

Nagaraj Fest: 10-12 July 2018

Conference on Algebraic Geometry and related areas

The Institute of Mathematical Sciences, Chennai

Equivariant principal bundles on toric varieties

Arijit Dey, IITM, Chennai

(This is based on joint work with Indranil Biswas and Mainak Poddar)

Following Nori, torus (T) equivariant principal G bundles over a toric variety X are precisely the functors from $G\text{mod}$ to the category of T equivariant vector bundles satisfying certain conditions. Assuming the base field to be complex numbers, we will prove a Klyachko type theorem for the classification of T equivariant principal G bundles over X with at most factorial singularities, when G is reductive.

Torsors on semistable curves and the problem of degenerations

V Balaji, CMI, Chennai

We answer two long-standing questions in the classification of G -torsors on curves for a simple, simply connected algebraic group G over the field of complex numbers. The first question is to give an intrinsic definition of (semi)stability for a G -torsor on an *irreducible nodal curve* and the second one is the construction of a flat degeneration of the moduli space of semistable G -torsors when the smooth curve degenerates to an irreducible nodal curve. A generalization of the classical Bruhat-Tits group schemes to two-dimensional regular local rings and an application of the geometric formulation of the McKay correspondence provide the key tools.

Some results on Seshadri constants

Krishna Hanumanthu, CMI, Chennai

Let X be a projective variety and let L be a line bundle on X . The Seshadri criterion for ampleness says that L is ample if and only if there is a positive real number ϵ such that for every pair (C, x) of a curve C on X and point x on C , the ratio $L.C/m$ is at least ϵ , where $L.C$ denotes the intersection product of L and C and m is the multiplicity of C at x . Inspired by this criterion, Demailly introduced the notion of Seshadri constants in the 1990s. They have interesting connections to the geometry of projective varieties and their study is now a very active area of research with connections to several different topics. We will give an overview of the current work on Seshadri constants and discuss some recent results.

Symplectic geometry of a moduli space of framed Higgs bundles

Indranil Biswas, TIFR, Mumbai

(Joint work with Marina Logares and Ana Peon-Nieto)

Let X be a compact Riemann surface and D an effective divisor on X . Let $N_H(r, d)$ denote the moduli space of D -twisted stable Higgs bundles (a special class of Hitchin pairs) on X of rank r and degree d . It is known that $N_H(r, d)$ has a natural holomorphic Poisson structure which is in fact symplectic if and only if D is the zero divisor. We prove that $N_H(r, d)$ admits a natural enhancement to a holomorphic symplectic manifold which is called $M_H(r, d)$. This $M_H(r, d)$ is constructed by trivializing, over D , the restriction of the vector bundles underlying the D -twisted Higgs bundles; such objects are called framed Higgs bundles. We also investigate the symplectic structure on the moduli space $M_H(r, d)$ of framed Higgs bundles and also the Hitchin system associated to it.

Secant Bundles on Symmetric Power of Curves

Krishanu Dan, CMI, Chennai

(This is a joint work with Suratno Basu)

Let C be a smooth, projective, irreducible curve over complex numbers, and let $S^2(C)$ be the second symmetric power of C . It is a smooth, irreducible, projective surface. Given a vector bundle of rank r on C , one can naturally associate a rank $2r$ vector bundle on $S^2(C)$, called secant bundles. In this talk we will discuss stability conditions of secant bundles with respect to certain ample divisors.

A geometric framework for dynamics with unilateral constraints and friction.

Nitin Nitsure, TIFR, Mumbai

We present a new geometric framework to deal with mechanical systems which have unilateral constraints, and are subject to damping/friction, which cannot be treated within usual classical mechanics. In this new framework, the dynamical evolution of the system takes place on a multidimensional curvilinear polyhedron, and energetics near the corners of the polyhedron leads to qualitative behavior such as stable entrapment and bifurcation. We illustrate this by an experiment in which dumbbells, placed inside a tilted hollow cylindrical drum that rotates slowly around its axis, climb uphill by forming dynamically stable pairs, seemingly against the pull of gravity.

On the index of homogeneous spaces under connected linear algebraic groups

Parimala Raman, Emory University, USA

For principal homogeneous spaces under connected linear algebraic groups, it is a question of Serre whether index one spaces admit rational points. We discuss recent progress on more general questions concerning the existence of closed points of degree equal to the index of homogeneous spaces under connected linear algebraic groups.

On Stratified Bundles

Parameswaran A J, TIFR, Mumbai

(This is an on going research work jointly with S. Subramanian)

We show that if we have a dominant separable morphism of smooth projective varieties which induces surjection (resp. isomorphism) of the etale fundamental group will induce surjection (resp. isomorphism) of the stratified fundamental group.

Symplectic geometry of character varieties and (quantum) gauge theory

T R Ramadas, CMI, Chennai

Automorphism groups of Schubert Varieties and Rigidity of Bott-Samelson-Demazure-Hansen varieties

Senthamarai Kannan, CMI, Chennai

If G is a simple laced algebraic group of adjoint type, earlier it is proved that the neutral component of the automorphism group of $X(w)$ is a quotient of the stabiliser of $X(w)$. Recently, we have proved that every parabolic subgroup of G containing B properly is the neutral component of the automorphism group of a Schubert variety. IN type B_n and C_n , We also give a combinatorial criterion for a BSDH variety to be rigid.

A relative version of Gieseker's problem on stratified vector bundles

V. Srinivas, TIFR, Mumbai

(This is a joint work with H. Esnault.)

This talk will discuss the proof of a result, which may be viewed as solving a relative version of a problem of Gieseker: if a map $f : X \rightarrow Y$ of smooth projective varieties in characteristic p induces the zero map on etale fundamental groups, then the pullback under f^* of any stratified bundle is trivial.

Bounded generation for $SL_2(\mathbb{O}_S)$.

B. Sury, ISI, Bangalore

(Based on joint work with Aleksander Morgan and Andrei Rapinchuk.)

Let \mathbb{O} be the ring of S -integers in a number field k . We prove that if the group of units \mathbb{O}^\times is infinite then every matrix in $\Gamma = SL_2(\mathbb{O})$ is a product of at most 9 elementary matrices. This essentially completes a long line of research in this direction. As a consequence, we obtain that Γ is boundedly generated as an abstract group.

Arithmeticity of monodromy groups of families of cyclic covers of the projective line

T N Venkataramana, TIFR, Mumbai

Deligne and Mostow constructed non-arithmetic lattices in $U(n, 1)$ for small n realising them as monodromy groups of certain families of d fold cyclic covers of the projective line, ramified at a small number of points relative to d . In contrast we show that if the number of ramification points n exceeds the degree d , the monodromy is most often arithmetic.