AGNES at UMass Amherst, 2019
Poster Session
Titles and Abstracts

- *Shamil Asgarli* (Brown University)

  Regular birational automorphisms of the plane

  Given a field k, we say that a birational automorphism of $\mathbb{P}^2$ is regular if it restricts to a bijection on the k-rational points. When k is a finite field, such an automorphism induces a permutation on those k-points. Can we recover every abstract permutation on the k-points in this way?

  Using a geometric construction provided by Cantat in 2009, we give a positive answer to the above question when the characteristic is odd. Using a family of homaloidal linear systems found by Ruffini in 1877, we also prove that the subgroup of such automorphisms is of infinite index in the Cremona group and infinitely-generated as an abstract group. This is a work in progress joint with Kuan-Wen Lai, Masahiro Nakahara, and Susanna Zimmermann.

- *Nathan Chen* (Stony Brook University)

  Degree of irrationality of very general abelian surfaces

  The degree of irrationality of a projective variety X is defined to be the smallest degree rational dominant map to a projective space of the same dimension. For abelian surfaces, Yoshihara computed this invariant in specific cases, while Stapleton gave a sublinear upper bound for very general polarized abelian surfaces (A, L) of degree d. Somewhat surprisingly, we show that the degree of irrationality of a very general polarized abelian surface is uniformly bounded above by 4, independently of the degree of the polarization. This result disproves part of a conjecture of Bastianelli, De Poi, Ein, Lazarsfeld and Ullery.

- *Shanna Dobson* (California State University, Los Angeles)

  The Lubin-Tate Tower at Infinite Level as a Perfectoid Space and a Derived Categorical Hodge-Tate Period Map

  Scholze reformulated Rapoport and Viehmann's construction and reformulation of towers of moduli spaces as local Shimura varieties, in hopes that the cohomology of the moduli space of Shimura varieties provides a realization of the Local Langlands correspondences. We review the Lubin-Tate tower as a Perfectoid Space, and then consider a derived categorical analogue of the Hodge-Tate period map.

- *Lian Duan* (University of Massachusetts Amherst)

  Transverse lines to surfaces over finite fields

  Given a smooth hypersurface $X \subseteq \mathbb{P}^n$ defined over an algebraically closed field k, a classical theorem of Bertini implies that $X \cap L$ is smooth for a general straight line L defined over k. The same result in fact holds for any infinite field k. However, when $k = \mathbb{F}_q$ is a finite field, it is possible that $X \cap L$ is singular for every L defined over $\mathbb{F}_q$. One approach to remedy the original Bertini theorem in the case of finite fields is to investigate how large q should be with respect to the invariants of the variety X (such as its degree d) so that X admits a favourable $\mathbb{F}_q$-line. When X is a reflexive curve, the first author proved that there is an $\mathbb{F}_q$-transverse line to X provided that $q \geq d - 1$. In this recent work, we generalize this result and show that when X is a smooth reflexive surface of degree d satisfying $q \geq 1.8d$, there exists an $\mathbb{F}_q$-transverse line to X. This is a joint work with Shamil Asgarli and Kuan-Wen Lai.

- *Iulia Gheorghita* (Boston College)

  Effective divisors in the projectivized Hodge bundle

  We compute the class of the closure of the locus of canonical divisors in the projectivization of the Hodge bundle $\mathbb{P}\overline{\mathcal{H}}_g$ over $\overline{\mathcal{M}}_g$ which have a zero at a Weierstrass point. We also show that the strata of canonical and bicanonical divisors with a double zero span extremal rays of the respective pseudoeffective cones.

- *Ross Goluboff* (Boston College)

  Genus six curves, K3 surfaces, and stable pairs

  A general smooth curve of genus six lies on a quintic del Pezzo surface. Artebani and Kondo have constructed a birational period map for genus six curves by taking ramified double covers of del Pezzo surfaces. In this poster, I will describe a smooth Deligne-Mumford stack parametrizing certain stable surface-curve pairs that essentially resolves this map.

- *Brian Hwang* (Cornell University)

  Toric degenerations, limit linear series, and quivers in Bruhat–Tits buildings.

