Discussion Meeting on
Analytic and Algebraic Geometry

17–21 March, 2014

Schedule and Abstracts of Talks

Tata Institute of Fundamental Research

DAY& DATE		11.30 a.m-12.30p.m		2.30 p.m - 3.30 p.m		4.00 p.m - 5.00 p.m
MONDAY MARCH 17	T	U.N. Bhosle@@		Nitin Nitsure@@	T	Benjamin Mckay@@
TUESDAY MARCH 18		Viktoria Heu@@	U	Ritwik Mukherjee@@		Niels Borne@@
WEDNESDAY MARCH 19	E	Mahan Mj@@		Harish Seshadri@@	E	Chaitanya Senapathi++
THURSDAY MARCH 20		Johannes Huisman@@		S.Venugopalan@@		Javier Martinez@@
FRIDAY MARCH 21	A	Kingshook Biswas@@		L. Brambila-Paz@@	A	

@@ In the Lecture Theatre AG-66

++ In the Lecture Room AG-69

Title of Talks

U.N. Bhosle	*Hitchin pairs on singular curves.*
Nitin Nitsure	*Cohomology of algebraic atacks, and application to quadric invariants.*
Benjamin McKay	*Locally homogeneous geometry on algebraic manifolds.*
Viktoria Heu	*Flat rank 2 vector bundles on genus 2 curves.*
Ritwik Mukherjee	*Counting curves via Topology.*
Niels Borne	*The Nori fundamental gerbe.*
Mahan Mj	*3-manifolds and (quasi)projective groups*
Harish Seshadri	*Noncompact manifolds with positive curvature.*
Chaitanya Senapathi	*A lower bound for the index of a geodesic in a full flag manifold.*
Johannes Huisman	*Chern-Stiefel-Whitney classes of real vector bundles.*
S. Venugopalan	*A symplectic analog for stable quasimaps.*
Javier Martinez	*E-polynomials of character varieties.*
Kingshook Biswas	*Rigidity theorems for Moebius maps between boundaries of $CAT(-1)$ spaces.*
L. Brambila-Paz	*On Chow Stability for algebraic curves.*

Abstracts

Monday, 17 March 2014 (11:30-12:30)

Speaker : **U.N. Bhosle**
Title : **Hitchin pairs on singular curves**

We define generalized parabolic Hitchin pairs (GPH) on a nonsingular curve X and construct their moduli spaces. When X is the normalization of an integral projective curve Y, we give a birational morphism from the moduli space of good GPH on X to the moduli space of Hitchin pairs on Y. We define a Hitchin map on GPH and show that it is a proper map on the moduli space of GPH and induces a proper Hitchin morphism on a subscheme of the moduli space of Hitchin pairs on Y. We study relation between Hitchin pairs and the compactified Jacobian of a spectral curve.

Monday, 17 March 2014 (2:30–3:30)

Speaker : **Nitin Nitsure**
Title : **Cohomology of algebraic atacks, and application to quadric invariants.**

A cohomology theory for finite and l-adic coefficients has recently been developed for algebraic stacks by Behrend, Laszlo, Olsson, etc. I will give an exposition of this theory, and indicate application to quadric invariants (joint work with Saurav Bhaumik).

Monday, 17 March 2014 (4:00–5:00)

Speaker : **Benjamin McKay**
Title : **Locally homogeneous geometry on algebraic manifolds**

I will describe some obstructions to locally homogeneous holomorphic geometric structures on smooth complex projective varieties.

Tuesday, 18 March 2014 (11:30–12:30)

Speaker : **Viktoria Heu**
Title : **Flat rank 2 vector bundles on genus 2 curves**

We will explore the particularly rich geometry of the (non separated) moduli space of such bundles, resuming and completing classical results.

Tuesday, 18 March 2014 (2:30–3:30)

Speaker : **Ritwik Mukherjee**
Title : **Counting curves via Topology.**

Enumerative geometry is a branch of mathematics concerned with the following question: "How many geometric objects are there that satisfy certain constraints?" Thesimplest example of such a question is: "How many lines pass through two distinct points?"A more interesting example is: "How many lines are there in threedimensional space that intersect four generic lines?"In this talk we will describe a topological method to approach enumerative questions. We will use this method to count how many degree d curves are there in CP^2 that pass through certain number of generic points and have certain singularities.

Tuesday, 18 March 2014 (4:00–5:00)

Speaker **:** **Niels Borne**
Title **:** **The Nori fundamental gerbe**

This is joint work with Angelo Vistoli. I will first review various constructions of fundamental groups in algebraic geometry (due to Grothendieck, Nori) and also discuss base-point free versions. Then I will explain why a (reasonable) scheme over a field admits a profinite fundamental gerbe, and how this relates to previous constructions. I will also give an application of our main result and potential generalizations.

