AARHUS UNIVERSITY
DEPARTMENT OF MATHEMATICS
CENTRE FOR QUANTUM GEOMETRY OF MODULI SPACES

Hitchin 70: Differential Geometry & Quantization
Programme, Aarhus 5-8 Sept 2016
Venue: AIAS Aud., building 1632

Monday 5 September

09:00-09:20 Coffee/tea

09:20-09:30 Welcome

09:30-10:30 **David Calderbank:** The quaternionic Feix-Kaledin construction

11:00-12:00 **Christian Bär:** An index theorem for Lorentzian manifolds with boundary

12:00-13:30 Lunch break

13:30-14:30 **Paul Gauduchon**: The Taub-NUT ambitoric structure

14:30-14:45 Coffee/tea

14:45-15:45 **Du Pei:** The Verlinde Formula for Higgs Bundles

16:00-16:45 Coffee/tea

16:45-17:45 **Misha Verbitsky:** Ergodic theory and hyperkähler geometry

18:00 Light supper & networking (Venue MatLab. bldg. 1536)

Tuesday 6 September

09:00-09:30 Coffee/tea

09:30-10:30 **Tamás Hausel:** Equivariant Verlinde algebra for Higgs bundles

11:00-12:00 **Sergei Gukov:** Resurgence in complex Chern-Simons theory and new invariants of 3-manifolds

12:00-13:30 Lunch break

13:30-14:30 **Lisa Jeffrey**: The Genus Two Moduli Space

14:30-14:45 Coffee/tea

14:45-15:45 **Thomas Bruun Madsen:** Quaternionic geometry in eight dimensions

Wednesday 7 September

09:00-09:30 Coffee/tea

09:30-10:30 **Vladimir Fock:** Higher complex structures on Riemann surfaces

11:00-12:00 **Jörg Teschner:** Quantization conditions in the Hitchin system

12:00-13:30 Lunch break

13:30-14:30 **Laura Fredrickson:** From the Hitchin component to opers

14:30-14:45 Coffee/tea

14:45-15:45 **Qiongling Li:** Minimal surfaces for Hitchin representations

16:00-17:00 **Sergei Merkulov**: Exotic automorphisms of the Lie algebra of polyvector fields

18:30 Conference dinner (Venue: Matlab bldg. 1536)

Thursday 8 September - Day of departure

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Book of abstracts

David Calderbank
Title: The quaternionic Feix-Kaledin construction
Abstract: At the turn of the millenium, Birte Feix and Dimitry Kaledin independently obtained a general existence result for hyperkaehler metrics on contangent bundles. Feix's method also proceeds by constructing explicitly a complex manifold with special twistor lines, and showing that the Kodaira moduli space of their real deformations carries a U(1)-invariant hyperkaehler metric with the original Kaehler manifold as a fixed submanifold of the U(1) action. In this talk I discuss a correspondence between U(1)-invariant quaternionic manifolds with a maximal totally complex fixed submanifold, and complex manifolds with a so-called c-projective structure. This generalizes and provides a natural context for the results of Feix and Kaledin. In the four dimensional case, it is also related to a minitwistor construction of asymptotically hyperbolic Einstein-Weyl structures. This is joint work with Aleksandra Borowka.

Christian Bär
Title: An index theorem for Lorentzian manifolds with boundary
Abstract: We show that the Dirac operator on a compact globally hyperbolic Lorentzian spacetime with spacelike Cauchy boundary is a Fredholm operator if appropriate boundary conditions are imposed. We prove that the index of this operator is given by the same expression as in the index formula of Atiyah-Patodi-Singer for Riemannian manifolds with boundary. If time permits, an application to quantum field theory will be sketched. This is the first index theorem for Lorentzian manifolds and, from an analytic perspective, the methods to obtain it are quite different from the classical Riemannian case. This is joint work with Alexander Strohmaier.

Paul Gauduchon
Title: The Taub-NUT ambitoric structure
Abstract: We show that any Kähler structure pertaining the Taub-NUT hyperkähler structure on R^4 is naturally coupled with a complete Kähler surface, isomorphic to a Bryant self-dual Kähler metric on C^2, to form a regular ambitoric structure of parabolic type.

Du Pei
Title: The Verlinde Formula for Higgs Bundles
Abstract: As the moduli space of Higgs bundles is non-compact, its quantization will lead to an infinite-dimensional Hilbert space. However, Hitchin's C*-action lifts to an action on this Hilbert space, whose character is well-defined. String theory predicts that this "Hitchin character" is given by a Verlinde-like formula, for which I will give a proof in this talk. I will further prove a formula for parabolic Higgs bundles and discuss various generalizations. This is joint work with J.E. Andersen and Sergei Gukov based on the paper arXiv:1608.01761.