  We show how quivers (directed graphs) in Bruhat–Tits buildings give rise to degenerations of Grassmannians. These are flat families whose generic fiber is a Grassmannian and whose special fiber is a certain quiver Grassmannian attached to the diagram. It turns out that these can be understood as moduli spaces of limit linear series and provide an easy way to unify a number of such degenerations that arise in algebraic geometry, such as local models of Shimura varieties, linked Grassmannians, the Mumford degeneration, and Mustafin varieties. In fact, it turns out that there are some non-obvious isomorphisms between such degenerations that arise from seemingly unrelated quiver, such as one with a single cycle, and one with multiple cycles. As an illustration, we construct some toric degenerations and point out some interesting connections between these embedded quivers, the toric data of the special fiber, and associated combinatorial diagrams.

- *Yoonjoo Kim* (Stony Brook University)

  Degeneration of hyperkähler manifolds and Nagai's conjecture

  For degenerations of compact hyperkähler manifolds, Nagai's conjecture predicts the behavior of monodromy on the $2k$-th cohomology in terms of monodromy on the second cohomology. Degenerations of hyperkähler manifolds naturally fall into three types, analogous to the well-known situation for K3 surfaces. For type I and III degenerations, the conjecture was established by Kollár-Laza-Saccà-Voisin. Here we settle the conjecture for all currently known examples of compact hyperkähler manifolds, under a certain cohomology assumption on OG10.

- *Jennifer Li* (University of Massachusetts Amherst)

  The Kawamata-Morrison-Totaro Cone Conjecture for log Calabi-Yau surfaces

  Morrison's cone conjecture states that for a smooth Calabi-Yau manifold X, the automorphism group of X acts on its effective nef cone with rational polyhedral fundamental domain. Totaro generalized this conjecture to Kawamata log terminal (klt) Calabi-Yau pairs (X, D). In our project, we are studying pairs (X, D) where X is a smooth projective surface and $D = D_1 + \cdots + D_n$ is a reduced normal crossing divisor on X, with the properties that $K_X + D = 0$ and D has negative-definite self intersection matrix. Results by Gross-Hacking-Keel on mirror symmetry for cusp singularities suggest that we consider the pair (X, D) with a distinguished complex structure in which the mixed Hodge structure on $U = X \backslash D$ is split. The goal of our project is to prove Morrison's cone conjecture in this special case. We note that this is different from Totaro's work, because in our project the pair (X, D) is not klt, and we must consider (X, D) with the special complex structure (otherwise the conjecture is false as observed by Totaro). We have shown that the cone conjecture holds when D has at most six components: in these cases the nef cone is rational polyhedral and we give explicit generators for the dual cone. The cases where D has more than six components are current work in progress.

  Under our conditions, there exists a contraction of (X, D) to a cusp singularity (X', p). Cusp singularities come in mirror dual pairs, and the embedding dimension m of the dual cusp is equal to $\max(n, 3)$ where n is the number of components of the boundary divisor D. By studying the nef cone of (X, D), we hope to give a description of the deformation space of the dual cusp, which is not well understood for m greater than six.

- *Yucheng Liu* (Northeastern University)

  A construction of new Bridgeland stability conditions

  Motivated by Michael Douglas's work, Bridgeland constructed a general theory of stability conditions on triangulated categories. The most important question in this theory is the existence of stability conditions. In this paper, I will construct a map from rational stability conditions on $D^b(X)$ to the rational stability conditions on $D^b(X \times C)$, where C is an integral smooth curve.

- *Takumi Murayama* (University of Michigan)

  Seshadri constants for vector bundles

  We introduce Seshadri constants for line bundles in a relative setting. They are a generalization of notions for line bundles and vector bundles respectively due to Demailly and to Beltrametti–Schneider–Sommese and Hacon. We give three applications: (1) A characterization of projective space in terms of the Seshadri constant of the tangent bundle; (2) An identification of new nef classes on self-products of curves; and (3) A generic jet separation statement for direct images of pluricanonical bundles. This is joint work with Mihai Fulger.

- *Chengxi Wang* (Rutgers University)

  On stringy Euler characteristics of Clifford non-commutative varieties

  It was shown by Kuznetsov that complete intersections of n generic quadrics in $\mathbb{P}^{2n-1}$ are related by Homological Projective Duality to certain non-commutative (Clifford) varieties which are in some sense birational to double covers of $\mathbb{P}^{n-1}$ ramified over symmetric determinantal hypersurfaces. Mirror symmetry predicts that the Hodge numbers of the complete intersections of quadrics must coincide with the appropriately defined Hodge numbers of these double covers. We observe that these numbers must be different from the well-known Batyrev's stringy Hodge numbers, else the equality fails already at the level of Euler characteristics. We define a natural modification of stringy Hodge numbers for the particular class of Clifford varieties, and prove the corresponding equality of Euler characteristics in arbitrary dimension.