Wednesday, 19 March 2014 (11:30–12:30)

Speaker **:** **Mahan Mj**
Title **:** **3-manifolds and (quasi)projective groups**

We shall classify quasiprojective and projective 3-manifold groups. If time permits, we shall use this to classify 3-manifolds admitting a good complexification (in the sense of Totaro). This is joint work with Indranil Biswas.

Wednesday, 19 March 2014 (2:30–3:30)

Speaker **:** **Harish Seshadri**
Title **:** **Noncompact manifolds with positive curvature**

This is a survey talk on known results about the topology of complete noncompact Riemannian or Kahler manifolds which satisfy various notions of positive curvature.

Wednesday, 19 March 2014 (4:00–5:00)

Speaker : **Chaitanya Senapathi**

Title : **A lower bound for the index of a geodesic in a full flag manifold.**

A flag manifold can be writtien as a quotient of acompact group, as a consequence we can equip the flag manifold with the push forward of the bi-invariant metric. This metric has non-negative curvature and is not Kahler. We demonstrate a lower bound for the index of a geodeic which is critical among paths joining two complex submanifolds. As a consequence of this lower bound, homotopy connectedness results of Sommese and others follow.

Thursday, 20 March 2014 (11:30–12:30)

Speaker : **Johannes Huisman**

Title : **Chern-Stiefel-Whitney classes of real vector bundles**

Let X be a real algebraic variety and F a real vector bundle over X. I will define Chern-Stiefel-Whitney classes of F with values in certain hypercohomology groups on the quotient topological space $X(C)/G$, where G is the Galois group of C/R. These classes unify the ordinary characteristic classes in the sense that they induce the Chern classes of $F(C)$, on the one hand, and the Stiefel-Whitney classes of $F(R)$, on the other hand. The construction sheds a seemingly new light on the fact that the mod-2 cohomology ring of a real Grassmannian is the reduction modulo 2 of the integral cohomology ring of a complex Grassmannian after dividing all degrees by 2.

Thursday, 20 March 2014 (2:30–3:30)

Speaker : **S. Venugopalan**

Title : **A symplectic analog for stable quasimaps**

The stable quasimap compactification is an alternate way of compactifying the moduli space of holomorphic maps from a curve to a GIT quotient compared to Kontsevich's stable map compactification. This talk will give an introduction to quasimaps and present a symplectic analog for them - this is a space of vortices with varying domain curve.

Thursday, 20 March 2014 (4:00–5:00)

Speaker : **Javier Martínez**

Title : **E-polynomials of character varieties**

The G-character variety of a surface of genus g is the moduli space parametrizing representations of the fundamental group of the surface into G. Twisted character varieties consist of representations of the fundamental group of a punctured surface with fixed holonomy around the puncture. Using a geometric technique based on stratifications and fibrations of the moduli space, we will show how to compute the E-polynomials of these spaces for low genus $(g = 1, 2, 3), G = SL(2, \mathbb{C}), PGL(2, \mathbb{C})$. (joint work with V.Munoz)

Friday, 21 March 2014 (11:30–12:30)

Speaker : **Kingshook Biswas**

Title : **Rigidity theorems for Moebius maps between boundaries of** $CAT(-1)$ **spaces.**

Motivated by classical rigidity results for negatively curved spaces, we study Moebius and conformal maps between boundaries of $CAT(-1)$ spaces. For a conformal map f between boundaries of $CAT(-1)$ spaces X, Y, we define a function $S(f)$ on the space of geodesics of X, the "integrated Schwarzian" of f, which measures the deviation of f from being Moebius. In particular if X is a simply connected complete negatively curved Riemannian manifold with sectional curvatures bounded above and below and Y is a proper geodesically complete $CAT(-1)$ space, we give an explicit formula for the cross-ratio distortion of f in terms of $S(f)$, showing in particular that $S(f)$ is identically zero if and only if f is Moebius. We show that a Moebius map between boundaries of proper geodesically complete $CAT(-1)$ spaces extends to a (1, log 2)-quasi-isometry between X and Y. For a simply connected complete negatively curved Riemannian manifold (X, g_0), we show that a smooth 1-parameter compactly supported deformation through negatively curved metrics (g_t) is isometric if all the boundary maps are Moebius. We also show that a metric g with $(g - g_0)$ compactly supported and small enough in C^3 norm is isometric to g_0 if the boundary map is Moebius. The main tools are the integrated Schwarzian and results on the ray transform on a Riemannian manifold due to Croke-Sharafutdinov.

Friday, 21 March 2014 (2:30–3:30)

Speaker : **L. Brambila-Paz**

Title : **On Chow Stability For Algebraic Curves**

In the last decades there have been introduced different concepts of stability for projective varieties. In this talk we give a natural and intrinsic criterion of the Chow, and Hilbert, stability for irreducible complete reduced curves C, with at most ordinary nodes and cusps as singularities. Namely, if the restriction of the tangent bundle of the projective space to C is stable then C is Chow stable, and hence Hilbert stable. We apply this criterion to describe a smooth open set of an irreducible component of the Hilbert scheme.