SHORT TALKS SCHEDULE

AGNES @ DARTMOUTH COLLEGE FALL 2024

Schedule Overview

- **Total Sessions:** 3
- **Duration of each talk:** 6 minutes with 2 minutes for questions.
- **Date:** Saturday November 9th
- **Time:** 11AM – 12PM
- **Location:** parallel sessions in Moore Hall 110, 150, and B03

Session 1: Hodge Theory
Room A: Moore Hall 110

1. *Varieties carrying a nowhere vanishing 1-form* - Benjamin Church
2. *On the Hitchin morphism for surfaces fibered over a curve* - Matthew Huynh
3. *Enumerative invariants for algebraic stacks* - Andrés Ibáñez Núñez
4. *Connected components of generalized strata of differentials with residue conditions* - Myeongjae Lee
5. *Stringy Hodge numbers, Homological Projective Duality and Pfaffian double mirrors* - Zengrui Han
6. *Tropicalizations of Shimura varieties* - Raluca Vlad

Session 2: Algebraic Geometry
Room B: Moore Hall 150

1. *Sections rings of genus one curves* - Mike Cerchia
2. *Algebraic skew embedding of curves* - Andy Day
3. *A counterexample to a question on Grothendieck groups of schemes* - Amal Mattoo
4. *A quick example in measures of association* - Giovanni Passeri
5. *Amitsur subgroup of Fano threefolds* - Shreya Sharma
6. G_0 *of affine, simplicial toric varieties* - Zeyu Shen
7. *Topology of the Vakil–Zinger mapping space* - Terry Song

Session 3: Brauer groups, derived categories
Room C: Moore Hall B03

1. *Hecke modifications of vector bundles* - Roberto Alvarenga
2. *Dimension theory of noncommutative curves* - Anirban Bhaduri
3. *Approximability in noncommutative flavors of algebraic geometry* - Pat Lank
4. *Points of bounded height on weighted projective stacks over global function fields* - Tristan Phillips
5. *Morita theory of cyclic gerbes* - Yu Shen
6. *Classifications of forms of tori using separable algebras* - Pankaj Singh

Date: 11/08-11/10.

Abstracts

Room A

(1) *Nonvanishing* 1*-forms on varieties admitting a good minimal model.*
Presenter: Benjamin Church (Stanford University)
Abstract: Let X be a smooth projective variety and $\omega \in H^0(X, \Omega^1_X)$ a 1-form with no zeros. A theorem of Popa and Schnell says that X is not of general type. We investigate further restrictions on the geometry of X. In particular, we show that X must be close to an isotrivial fibration over an abelian variety.

(2) *On the Hitchin morphism for surfaces fibered over a curve*
Presenter: Mathew Hyunh (Stony Brook University)
Abstract: Let $G/\mathbf{C}$ be a connected, reductive group, and let $X/\mathbf{C}$ be a connected, smooth, projective surface. We can form the moduli space of G-Higgs bundles on X (valued in Ω^1_X, satisfying the integrability condition), which carries a morphism to an affine scheme. This morphism is not surjective in general, but there is a conjecture due to T. S. Chen and B. C. Ngô for what the image of this morphism is. I will describe work in progress on this conjecture in the case when G is a classical group and X is a geometrically ruled surface, or a certain elliptic surface.

(3) *Motivic enumerative invariants of algebraic stacks.*
Presenter: Andrés Ibáñez Núñez (Columbia University)
Abstract: The Euler characteristic of a complex algebraic variety is the alternating sum of its Betti numbers. However, moduli spaces in algebraic geometry are often not varieties but Artin stacks $\mathcal{X}$, and for them the Euler characteristic is undefined, since there may be infinitely many nonzero Betti numbers.

When $\mathcal{X}$ parametrises objects in an abelian category, Joyce defined a meaningful notion of Euler characteristic of $\mathcal{X}$ using the motivic Hall algebra, a structure that heavily depends on the underlying abelian category. This was in turn used to define Donaldson–Thomas invariants by Joyce–Song. I will explain how to define motivic Hall algebra like structures for general stacks and how this yields a definition of Euler characteristic and of Donaldson–Thomas invariants that is valid for nonlinear moduli problems, like G-bundles or G-local systems. A crucial ingredient is the stack of filtrations of $\mathcal{X}$, defined by Halpern–Leistner. This is joint work with Chenjing Bu and Tasuki Kinjo.

