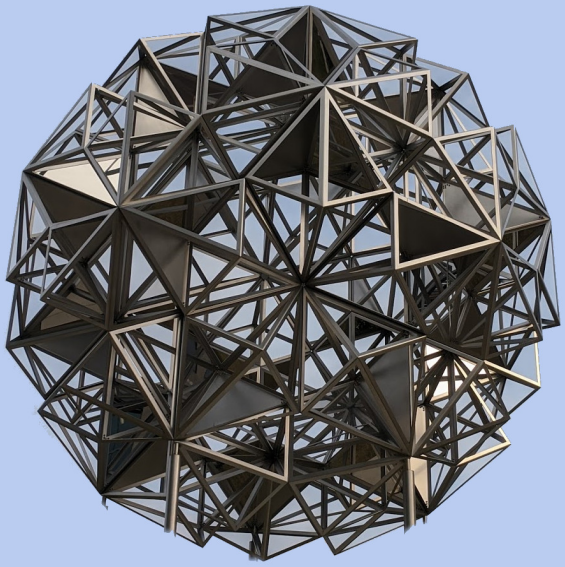

"How to build a sphere out of cubes"

Hodge Theory, Arithmetic and Moduli II:

Texas A&M University, February 8 & 9, 2020.

The broad themes of this conference are Hodge theory, algebraic cycles and the arithmetic of period integrals. Topics of particular interest are compactications of images of period maps, hyperkähler manifolds, Hodge theoretic aspects of moduli spaces, recent progress on regulators and height pairings for higher Chow groups.

Confirmed Speakers:

Patricio Gallardo, Washington University in St. Louis.
Souvik Goswami, Texas A&M University.
Changho Han, University of Georgia.
Yordanka Kovacheva, University of Maryland.
Olivier Martin, University of Chicago.
Sebastian Olano, Northwestern University
Luca Schaffler, University of Massachusetts, Amherst.

Organizer: Gregory Pearlstein, Texas A&M University, (gpearl@math.tamu.edu)
Registration: If you would like to attend the conference, please contact the organizer by January 20, 2020. Unfortunately, the conference is unable to provide travel support to non-speakers.
Local Information: www.math.tamu.edu/~laura/TAGS2015/local.html.
The conference is generously supported by the National Science Foundation and the Texas A&M Mathematics Department.

Schedule: Saturday, Feburary 8th. All talks in Blocker 628.

9-10 am	Patricio Gallardo	On Geometric interpretations of toroidal compactifications.
10-10:30	Coffee	
10:30-11:30	Sebastian Olano	On the nonnegativity of stringy Hodge numbers.
11:30-1:00 pm	Lunch	
1:00-2:00	Luca Schaffler	Compactifications of moduli of points and lines in $\mathbb{P}^2$
2:00-2:30	Coffee	
2:30-3:30	Changho Han	Genus four curves, K3 surfaces, and del Pezzo surfaces
3:30-4:00	Coffee	
4:00-5:00	Olivier Martin	The degree of irrationality of most abelian surfaces is 4.

Sunday, February 9th.

9:30-10:30 am	Souvik Goswami	Height Pairing on Bloch's higher cycles and mixed Hodge structures.
10:30-11	Coffee	
11-12 noon	Yordanka Kovacheva	Intersection pairing of cycles and biextensions

Titles and Abstracts:

Patricio Gallardo

Title: On Geometric interpretations of Toroidal compactifications.

Abstract: It is known, due to the work of Deligne and Mostow, that some GIT compactifications of moduli spaces of points in the projective line are isomorphic to the Baily-Borel compactification of an appropriate ball quotient. In ongoing work with L. Schaffler and M. Kerr, we show that for each Deligne-Mostow ball quotient, the corresponding unique toroidal compactification is isomorphic to a Hasset's moduli space of weighted stable rational curves. Similar results relating to the KSBA and toroidal compactifications of the moduli space of cubic surfaces will be discussed.

Souvik Goswami

Title: Height Pairing on Bloch's higher cycles and mixed Hodge structures.

Abstract: In a previous work with José Ignacio Burgos Gil (Higher arithmetic intersection theory, Adv. Math. 346 (2019), 569-664), we have studied the intersection theory of higher arithmetic Chow groups. As a byproduct, an Archimedean height pairing between higher cycles has already been defined. Classically, Ricard Hain has shown that the Archimedean component of the usual height pairing between ordinary cycles can be interpreted as the class of a biextension in the category of mixed Hodge structures.

In the current work we study the mixed Hodge structure defined by a pair of higher cycles intersecting properly and show that, in a special case, the Archimedean height pairing is one of the invariants attached to the mixed Hodge structure. This is joint work in preparation with Greg Pearlstein and José Ignacio Burgos Gil.

Changho Han

Title: Genus four curves, K3 surfaces, and del Pezzo surfaces.

