Higgs bundles and related topics
Titles and Abstracts

Jorgen Andersen : The Verlinde formula for Higgs bundle moduli spaces

In this talk we will present a Verlinde formula for the quantization of the Higgs bundle moduli spaces and stacks for any simple and simply-connected group. We further present a Verlinde formula for the quantization of parabolic Higgs bundle moduli spaces and stacks. We will explain how all these dimensions fit into a one parameter family of 2D TQFT's, encoded in a one parameter family of Frobenius algebras, which we will construct.

David Baraglia : On the image of the strongly parabolic Hitchin map

A parabolic Higgs bundle is called strongly parabolic if the residue of the Higgs field at each puncture lies in the nilpotent radical of the corresponding parabolic. In joint work with M. Kamgarpour and R. Varma we have shown that the moduli space of strongly parabolic Higgs bundles is an integrable system. This motivates us to study the image of Hitchin map for strongly parabolic Higgs bundles. In this talk I will describe the image for arbitrary parabolics in the classical groups or G_2. Surprisingly, we find that the image is isomorphic to an affine space in all cases, except for certain "bad parabolics" in type D, where the image can be singular.

Indranil Biswas : Higgs bundles on Sasakian manifolds

In this joint work with M. Mj we extend the Donaldson-Corlette-Hitchin-Simpson correspondence between Higgs bundles and flat connections on compact Kähler manifolds to compact quasi-regular Sasakian manifolds. A particular consequence is the translation of restrictions on Kähler groups proved using the Donaldson-Corlette-Hitchin-Simpson correspondence to fundamental groups of compact Sasakian manifolds.

Ron Donagi : BPS states, torus links and wild character varieties

A string theoretic framework is constructed relating the cohomology of wild character varieties to refined stable pair theory and torus link invariants. Explicit conjectural formulas are derived for wild character varieties with a unique irregular point on the projective line. For this case the string theoretic construction leads to a conjectural colored generalization of existing results of Hausel, Mereb and Wong as well as Shende, Treumann and Zaslow.

David Dumas : TBA

Vladimir Fock : Higher complex structures: spectral curve

We suggest a geometric structure on smooth surfaces generalizing complex structures. Conjecturally the moduli space M of these structures coincide with higher Teichmüller spaces. In the talk we will discuss some natural properties of M and of its cotangent bundle. In particular we

will construct an analogue of the Hitchin map from cotangent bundle to Lagrangian submanifolds of the cotangent bundle to the curve. This is joint work with A.Thomas.

Tamas Hausel : Mirror symmetry with branes by equivariant Verlinde formulae

I will discuss an agreement of equivariant indices of semi-classical homomorphisms between pairwise mirror branes in the GL_2 Higgs moduli space on a Riemann surface. One side we have the components of the Lagrangian brane of U(1,1) Higgs bundles whose mirror was proposed by Nigel Hitchin to be certain even exterior powers of the hyperholomorphic Dirac bundle on the SL_2 Higgs moduli space. The agreement arises from a mysterious Hard Lefschetz type functional equation. This gives strong computational evidence for Hitchin's proposal. This is joint work with Du Pei.

Victoria Hoskins : Group actions on quiver moduli spaces

We decompose the fixed loci of two types of actions on moduli spaces of quiver representations over a field k using group cohomology and give moduli-theoretic interpretations of the components. First, we consider actions by finite groups of quiver automorphisms and, over the complex numbers, we describe the symplectic and holomorphic geometry of these fixed loci in hyperkaehler quiver varieties in the language of branes. Second, for a perfect field k, we consider the action of the absolute Galois group on the points of this quiver moduli space valued in an algebraic closure of k; the fixed locus is the set of k-rational points, and we obtain a decomposition of this fixed locus indexed by the Brauer group of k and we describe the rational points as quiver representations over division algebras. If time permits, I will explain how these techniques can also be employed to study moduli spaces of Higgs bundles. This is joint work with Florent Schaffhauser.