(4) *Connected components of generalized strata of meromorphic differentials with linear residue conditions.*
Presenter: Myeongjae Lee (Stony Brook University)
Abstract: Strata of differentials are interesting objects studied in various fields such as Teichmuller dynamics, topology and algebraic geometry. Generalized strata are subsets of the strata of meromorphic differentials, where certain sets of residues summing up to zero. We present the classification of the connected components of these strata.

(5) *Stringy Hodge numbers of Pfaffian double mirrors and Homological Projective Duality*
Presenter: Zengrui Han (Rutgers University)
Abstract: The Pfaffian double mirrors provide historically the first example of derived equivalent but not birationally equivalent Calabi-Yau manifolds. This construction fits into a conceptual framework of Kuznetsov called Homological Projective Duality.

In this project we study the relationship between the Hodge-theoretic aspects and homological aspects of Pfaffian double mirrors. More precisely, we obtain results on the stringy Hodge numbers of Pfaffian double mirrors, and apply them to make numerical prediction on the Lefschetz decomposition of categorical crepant resolution of Pfaffian varieties.

(6) *Tropicalizations of Locally Symmetric Spaces*
Presenter: Raluca Vlad (Brown University)
Abstract: Let D be a symmetric domain and G a discrete algebraic group acting on it. For example, one can take $\mathrm{SL}_2(\mathbb{Z})$ acting on the Siegel upper half-plane via Möbius transformations. We consider a certain (toroidal) compactification of the quotient space D/G, due to Mumford, and we describe its tropicalization, as follows. We construct a collection of polyhedral cones that encodes the combinatorics of the boundary of our compactification. I will show how this tropical object can be used to deduce statements about the cohomology of the original space. The main example I will discuss will be the moduli space of abelian varieties. Based on work in progress with E. Assaf, M. Brandt, J. Bruce, and M. Chan.

Room B

(1) *Section Rings of $\mathbb{Q}$-Divisors on Elliptic Curves*
Presenter: Mike Cerchia (University of Maine)
Abstract: The section ring of a curve is a classical object of study and has applications in arithmetic: with an appropriate curve and divisor, these rings describe rings of modular forms. In this talk, we bound the generators and relations of section rings of genus 1 curves associated to arbitrary $\mathbb{Q}$-divisors. When the corresponding divisor is supported by at most two points, we give a complete description of the ring. This is joint work with Jesse Franklin and Evan O'Dorney.

(2) *Algebraic Skew Embedding for Curves*
Presenter: Andy Day (Penn State)
Abstract: Given a smooth manifold X, a totally skew embedding of X is an embedding of X into an euclidean space $\mathbb{R}^N$ such that for any two distinct points $x, y \in X$, their embedded tangent spaces in $\mathbb{R}^N$ neither intersect nor contain parallel lines. The concept can be generalized to algebraic skew embeddings of complex smooth varieties into complex projective spaces. In this talk, we establish an upper bound and a lower bound of the minimal dimension N such that there exists a skew embedding into the space $\mathbb{CP}^N$ for a given smooth variety X. In particular, we classify the algebraic curves in terms of their minimal skew embedding dimension N.

(3) *A Counterexample to a Question on Grothendieck Groups of Schemes*
Presenter: Amal Mattoo (Columbia University)
Abstract: If an element of the Grothendieck group of the derived category of a scheme is locally represented by perfect complexes, then can the original element be represented by a perfect complex? We provide a counterexample on a projective variety of dimension 2, as well as a counterexample on a thickening of a Dedekind domain.

(4) *A quick example in measures of association*
Presenter: Giovanni Passeri (Stony Brook University)
Abstract: We extend some of the measures of association defined by Lazarsfeld and Martin, obtaining useful invariants to compare the birational geometry of two varieties having different dimensions. We explore such invariants providing examples and computing them in some cases of interest.

(5) *Amitsur subgroup of Fano threefolds*
Presenter: Shreya Sharma (University of South Carolina)
Abstract: The Amitsur subgroup of a smooth Fano G-variety measures the obstruction to G-linearization of line bundles on it. It is an equivariant birational invariant. The Amitsur subgroup of such varieties has already been described in cases of dimensions 1 and 2. A natural next step is to compute it for Fano varieties of dimension 3. In this talk, we discuss the Amitsur subgroup of smooth Fano threefolds defined over the field of complex numbers.