Abstract: Observe that any construction of "meaningful" compactification of moduli spaces of objects involve enlarging the class of objects in consideration. For example, Kondo observed that given a general smooth curve of genus 4, it lies on a smooth quadric surface by canonical embedding, which is realized as a nonsymplectic Z/3Z group quotient of a U(3) lattice polarized (thus having degree 6) K3 surface. This gives Kondo's birational period map from the moduli of smooth curves of genus 4 to certain dimension 9 ball quotient (as a moduli space of those K3 surfaces), which is resolved by blowing up the hyperelliptic locus of the moduli of genus 4 curves. However, neither moduli spaces are compact, so then how do we extend Kondo's map into a morphism between compact moduli spaces? We will answer this question by understanding the geometry of moduli spaces involved. First, I will describe joint works with Anand Deopurkar that describes the geometry of the moduli of 'almost K3' stable log surfaces (degenerations of smooth quadrics with a genus 4 curve) by relating to the moduli of curves of genus 4. Then, I will introduce observations from the work in progress with Valery Alexeev, Anand Deopurkar, and Philip Engel on relation with the Baily-Borel and toroidal compactifications of such K3 surfaces, giving us the desired extensions of Kondo's map from the moduli of 'almost K3' stable log surfaces into both Baily-Borel and toroidal compactifications of K3 surfaces.

Yordanka Kovacheva

Title: Intersection pairing of cycles and biextensions

Abstract: We study the intersection of two cycles on a variety in a situation similar to the Bloch-Beilinson height pairing and Arakelov theory. The main question we answer is as follows. For a fixed cycle, find conditions on it, such that whenever we pair it with two rationally equivalent cycles (with possible multiple equivalences), we get the same equivalence between the images of the pairing. This question relates to the question of a biextension, associated to a paring of cycles. In particular, we show that Bloch's biextension of homologically trivial cycles cannot be extended to a biextension of numerically trivial cycles. As part of the proof we give an explicit expression of the Suslin-Voevodsky's isomorphism.

Olivier Martin
Title: The degree of irrationality of most abelian surfaces is 4.
Abstract: The degree of irrationality of a complex projective n-dimensional variety X is the minimal degree of a dominant rational map from X to n-dimensional projective space. It is a birational invariant that measures how far X is from being rational. Accordingly, one expects the computation of this invariant in general to be a difficult problem. Alzati and Pirola showed in 1993 that the degree of irrationality of any abelian g-fold is at least g+1 using inequalities on holomorphic length. Tokunaga and Yoshihara later proved that this bound is sharp for abelian surfaces and Yoshihara asked for examples of abelian surfaces with degree of irrationality at least 4. Recently, Chen and Chen-Stapleton showed that the degree of irrationality of any abelian surface is at most 4. In this work, I provide the first examples of abelian surfaces with degree of irrationality 4. In fact, I show that most abelian surfaces have degree of irrationality 4. For instance, a very general (1,d)-polarized abelian surface has degree of irrationality 4 if d does not divide 6. The proof is very short and uses nothing beyond Mumford's theorem on rational equivalences of zero-cycles on surfaces with p_g>0.

Sebastian Olano
Title: On the nonnegativity of stringy Hodge numbers.
Abstract: Stringy Hodge numbers are a generalization of the usual Hodge numbers of a smooth projective variety. Batyrev introduced them to formulate the topological mirror symmetry test for singular Calabi-Yau varieties. These numbers are defined on a wider class of projective varieties with mild singularities, which are studied in birational geometry. In contrast to the usual Hodge numbers, stringy Hodge numbers are not defined via a cohomology theory. Consequently, Batyrev conjectured that they are nonnegative. This nonnegativity represents a numerical constraint on the exceptional divisor of a resolution of singularities, and thus, it is of intrinsic interest in birational geometry. In this talk, I will present positive results towards Batyrev’s conjecture.

Luca Schaffler
Title: Compactifications of moduli of points and lines in $\mathbb{P}^2$
Abstract: Projective duality identifies the moduli space B_n parametrizing configurations of n general points in projective 2-space $\mathbb{P}^2$ with $X(3,n)$, parametrizing configurations of n general lines in the dual $\mathbb{P}^2$. When considering degenerations of such objects, it is interesting to compare different compactifications of the above moduli spaces. In this work, we consider Gerritzen-Piwek's compactification $\overline{B}_n$ and Kapranov's Chow quotient compactification $\overline{X}(3,n)$, and we show they have isomorphic normalizations. We prove that $\overline{B}_n$ does not admit a modular interpretation claimed by Gerritzen and Piwek, namely a family of n-pointed central fibers of Mustafin joins associated to one-parameter degenerations of n points in $\mathbb{P}^2$. We construct the correct compactification of B_n which admits such a family, and we describe it for $n=5,6$. This is joint work in progress with Jenia Tevelev.