Misha Verbitsky
Title: Ergodic theory and hyperkahler geometry
Abstract: Let M be a compact manifold. Consider the action of the diffeomorphism group Diff(M) on the (infinite-dimensional) space Comp(M) of complex structures on M. This action is has dense orbits when M is a holomorphically symplectic manifold or a compact torus of dimension > 1. Using ergodic theory, I will show that an orbit of a complex structure I is dense in its component of Comp(M) unless the Picard rank of (M,I) is maximal. This result has many geometric consequences: any semicontinuous invariant of a complex structure is constant in a dense, open set.

Tamás Hausel
Title: Equivariant Verlinde algebra for Higgs bundles
Abstract: Motivated by the work of Gukov and Du Pei we discuss a construction of a Frobenius algebra, which computes equivariant indices of line bundles on the moduli space of Higgs bundles. This is joint work with Andras Szenes.

Sergei Gukov
Title: Resurgence in complex Chern-Simons theory and new invariants of 3-manifolds
Abstract: TBA

Lisa Jeffrey
Title: The Genus Two Moduli Space
Abstract: In 1969 Narasimhan and Ramanan proved the genus two character variety (in other words the moduli space of conjugacy classes of representations ofthe fundamental group of a genus two 2-manifold into SU(2)) is isomorphic to complex projective space in dimension 3. Usually these moduli spaces are singular, because of the presence of representations with nontrivial isotropy. Narasimhan and Ramanan's proof uses methods from algebraic geometry. We use symplectic methods to give a bijection between an open dense subset of the genus two character variety and an open dense subset of CP^3.

Thomas Bruun Madsen
Title: Quaternionic geometry in eight dimensions
Abstract: It is well-known that there are only three positive quaternionic K ahler 8-manifolds. These are the symmetric spaces HP(2), $Gr_2(C^4)$ and $G_2/SO(4)$. It seems natural to ask what happens to this rigidity if one weakens the integrability condition. As the quaternionic Kähler structure is defined by a parallel 4-form Ω, with pointwise stabiliser Sp(2)Sp(1), one way of doing so is by asking that Ω is closed (rather than parallel). In this talk, I shall address a way of \perturbing" the quaternionic K ahler structures so as to obtain "closed" Sp(2)Sp(1)-structures. From this viewpoint $G_2/SO(4)$ is flexible whilst the other two Wolf spaces are not. The talk is based on joint work with Diego Conti and Simon Salamon.

Vladimir Fock
Title: Higher complex structures on Riemann surfaces (Joint work with A. Thomas).
Abstract: The ordinary Teichmüller space can be defined either as the space of complex structures or as a space of hyperbolic structures or as a component of the space of discrete representations of the fundamental group in PSL(2,R). The second and the third definitions were generalized to groups of higher rank providing a definition of a Higher Teichmüller space. In this talk we suggest a construction of a structure generalizing the first definition by constructing a local structure on the surface which can be considered as a complex structure for higher rank.

Jörg Teschner
Title: Quantization conditions in the Hitchin system
Abstract: After reviewing basic results on the integrability and the quantization of Hitchin's integrable system I'll discuss a natural quantization condition that can be imposed on the eigenvalues of the quantized Hamiltonians. For the cases associated to the sl(2) Lie algebra I will explain how this quantization condition can be reformulated in terms of the generating function of the variety of opers within the moduli space of flat SL(2,C)-connections.

Laura Fredericksson
Title: From the Hitchin component to opers
Abstract: Let C be a compact Riemann surface. The SL(n,C)-Hitchin moduli space has two interesting

subspaces: the Hitchin component and the space of opers. The Hitchin component is related to SL(n,R)-representations. Opers are generalizations of projective structures on C. Recently Gaiotto conjectured a relation between these two families of flat SL(n,C)-connections. I will describe a proof of this conjecture. This is joint work with Olivia Dumitrescu, Georgios Kydonakis, Rafe Mazzeo, Andy Neitzke, and Motohico Mulase.

Sergei Merkulov

Title: Exotic automorphisms of the Lie algebra of polyvector fields

Abstract: We show an explicit formula for the action of the Grothendieck-Teichmueller group GT on the Schouten algebra of polyvector fields on any smooth manifold M. This action induces a highly non-trivial (in general) action of GT on the set of Poisson structures on M.