dolbeault moduli spaces. The second part of the talk is joint work with P. Ivanics and A. Stipsicz.

Thursday, June 16th

9:00am **Richard Wentworth - SCGP 102**

Title: Deligne Pairings and Flat Connections

Abstract: On a smooth holomorphic fibration of projective curves the Deligne pairing produces a line bundle on the base parameter space from a pair of line bundles on the total space of the family. If the line bundles are endowed with metrics then the pairing has a canonically defined metric as well. I will introduce a generalization of this construction where metrics are replaced by relatively flat connections. This gives an interpretation via the Deligne isomorphism of the holomorphic extension of analytic torsion on considered by Fay and Cappell-Miller. The hyperholomorphic line bundle on the twistor space of the moduli of Higgs bundles admits a meromorphic connection with certain properties. I will show that the existence of this connection for rank one Higgs bundles also follows naturally from our construction. This is joint work with Gerard Freixas I Montplet.

10:00am **Coffee Break - SCGP Cafe**

10:30am **Sebastian Heller - SCGP 102**

Title: Deformation Theory for Higher Genus CMC Surfaces

Abstract: We consider compact surfaces of constant mean curvature (CMC) in the 3-sphere. These surfaces are characterized by the harmonicity of their Gauss maps. While equivariant harmonic maps into hyperbolic 3-space lead to Hitchin's self-duality equations and play a very prominent role in modern geometry, their analogues into positively curved space, namely harmonic maps from compact Riemann surfaces into the round 3-sphere, are not well-understood. Besides the trivial case of harmonic spheres only harmonic tori have allowed for a profound gauge theoretic description: They can be parametrized in terms of (algebraic-geometric) spectral data due to the work of Hitchin (and Pinkall-Sterling). In this talk I will describe how CMC surfaces of higher genus in the 3-sphere are determined by special holomorphic curves into the moduli space of flat SL(2, C)-connections. Under the assumption of certain discrete symmetries, irreducible connections on higher genus surfaces are determined by flat line bundle connections. This observation enables us to define a generalization of the spectral curve theory for symmetric higher genus CMC surfaces. In a recent preprint (joint work with L. Heller and N. Schmitt) we have introduced a flow on the spectral data from CMC tori towards higher genus CMC surfaces. This (generalized Whitham) flow can be used to study deformations of symmetric CMC surfaces of higher genus and to obtain a clearer picture of the moduli space of CMC surfaces of higher genus.

11:30am **Short Break - SCGP Cafe**

11:45am **Sean Lawton - SCGP 102**

Title: Recent Results on the Betti Moduli Space

12:45pm **Lunch - SCGP Cafe**

2:15pm **Graeme Wilkin - SCGP 102**

Title: The Yang-Mills-Higgs Flow in the Neighbourhood of a Critical Point

Abstract: The Yang-Mills-Higgs flow was originally studied by Simpson in the context of constructing Hermitian-Einstein metrics on Higgs bundles. Methods of Donaldson and Simpson show that the Yang-Mills-Higgs flow resembles a nonlinear heat equation on the space of Hermitian metrics on the bundle and therefore the downwards flow is well-behaved with respect to existence and uniqueness, and it also has nice smoothing properties. On the other hand, the upwards flow is ill-posed and therefore even existence of solutions is problematic. In this talk I will describe how to construct long-time solutions to the reverse Yang-Mills-Higgs flow that converge to a given critical point. On the space of Hermitian metrics, these solutions are asymptotic to a solution of the linear heat equation with initial condition at a finite sum of eigenfunctions of the Laplacian. This gives an algebro-geometric criterion for two critical points to be connected by a flow line, which leads naturally to a Morse-theoretic construction of the Hecke correspondence for Higgs bundles.

3:30pm **Tea Time - Lobby**

4:00pm **Vicky Hoskins - SCGP 102**

Title: On the Voevodsky Motive of Moduli Spaces of Vector Bundles and Higgs Bundles

Friday, June 17th

9:00am **Duiliu Emanuel Diaconescu - SCGP 102**

Title: Higgs bundles and Donaldson-Thomas invariants

10:00am **Coffee Break**

10:30am **Sara Maloni - SCGP 102**

Title: Mapping Class Group Actions on Character Varieties

Abstract: In this talk we study the action of the mapping class group on the SL(2,C)-character variety. In particular, we focus on the character variety of the free group F_3 of rank 3, considered as the fundamental group of the four-holed sphere S. We define a domain of discontinuity for this action which strictly contains the interior of discrete and faithful representations. We will describe the combinatorial view point we adopt using trace functions on simple closed curves, and sketch the main ideas of the proof. In the case of real characters, we show that this domain of discontinuity may be non-empty on the components where the relative Euler class is non-maximal. Time permitting, we will also discuss the more recent work with F. Palesi where we see F_3 as the fundamental group of the three-holed projective plane N, and the various open questions on the topic. (This is joint work with F. Palesi and S. P. Tan.)

11:30am **Short Break - SCGP Cafe**

11:45am **Motohico Mulase - SCGP 102**

Title: Algebraic geometry of Gaiotto correspondence and quantization of Higgs bundles

Abstract: In this talk, I will start with reporting the newly established solution to a conjecture of Gaiotto, due to Olivia Dumitrescu, Laura Fredrickson, Georgios Kydonakis, Raffe Mazzeo, Andrew Neitzke, and myself. The conjecture states that a particular scaling limit of the non-Abelian Hodge correspondence gives a biholomorphic mapping from the Hitchin section of the moduli of G-Higgs bundles to the moduli of Lie(G)-opers in the Betti-moduli space. Here, G is a complex simple Lie group. The process can be understood as a quantization, where C-star action on the Higgs bundle side corresponds to the h-bar deformation family of opers. Then we describe the extension of the biholomorphic correspondence to open neighborhood of the holomorphic Lagrangians on each side. This gives a correspondence totally different from non-Abelian Hodge correspondence. This part of the story is based on a joint work with Dumitrescu, Priya Kshirsagar, and Ruifang Song.

12:45pm **Lunch - SCGP 102**

3:30pm **Tea Time - Lobby**