Fall 2016

- **August 29**

Speaker: N/A
Title: Organizational Meeting

Abstract: We will discuss schedule and speakers for this semester

- **September 12**

Speaker: Alexander Borisov (Binghamton)
Title: Adjunction on Surfaces and Keller Maps

Abstract: We will first review the basic theory of adjunction, canonical class, intersection pairing, and resolution of singularities of algebraic surfaces. Then we will discuss a certain adjunction inequality and inversion of adjunction results that are related to our approach to the two-dimensional Jacobian Conjecture.

- **September 19**

Speaker: Tom Price (Toronto)
Title: The Regev Stephens-Davidowitz Inequality

Abstract: This talk will be about a recent inequality of Oded Regev and Noah Stephens-Davidowitz regarding the sum of the Gaussian function over lattice cosets. We'll discuss applications to arithmetic and to diffusion on tori and abelian Cayley graphs. We'll also discuss relevant open questions and the potential for generalization.

- **September 26**

Speaker: Jaiung Jun (Binghamton)
Title: Introduction to Weil conjectures.

Abstract: This talk is an expository talk to introduce Weil conjectures to graduate students. We explain Weil conjectures and give a sketch of proofs for the curve case. If time permits, we explain how this naturally motivates the recent work of Connes and Consani.

- **October 10**

Speaker: Xiao Xiao (Utica College)
Title: Minimal F-crystals.

Abstract: Let k be an algebraically closed field of characteristic $p>0$. A p-divisible group D over k is said to be minimal if the isomorphism type of D is determined by the kernel of the endomorphism $p: D \to D.$ Oort has given a complete classification of minimal p-divisible groups in 2005. In this talk, we will generalize this to F-crystals and give a classification theorem of minimal F-crystals. As an application of minimal F-crystals, we will give an upper bound of the isomorphism numbers of isosimple F-crystals, whose isogeny type are determined by simple F-isocrystals, in terms of their ranks, Hodge slopes and Newton slopes. In many

cases, this new upper bound is sharper than some of the known results.

- **October 20**
  (CROSS LISTING WITH THE COLLOQUIUM –Dean's Speaker Series in Geometry/Topology; SPECIAL DAY THURSDAY and TIME 4:30pm):
  Speaker: Ted Chinburg (University of Pennsylvania)
  Title: Capacity theory and cryptography

  Abstract: This talk is about an unexpected connection between cryptography and the theory of electrostatics. RSA cryptography is based on the presumed difficulty of factoring a given large integer N. In the 1990's, Coppersmith showed how one could quickly determine whether there is a factor of N which is within N^{1/4} of a given number. Capacity theory originated in studying how charged particles distribute themselves on an object. I will discuss how an arithmetic form of capacity theory can be used to show that one cannot increase the exponent 1/4 in Coppersmith's method. This is joint work with Brett Hemenway, Nadia Heninger and Zach Scherr.

- **October 21**
  (DEAN'S SPEAKER SERIES IN GEOMETRY/TOPOLOGY)
  Speaker: Ted Chinburg (University of Pennsylvania)
  Title: Constructing elements of Brauer groups and Tate-Shafarevitch groups from knots

  Abstract: This talk has to do with knots invariants which are elements of the Brauer groups and of the Tate-Shafarevitch groups of curves over number fields. Constructing these invariants involves a close analysis of the canonical Azumaya algebra which is defined over an open dense subset of Thurston's canonical curve in the representation variety of the knot group. This is joint work with Alan Reid and Matt Stover.

- **October 24**

  Speaker: Brian Hwang (Cornell)
  Title: An application of automorphic forms to Galois theory

  Abstract: A classical problem in Galois theory is a strong variant of the Inverse Galois Problem: “What finite groups arise as the Galois group of a finite Galois extension of the rational numbers, if you impose the additional condition that the extension can only ramify at finite set of primes?” This question is wide open in almost every nonabelian case, and one reason is our lack of knowledge about how to find number fields with prescribed ramification at fixed primes. While such fields are often constructed to answer arithmetic questions, there is currently no known way to systematically construct such extensions in full generality.
  However, there are some inspiring programs that are gaining ground on this front. One method, initiated by Chenevier, is to construct such number fields using Galois representations and their associated automorphic representations via the Langlands correspondence. We will explain the method, show how some recent advances in these subfields allow us to gain some additional control over the number fields constructed, and indicate how this brings us closer to our goal. As a application, we will show how one can use this knowledge to study the arithmetic of curves over number fields.

- **October 31**

  Speaker: Patrick Milano (Binghamton)

Title: TBA

Abstract: TBA

- **November 7**
  (Joint with Algebra Seminar)
  Speaker: Matthew Moore (McMaster University)
  Title: Dualizable algebras omitting types 1 and 5 have a cube term

  Abstract: An early result in the theory of Natural Dualities is that an algebra with a near unanimity (NU) term is dualizable. A converse to this is also true: if V(A) is congruence distributive and A is dualizable, then A has an NU term. An important generalization of the NU term for congruence distributive varieties is the cube term for congruence modular (CM) varieties, and it has been thought that a similar characterization of dualizability for algebras in a CM variety would also hold. We prove that if A omits tame congruence types 1 and 5 (all locally finite CM varieties omit these types) and is dualizable, then A has a cube term.

- **November 14**

  Speaker: Micah Loverro (Binghamton)
  Title: Lie algebras of linear algebraic groups and their representations.

  Abstract: I will discuss the Lie algebra g of a linear algebraic group G, and the problem of classifying representations of g.

- **November 21**

  Speaker: Noah Giansiracusa (Swarthmore College)
  Title: Tropicalizing schemes

  Abstract: I'll discuss joint work with my brother, Jeff Giansiracusa, in which we extend tropicalization to a scheme-theoretic setting by writing down explicit equations cutting out tropical varieties. Tropical geometry has been rapidly gaining momentum and achieving exciting results in a variety of areas; our hope is that by expanding the scope to allow non-reduced structure and basing tropical methods on algebraic foundations that the range of applications with increase, though the program is still in its early steps. Connections to matroids and to Berkovich analytification will be mentioned.

- **November 28**

  Speaker: Alexander Borisov (Binghamton)
  Title: Role's Theorem, Belyi's Theorem, and more

  Abstract: Suppose a polynomial with real coefficients has all real roots, i.e. it is split over the reals. Then Rolle's theorem implies that its derivative is also split over the reals. We will prove the following theorem. A polynomial with rational coefficients divides a derivative of a polynomial split over the rationals if and only if all of its irrational roots are real and simple. The proof is related to the famous Belyi's theorem and to the basic but mysterious similarity between the logarithmic differentiation of products of powers and the Lagrange interpolation formula.

- **December 5**

Speaker: Sayak Sengupta (Binghamton)
Title: Dual Spaces

Abstract: The talk primarily covers different properties of linear functionals on vector spaces supported by appropriate examples and theorems. We will discuss about these functionals over arbitrary fields, starting with the dual space of a vector space and then moving on to the double dual up to arriving at the conclusion that the double dual is same as the original space in the finite dimensional case.