Adrian Langer : Some remarks on opers

I plan to survey a theory of opers and show a few new results concerning opers in a higher dimensional case.

Qiongling Li : Higgs bundles of cyclic quiver type

Given a G-Higgs bundle over a Riemann surface, there is a unique equivariant harmonic map from the universal cover of the Riemann surface into the associated symmetric space. We find a maximum principle theorem for a type of coupled linear elliptic systems and apply it to analyze the Hitchin equation for Higgs bundles of cyclic quiver type. In this case, the harmonic map is conformal and hence minimal. We show several domination results of the pullback metrics of the branched minimal immersion. This is joint work with Song Dai.

Marina Logares : TBA

Takuro Mochizuki : Mixed twistor D-modules and some examples

In the study of mixed twistor D-modules, an important issue is to relate mixed twistor D-modules with concrete objects in various problems. Although we know that there exist many mixed twistor D-modules by an abstract existence theorem and by the functoriality, it is not easy to describe them explicitly, which is one of the blocks to find applications of the theory.

In this talk, after giving a brief survey of the general theory, we shall describe some examples of mixed twistor D-modules for which the underlying R-modules can be given explicitly. We shall also mention some examples for which V-filtrations can be computed, and we shall explain how they allow us to revisit some known results.

Motohico Mulase : TBA

Pranav Pandit : TBA

Laura Schaposnik : On some singular fibres of the Hitchin fibration

The Hitchin fibration is a natural tool through which one can study the moduli space of Higgs bundles and its interesting subspaces (branes). We shall dedicate this talk to the study of certain singular fibres of the Hitchin fibrations, obtain correspondences between fibres, and provide a geometric description of branes which lie entirely over the singular loci (based partially on work in collaboration with David Baraglia, Steve Bradlow and Sebastian Heller).

Misha Verbitsky : Comples submanifolds of Hopf manifolds

Celebrated Kodaira theorem gives a cohomological criterion of projectivity for a Kahler manifold. Locally conformally Kahler (LCK) manifold is one which admits a Kahler form with coefficients in a real oriented local system L. Examples of LCK manifolds include Hopf manifolds (that is, compact quotients of form $C^n \backslash 0 / Z$) and most non-Kahler surfaces. Compact LCK manifolds are never Kahler unless L is trivial. Clearly, a complex submanifold of an LCK manifold is again LCK. It turns out that a certain cohomology class w, associated with the LCK form, vanishes for all subvarieties of Hopf manifolds, and, conversely, any compact LCK manifold with w=0 can be embedded to a Hopf manifold. This gives an LCK analogue of Kodaira theorem. This is a joint work with Liviu Ornea.

Richard Wentworth : Deligne pairings and flat connections

Abstract: I will discuss a generalization of the construction of metrics and connections on Deligne pairings to the case of flat, not necessarily unitary, connections. In this context, there is an extension of Deligne's functorial Riemann-Roch isomorphism, and this gives an interpretation of the holomorphic extension of analytic torsion of 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 from our construction. This is joint work with Gerard Freixas i Montplet.

Kang Zuo : Constructing crystalline representations on p-adic curves via stable Higgs bundles.

This is a joint work with R-R Sun and J-B Yang. Based on my previous work with Lan-Sheng we show that the category of rank-r periodic logarithmic Higgs bundles on a smooth logarithmic scheme $(X, S)/Z_p$ after twisting line bundles is equivalent to the category of PGL_r-crystalline representations of the etale fundamental group of $X\backslash S/Q_p$.

As applications we show:

1. Any hyperbolic curve carries irreducible PGL_2(F_p^f)- crystalline representations.

2. The projective line with n-marked points (n>3) carries infinetly many irreducible PGL_2(Z_p^f)-crystalline representations and such that the Zariski closure of the set of the corresponding periodic Higgs bundles has dimension n-3.

If time permits I will talk about some results on the finiteness of the set of isomorphic classes of GL_r(W_n(F_p^f))-crystalline representations on a given scheme with bounded r, n and f.