International Conference on Analytic and Algebraic Geometry related to Bundles

18–22 March, 2013

Schedule and Abstracts of Talks

Tata Institute of Fundamental Research

DAY& DATE	11.00 a.m.	11.30 a.m.-12.30 p.m.	12.45 p.m.	2.30 p.m. –3.30 p.m.	3.30 p.m.	4.00 p.m – 5.00 p.m
MONDAY MARCH 18	**T**	F. Campana @@	**L**	S. Venugopalan @@	**T**	A. Zamora @@
TUESDAY MARCH 19		M. Verbitsky @@	**U**	S. Bhaumik @@		A. Hogadi @@
WEDNESDAY MARCH 20	**E**	N. Borne @@	**N**	F. Schaffhauser @@	**E**	M. Logares ++
THURSDAY MARCH 21		T. Gomez @@	**C**	A. Dhillon @@		A. Mandini @@
FRIDAY MARCH 22	**A**	G. Wilkin @@	**H**	S. Subramanian @@	**A**	-

@@ In the Lecture Theatre AG-66
++ In the Lecture Room AG-69

Title of Talks

F. Campana	*Generic semi-positivity theorem for orbifold pairs, and application to the Shafarevich-Viehweg 'hyperbolicity' conjecture.*
S. Venugopalan	*Classification of affine vortices*
A.Zamora	*GIT Characterization of the Harder-Narasim Filtration for Finite Dimensional Representations of Quivers.*
M. Verbitsky	*Instanton bundles on P^3 and rational curves in twistor spaces of Nakajima quivers.*
S. Bhaumik	*On Quadric Bundles*
A. Hogadi	*Birational invariance of the S-fundamental group scheme.*
N. Borne	*Parabolic vector bundles and Nori's fundamental group scheme.*
F. Schaffhauser	*The Yang-Mills equations over Klein surfaces.*
M. Logares	*TBA*
T. Gomez	*Torelli theorem for the Deligne-Hitchin moduli space.*
A. Dhillon	*Essential dimension of algebraic stacks.*
A. Mandini	*Polygon Spaces and an involution On The Moduli Space Of Parabolic Higgs Bundles.*
G. Wilkin	*Moment map flows and the Hecke correspondence for quivers.*
S. Subramanian	*Fundamental Group of a smooth projective variety over a ring of Witt vectors.*

Abstracts

Monday, 18 March 2013 (11:30-12:30)

Speaker : F. Campana
Title : Generic semi-positivity theorem for orbifold pairs, and application to the Shafarevich-Viehweg 'hyperbolicity' conjecture.

The generic semi-positivity theorem of Miyaoka can be formulated so as to state that a projective manifold with pseudo-effective canonical bundle has generically semi-positive cotangent bundle. We extend this statement to the case of smooth log-canonical pairs by a totally different proof (in characteristic zero). As a consequence, we can prove that if some tensor power of such an orbifold cotangent bundle contains a 'big' line bundle, its canonical bundle itself is 'big'. This is exactly what is needed to imply (using a fundamental result of Viehweg-Zuo) the conjecture of the title: if a family of canonically polarised manifold parametrised by a quasi-projective manifold B has maximal 'variation', the B is of log-general type.

Monday, 18 March 2013 (2:30–3:30)

Speaker : S. Venugopalan
Title : Classification of affine vortices

The work of Jaffe-Taubes, Bradlow relate the stability of holomorphic pairs (a holomorphic structure on a Hermitian vector bundle and a holomorphic section on it) with the zeros of the vortex equation. This set-up can be generalized by replacing the vector bundle by a fiber bundle - the fiber is a Kahler manifold X with Hamiltonian action of a compact Lie group K. There is a Hitchin-Kobayashi correspondence for K-vortices on the complex plane, and it leads to a classification of such vortices modulo gauge. This result has applications in constructing a quantum Kirwan map in Gromov-Witten theory.

Monday, 18 March 2013 (4:00–5:00)

Speaker : A. Zamora
Title : GIT Characterization of the Harder-Narasim Filtration for Finite Dimensional Representations of Quivers.

In a moduli problem where we use Geometric Invariant Theory to take the quotient to get a moduli space, an unstable object gives a GIT unstable point in certain parameter space. To a GIT unstable point, Kempf associates a "maximally destabilizing" 1-parameter subgroup, and this induces a filtration of the object. We show that this filtration coincides with the Harder-Narasimhan filtration for finite

dimensional representations of a finite quiver on vector spaces, using the construction of a moduli space for these objects given by King. This work is a continuation of previous work joint with T Gmez and I. Sols, where we show a similar correspondence for moduli problems related to sheaves with additional structure, now in a different moduli problem.

Tuesday, 19 March 2013 (11:30–12:30)

Speaker : M. Verbitsky

Title : Instanton bundles on P^3 and rational curves in twistor spaces of Nakajima quivers.

I will explain the construction of instantons over P^3 via a complexified version of the ADHM construction. This gives a holomorphic connection with special holonomy on the moduli of mathematical instantons on P^3. The same geometry, called trisymplectic, appears whenever one attempts to build a complexification of a hyperkaehler manifold. The space of moduli of mathematical instantons on CP^3 can be identified with a component on the moduli space of rational curves on a twistor space of a certain quiver variety. The trisymplectic structure on this space is applied to obtain the space of instantons using a new geometric reduction procedure, called trihyperkaehler reduction. This is used to prove that the space of mathematical instantons on CP^3 is smooth, settling a long-standing conjecture. This is a joint work with Marcus Jardim.