(6) *G_0 of affine, simplicial toric varieties*
Presenter: Zeyu Shen (Rutgers University-New Brunswick)
Abstract: Let k be an algebraically closed field. Let X be an affine, simplicial toric variety over k. It has the form $\operatorname{Spec} k[\sigma^\vee \cap \mathbb{Z}^n]$ for an n-dimensional simplicial cone σ in $\mathbb{R}^n$, where n is the Krull dimension of the variety.Let $G_0(X)$ denote the Grothendieck group of coherent sheaves on X. Then $G_0(X)$ is isomorphic to $\mathbb{Z} \oplus F^1G_0(X)$, where $F^1G_0(X)$ is the first step of the filtration on $G_0(X)$ by codimension of support. In our case, the $F^1G_0(X)$ is always a finite abelian group. In dimension 2, $F^1G_0(X)$ is cyclic of order $|\delta|$, where δ is the determinant of the matrix taking the minimal generators of the simplicial cone σ as its columns. In dimension 3, $F^1G_0(X)$ is an extension of the Chow group $A^1(X)$ by the Chow group $A^2(X)$. The Chow group $A^1(X)$ has order $|\delta|$ in all dimensions. And the order of the Chow group $A^2(X)$ is conjectured to divide $|\delta|$ when $\dim(X) = 3$.

(7) *Dual complex of genus one mapping spaces*
Presenter: Terry Song (University of Cambridge)
Abstract: The dual complex of a smooth variety encodes the combinatorial structure that underlies all its possible normal crossings compactifications. We prove that the dual complexes of genus zero and genus one mapping spaces are contractible (in degrees > 0 and > 1 respectively) via an explicit deformation retraction. In genus one, the key geometric input comes from the Vakil-Zinger space and its tropical interpretation due to Ranganathan–Santos-Parker–Wise. Joint work with Siddarth Kannan (MIT).

Room C

(1) *Hecke modifications of vector bundles*
Presenter: Roberto Alvarenga (UNESP/Tufts University)
Abstract: This talk is dedicated to explain the importance of the calculus of explicit Hecke modifications on vector bundles defined over a smooth and projective curve. After a short introduction, we shall address what is known about.

(2) *Dimension theory of noncommutative curve*
Presenter: Anirban Bhaduri (University of South Carolina)
Abstract: We compute several types of dimension for the bounded derived categories of coherent sheaves of orbifold curves. This completes the calculation of these dimensions for derived categories of noncommutative curves in the sense of Reiten-van den Bergh.

(3) *Approximability in noncommutative flavors of algebraic geometry*
Presenter: Pat Lank (Università degli Studi di Milano)
Abstract: Recently the Bondal-Van den Bergh conjecture has been resolved using approximable triangulated categories. This talk, which is joint work with De Deyn and Manali Rahul, will highlight recent developments in applying the theory of approximability (‘a la Neeman) to noncommutative flavors of algebraic geometry. The focus will be on derived categories arising from noncommutative coherent algebras over a scheme. We will discuss a noncommutative generalization of the Bondal-Van den Bergh conjecture.

(4) *Rational points of prescribed height on weighted projective stacks over global function fields*
Presenter: Tristan Phillips (Dartmouth College)
Abstract: In this talk I will discuss how one can show that the height zeta functions of weighted projective stacks are rational. This gives an exact formula for the number of rational points of a given height.

(5) *Morita theory on root gerbes*
Presenter: Yu Shen (Michigan State University)
Abstract: We study Morita theory of Azumaya algebras on root gerbes $\mathscr{X}$. There, we find explicit equivalent conditions for Morita equivalence. During this study, we find examples of a decomposable category become indecomposable after a Brauer twist.

(6) *Classification of forms of tori using separable algebras*
Presenter: Pankaj Singh (University of South Carolina)
Abstract: Algebraic tori are widely studied due to their connection with Galois cohomology and other algebraic invariants. The connection with Galois cohomology gives us a bijection between Severi-Brauer varieties and central simple algebras. Blunk has given classification of the forms of two dimensional tori in del Pezzo surfaces of degree 6 in terms of separable algebras over an arbitrary field $\mathbb{F}$. Duncan has proved that there exists an injective map from the forms of retract rational tori to isomorphism classes of separable algebras but there is no explicit description of the image of this map as for Blunk. In this talk, we discuss how to use the structure of *Mackey functors* to address this question.