MAGNTS 2019
Poster Abstracts

Chien-Hua Chen (Penn State)

Surjectivity of the adelic Galois Representation associated to a Drinfeld Module of rank 3

We construct a Drinfeld module φ over $\mathbb{F}_q(T)$ of rank 3 defined by $\varphi_T = T + \tau^2 + T^{q-1}\tau^3$. The adelic Galois representation associated to the Drinfeld module φ

$$\rho_\varphi : \mathrm{Gal}(\mathbb{F}_q(T)^{\mathrm{sep}}/\mathbb{F}_q(T)) \longrightarrow \varprojlim_{\mathfrak{a}} \mathrm{Aut}(\varphi[\mathfrak{a}]) \cong \mathrm{GL}_3(\widehat{A})$$

is surjective.

John Michael Clark (Oklahoma State)

Elliptic Mahler Measure via Genetic Algorithms

Lehmer's conjecture seeks to find minimal polynomials with low Mahler measure. Recent literature has done this in the classical case. In this paper we apply genetic algorithms to find points of low Mahler measure on elliptic curves.

Sumita Garai (Penn State)

Endomorphism Ring of a Finite Drinfeld Module of rank r over $\mathbb{F}_q[T]$

Let $A = \mathbb{F}_q[T]$ be the polynomial ring over $\mathbb{F}_q$ and F be the field of fractions of A. Let ϕ be a Drinfeld A-module of rank r over F. For all but finitely many primes $\mathfrak{p} \lhd A$, one can reduce ϕ modulo $\mathfrak{p}$ to obtain a Drinfeld A-module $\phi \otimes \mathbb{F}_\mathfrak{p}$ of rank r over $\mathbb{F}_\mathfrak{p} = A/\mathfrak{p}$. It is known that the endomorphism ring $\mathcal{E}_\mathfrak{p} = \mathrm{End}_{\mathbb{F}_\mathfrak{p}}(\phi \otimes \mathbb{F}_\mathfrak{p})$ is an order in an imaginary field extension K of F of degree r. Let $\mathcal{O}_\mathfrak{p}$ be the integral closure of A in K, and let $\pi_\mathfrak{p} \in \mathcal{E}_\mathfrak{p}$ be the Frobenius endomorphism of $\phi \otimes \mathbb{F}_\mathfrak{p}$. Then we have the inclusion of orders $A[\pi_\mathfrak{p}] \subset \mathcal{E}_\mathfrak{p} \subset \mathcal{O}_\mathfrak{p}$ in K. From which we can write $\mathcal{E}_\mathfrak{p}/A[\pi_\mathfrak{p}] \cong A/\mathfrak{b}_1 \times A/\mathfrak{b}_2 \times \cdots \times A/\mathfrak{b}_{r-1}$. In this talk we give an algorithm to compute the indices $\mathfrak{b}_1, \mathfrak{b}_2, \cdots \mathfrak{b}_{r-1}$, and give an explicit description of the Endomorphism ring $\mathcal{E}_\mathfrak{p}$ and show the connection of these indices with the higher reciprocity laws. (Joint work with Mihran Papikian)

Yuan Kong (Oklahoma State)

Some Questions in Unlikely Intersections for Dynamical Systems

We use a metric of mutual energy for adelic measure and potential theoretic techniques involving discrete approximations to energy integrals to prove an effective bound on a problem of Baker and DeMarco on unlikely intersections of dynamical systems, specifically, for the set of complex parameters c for which $z = 0$ and 1 are both preperiodic under iteration of $f_c^{11}(z) = z^2 + c$.

Caroline Matson (Colorado)

Formal Group Laws with Complex Multiplication

Let K be a field that is complete with respect to a discrete valuation. Let $\mathcal{O}_K$ denote its ring of integers and fix a choice of uniformizer π. Lubin and Tate showed that every one-dimensional formal group law F over $\mathcal{O}_K$ satisfying $[\pi]_F \equiv x^{q^h} \pmod{\pi}$ has a large endomorphism ring, or *complex multiplication.* This in turn shows that the roots of $[\pi^n]_F$ generate an abelian extension over K, and in fact all abelian extensions can be obtained this way. This result is the foundation of local class field theory. We work out some of the corresponding theory in multiple dimensions and construct a class of formal group laws with complex multiplication that do not arise from algebraic varieties.

Andrew Odesky (Michigan)

Moduli of Galois extensions with normal structure

In recent work with Julian Rosen we study a moduli-theoretic interpretation for a certain homogeneous space associated to a finite group. We show that the homogeneous space has a canonical embedding into an intersection of quadric hypersurfaces and give some applications.

Manami Roy (Fordham)

Paramodular forms coming from elliptic curves

There is a lifting from a non-CM elliptic curve over rationals to a paramodular form of degree 2 and weight 3 via the symmetric cube map. We find a description of the paramodular form in terms of the coefficients of the minimal Weierstrass equation of the given elliptic curve.

Jun Wang (Ohio State)

A mirror theorem for Gromov-Witten theory without convexity

A central question in Gromov-Witten (GW) theory is to relate the GW invariants of a positive hyperplane section to the GW invariants of the ambient variety or orbifold. In genus zero, this is usually done by the so-called quantum hyperplane principle, which uses the twisted GW theory of the ambient space. But this approach requires a technical assumption called convexity, which can fail for hyperplane sections in orbifolds. This poster presents a Mirror theorem for possible nonconvex hyperplane sections in Toric stacks. One key ingredient in the proof is to resolve the genus zero quasimap Wall-Crossing conjecture proposed by Ionuţ Ciocan-Fontaine and Bumsig Kim, where we don't require the target to be carried with a torus action as opposed to all previously proven examples (or convex hypersurfaces thereof).

Caleb Springer (Penn State)

Computing the endomorphism ring of an ordinary abelian surface over a finite field

The endomorphism ring of an abelian variety is an important object which is useful in many contexts, including understanding isogeny graphs, computing class polynomials, and other cryptographic applications. If A is a simple ordinary abelian surface over the finite field $\mathbb{F}_q$, then the endomorphism ring $\mathrm{End}(A)$ is isomorphic to an order in a CM field K. This poster presents a subexponential algorithm to compute $\mathrm{End}(A)$ when A has maximal real multiplication, generalizing an algorithm of Bisson and Sutherland for ordinary elliptic curves. The main idea is to probe the ideal class group of $\mathrm{End}(A)$ by computing certain isogenies. By comparing the class groups of $\mathrm{End}(A)$ and various known orders $\mathcal{O} \subseteq K$, one can then deduce $\mathrm{End}(A)$.

Mingming Zhang (Oklahoma State)

On the behavior of Mahler's measure under iteration

For an algebraic number α, we denote by $M(\alpha)$ the Mahler measure of α. As $M(\alpha)$ is again an algebraic number (indeed, an algebraic integer), $M(\cdot)$ is a self-map on $\overline{\mathbb{Q}}$, and therefore defines a dynamical system. The *stopping time* of α, denoted $ST(\alpha)$, is the cardinality of the forward orbit of α under M. We prove that for every degree at least 3 and every non-unit norm, there exist algebraic numbers of every stopping time. We then prove that for algebraic units of degree 4, the stopping time must be 1, 2, or ∞. Moreover, if α is an algebraic unit of degree $d \geq 5$ such that the Galois group of the Galois closue of $\mathbb{Q}(\alpha)$ contains A_d, then the stopping time must be 1, 2, or ∞.
This is joint work with Paul Fili and Lukas Pottmeyer.