Tuesday, 19 March 2013 (2:30–3:30)

Speaker : S. Bhaumik

Title : On Quadric Bundles

Let $GO(n)$ be the general orthogonal group i.e. the algebraic group of similitudes. On a scheme where 2 is invertible, a principal $GO(n)$-bundles is equivalent to a vector bundle together with a nondegenerate quadratic form with values in a line bundle. We will determine the smooth-étale cohomology ring of the classifying stack $BGO(n)$ with mod 2 coefficients over a separably closed field of characteristic $\neq 2$. (This part is based on my paper arXiv:1201.4628).
For a quadric bundle which minimally degenerates over a divisor, we will investigate how its quadric invariants behave under the Gysin map in étale cohomology. The results are algebro-geometric analogues of the topological results proved by Yogish Holla and Nitin Nitsure for complex vector bundles. (This part is based on my joint paper with Nitsure - arXiv:1302.0092).

Tuesday, 19 March 2013 (4:00–5:00)

Speaker : A. Hogadi
Title : Birational invariance of the *S*-fundamental group scheme.

In this talk we will prove that the *S*-fundamental group scheme is a birational invariant of smooth projective varieties. This is joint work with Vikram Mehta.

Wednesday, 20 March 2013 (11:30–12:30)

Speaker : N. Borne
Title : Parabolic vector bundles and Nori's fundamental group scheme.

This is a joint work with A. Vistoli. Parabolic vector bundles were introduced in the 70's to interpret the representations of the topological fundamental group of a non-compact Riemann surface. Nowadays, the definition as been generalized to arbitrary algebraic varieties endowed with a normal crossings divisor. They are moreover better understood via an equivalence of categories with usual vector bundles on certain orbifolds (algebraic stacks) built out directly from the variety and the divisor. I will first describe this correspondence in the easy case of a simple normal crossings divisor, and then turn to the general case, which requires the use of log geometry. If time permits, I will discuss how parabolic bundles are related to Nori's fundamental group scheme.

Wednesday, 20 March 2013 (2:30–3:30)

Speaker : F. Schaffhauser
Title : The Yang-Mills equations over Klein surfaces .

A Klein surface is the differential-geometric version of a real algebraic curve and can be seen as a Riemann surface equipped with an anti-holomorphic action of the Galois group of the field of real numbers. A moduli problem for Galois-invariant vector bundles over such a Riemann surface can be posed that naturally gives rise to two different kinds of invariant vector bundles, the real ones and the quaternionic ones. Using the gauge-theoretic approach to holomorphic vector bundles of Atiyah and Bott, moduli spaces can be constructed in a unified manner for both types of bundles. In my first talk, I will explain, based on results of Biswas, Huisman and Hurtubise (2010), the construction of these moduli spaces from that point of view. Then, in my second talk, I will show how one can compute the equivariant mod 2 Betti numbers of moduli spaces of real and quaternionic vector bundles (this second part is joint work with Melissa Liu from Columbia University).

Wednesday, 20 March 2013 (4:00–5:00)

Speaker : M. Logares
Title : Not given

Not given

Thursday, 21 March 2013 (11:30–12:30)

Speaker : T. Gomez
Title : Torelli theorem for the Deligne-Hitchin moduli space.

We prove a Torelli type theorem for the Deligne-Hitchin moduli space associated to a smooth projective curve X and semisimple group G (joint work with I. Biswas and N. Hoffmann).

Thursday, 21 March 2013 (2:30–3:30)

Speaker : A. Dhillon
Title : Essential dimension of algebraic stacks.

This talk will give an overview of results on essential dimension of algebraic stacks. We will discuss some recent work of Reichstein and Vistoli and how these techniques can be applied to study the essential dimension of vector bundles over curves.

Thursday, 21 March 2013 (4:00–5:00)

Speaker : A. Mandini
Title : Polygon Spaces and an involution On The Moduli Space Of Parabolic Higgs Bundles.

Joint work with I. Biswas, C. Florentino and L. Godinho. On the moduli space of trivial rank-2 parabolic Higgs bundles over $\mathbb{CP}^1$ with fixed determinant and trace-free Higgs eld consider the involution mapping the Higgs field Φ to Φ . The isomorphism classes of stable parabolic Higgs bundles fixed by this involution correspond to $SU(2)$ or $SL(2;\mathbb{R})$ representations, the former corresponding to pairs $(E,0)$, i.e., those with zero Higgs eld. We study the latter type of fixed points in the special case where the underlying vector bundle is holomorphically trivial. In this case, there is an isomorphism between the hyperpolygon spaces and moduli spaces of rank two parabolic Higgs bundles (E,Φ) where E is a topologically trivial bundle over $\mathbb{CP}^1$. Taking advantage of this isomorphism we give an explicit characterization of the fixed components. Moreover, we identify the fixed points set components with moduli spaces of polygons in the Euclidian space and in the Minkowski space.

Friday, 22 March 2013 (11:30–12:30)

Speaker : G. Wilkin
Title : Moment map flows and the Hecke correspondence for quivers.

Narasimhan and Ramanan's Hecke correspondence for bundles over curves relates bundles of different degree via a Hecke modification over a point on the curve. In the 1990s, Nakajima used an analogous correspondence for quiver varieties (Hecke modifications of bundles over an ALE 4-manifold) to give a geometric construction of representations of affine Kac-Moody algebras and quantum affine algebras. In this talk I will give an analytic interpretation of Nakajima's Hecke correspondence via the gradient flow of the norm-square of a moment map.

Friday, 22 March 2013 (2:30–3:30)

Speaker : S. Subramanian
Title : Fundamental Group of a smooth projective variety over a ring of Witt vectors.

We study the fundamental group scheme of a smooth projective variety over the ring of Witt vectors of an algebraically closed field of positive characteristic.