

Speakers, Lecture topics

Marina Logares

Title— Integrable systems and Torelli theorem for parabolic Higgs bundles

Abstract— In the same way that the classical Torelli theorem determines a curve out of its polarized Jacobian we will show that moduli spaces of parabolic and parabolic Higgs bundles over a compact Riemann surface X also determine X . We will make use of a theorem of J. Hurtubise on the geometry of algebraic completely integrable systems in the course of the proof. This is a joint work with I. Biswas and T. Gómez

Jacques Hurtubise

Title - “Deforming irregular singularities”.

Summary: The data classifying irregular singularities and regular singular points are similar, yet different: on one hand one has Stokes factors, and on the other, monodromy. One can deform one to the other, however, and the question is how does this get mediated in terms of the data. Joint work with Christiane Rousseau.

Mulase Motohico

Title: Quantum Curves and Gaiotto's Conjecture

Abstract: Let G be a complex simple Lie group. Gaiotto's conjecture (2014) is a particular construction of G -opers from G -Higgs bundles in the Hitchin component. The conjecture has been solved recently by a joint paper of Dumitrescu, Fredrickson, Kydonakis, Mazzeo, Mulase, and Neitzke (2016). In this talk, I will first describe the conjecture and its solution. I will then present a holomorphic correspondence between the specific G -Higgs bundles and G -opers, and show that this relation is exactly the same as the quantum curve construction of Dumitrescu-Mulase (2013). The talk is based on a forthcoming joint work with Olivia Dumitrescu.

Richard Wentworth

Title: Higgs bundles, harmonic maps, and applications.

Abstract: These lectures will outline the main ideas behind the nonabelian Hodge correspondence. I will introduce the key ideas behind equivariant harmonic maps and Higgs bundles. I will sketch the proofs of Corlette's theorem on existence of harmonic metrics, and Hitchin-Simpson's result generalizing the Donaldson-Uhlenbeck-Yau theorem on stable bundles. Time permitting, I will briefly survey some applications to Kähler groups, analytic compactifications of moduli spaces, and the harmonic maps approach to asymptotics of character varieties.

Schumacher

Title - The Weil-Petersson current for moduli of vector bundles and applications to orbifolds

Abstract: We investigate stable holomorphic vector bundles on a compact complex Kaehler manifold and more generally on an orbifold that is equipped with a Kaehler structure. We use the existence of Hermite-Einstein connections in this set-up and construct a generalized Weil-Petersson form on the moduli space of stable vector bundles with fixed determinant bundle. We show that the Weil-Petersson form extends as a (semi-)positive closed current for degenerating families that are restrictions of coherent sheaves. Such an extension will be called a Weil-Petersson current. When the orbifold is of Hodge type, there exists a certain determinant line bundle on the moduli space; this line bundle carries a Quillen metric, whose curvature coincides with the generalized Weil-Petersson form. As an application we show that the determinant line bundle extends to a suitable compactification of the moduli space.

Vijaylaxmi Trivedi

Title- Hilbert-Kunz Density Function and Hilbert-Kunz Multiplicity

Abstract- In this talk we recall a well-studied $\text{char } p$ invariant Hilbert-Kunz multiplicity, $e\text{HK}(R, I)$, for a local ring (standard graded) ring R with respect to an (graded) ideal of finite colength I . This could be considered as an analogue of Hilbert-Samuel function and Hilbert-Samuel multiplicity (but specific to characteristic $p > 0$).

We give a brief survey of some of the results on this invariant. In the graded case for a pair (R, I) , or equivalently for a projective scheme over a field of $\text{char } p > 0$ (based on the recent work), we introduce a new invariant, the Hilbert-Kunz density function, which is a limit of a uniformly convergent sequence of real valued compactly supported, piecewise linear and continuous functions.

We express $e\text{HK}(R, I)$ as an integral of this function. We prove that this function (unlike $e\text{HK}$) satisfies a multiplication formula for the Segre product of projective varieties. As a consequence some known result for $e\text{HK}$ of the projective schemes hold for $e\text{HK}$ of their Segre products.

We discuss a few other applications of this function, like asymptotic behaviour of $e\text{HK}(R, I_k)$ (possible approach for $e\text{HK}$ in characteristic 0.) as $k \rightarrow \infty$, $e\text{HK}$ of the Segre product and a possible approach for $e\text{HK}$ in characteristic 0.

John Loftin

Title- Minimal Surfaces in SCH^2 and their Higgs Bundles

This is joint work with Ian McIntosh. Let Σ be a closed oriented surface of genus at least 2. We study minimal immersions of the Poincare disk to the complex hyperbolic plane which are equivariant in the sense that there exists a representation ρ of $\pi_1\Sigma$ to $PU(2,1)$ which intertwines a Fuchsian representation providing the induced conformal structure on Σ . In particular, we use Higgs bundles to describe all such minimal immersions in terms of algebraic data on a Riemann surface. If time permits, we will also discuss the special case of minimal Lagrangian immersions, with some previous results of L-McIntosh & Huang-L-Lucia, together with some new results in this case.

Rukmini Dey

Title : The Quillen Determinant Bundle and Geometric Quantization of Various Moduli Spaces

Abstract : We will give a brief introduction to geometric quantization and Quillen's determinant line bundle. Then we will describe the quantization of various moduli spaces arising from physics using the Quillen construction. Examples include the Hitchin system and the vortex moduli space. We will also talk about a general theorem which essentially says that (a suitable tensor power) of the pre-quantum line bundle can be realised as a Quillen determinant line bundle for the quantization of a compact symplectic (or Kahler) manifold with integral symplectic (or Kahler) form. The last theorem is joint work with Mathai Varghese.

Sorin Dumitrescu

Title : Holomorphic rigid geometric structures on compact manifolds

This talk deals with rigid holomorphic geometric structures on compact complex manifolds. One can think at the following interesting examples: holomorphic affine connections or holomorphic Riemannian metrics. We will discuss the classification of compact complex manifolds bearing a holomorphic Riemannian metric or, more general a holomorphic affine connection. We will present a joint work with Benjamin McKay showing that complex compact manifolds with algebraic dimension zero bearing holomorphic affine connections have infinite fundamental group. We will also present a recent joint work with Indranil Biswas proving that compact complex manifolds with algebraic dimension one admitting holomorphic Riemannian metrics have infinite fundamental group.

Sean Lawton

Title : Homotopy of Character Varieties

Abstract: In this talk we will survey recent results concerning the topology of the Betti moduli space of representations of a finitely generated group into a real reductive Lie group.

Subhojoy Gupta

Title: Projective structures on Riemann surfaces and their monodromy

Abstract: The holonomy of a complex projective structure on a surface S determines a representation from the fundamental group of S to $\mathrm{PSL}(2, \mathbb{C})$. This talk concerns the resulting map from the space of marked projective structures $P(S)$ to the $\mathrm{PSL}(2, \mathbb{C})$ character variety. I shall describe past work with S. Baba on fibers of this map and their projection to the Riemann moduli space. Our work uses Thurston's geometric parameterisation of the space $P(S)$ by grafting deformations.