SPEAKER: **Archit Agarwal** (IIT Indore)

TITLE: One variable generalizations of five entries of Ramanujan

ABSTRACT: Ramanujan recorded five q-series identities at the end of his second notebook and an unified generalization of these identities obtained by Bhoria, Eyyunni and Maji. Recently, Dixit and Patel gave a finite analogue of the identity of Bhoria et. al. which in turn gives finite analogue of all the aforementioned identities of Ramanujan. In this talk, one of my main goals is to present a one-variable generalization of the identity of Bhoria et. al. along with its finite analogue, which naturally generalizes the result of Dixit and Patel. Utilizing these newly established identities, we derive one-variable generalizations for each of the five entries by Ramanujan and their corresponding finite analogues.

SPEAKER: **Scott Ahlgren** (University of Illinois at Urbana-Champaign)

TITLE: Congruences like Atkin's for Frobenius partitions

ABSTRACT: In the 1960s, Atkin found a handful of congruences for the partition function modulo primes p smaller than 37. These congruences are distinguished by the fact that they lie along arguments determined by the squares of certain large primes Q. With Allen and Tang, we recently proved that such congruences exist for all primes p.

I will discuss an extension of this result (which is joint work with Andersen and Dicks) to m-colored Frobenius partitions, which from the perspective of modular forms are natural higher-level analogues of the partition function. The methods involve an application of our previous work on the Shimura lift for modular forms with the eta multiplier together with tools from the theory of modular Galois representations and quite a bit of explicit computation.

SPEAKER: **Michael Allen** (LSU)

TITLE: Explicit modularity of hypergeometric Galois representations

ABSTRACT: In recent work with Grove, Long, and Tu, we provide an explicit method by which to attach a modular form to a given hypergeometric datum combining different techniques from classical, p-adic, and finite field settings. In this talk, we explore an application of this method from a motivic viewpoint through some known hypergeometric well-poised formulae of Whipple and McCarthy. Using well-poised hypergeometric formulas we construct a class of degree four Galois representations of corresponding cyclotomic fields. These representations are then shown to be extendable to the full absolute Galois group and the L-function of each extension coincides with the L-function of an automorphic form.

SPEAKER: **Maryam Alzahrani** (Southern Illinois University)

TITLE: Some explicit descriptions of characters stabilizing smooth complex representations of $GL(r, D)$ with a p-adic division algebra D

ABSTRACT: For a positive integer r and a central division algebra D over a p-adic field, we provide an explicit and precise description of (the number of) characters that stabilize irreducible smooth complex representations of $GL(r, D)$. The works of Gelbart-Knapp and Hiraga-Saito on L-packets for inner forms of $SL(n)$ over the p-adic field are being mainly applied, and we also explicitly discuss that there are some representations that have multiplicity that are different than 1.

SPEAKER: **Joselyne Ancieto** (UT Rio Grande Valley)

TITLE: Congruences in arithmetic progression for coefficients of Gaussian polynomials and crank statistics

ABSTRACT: The study of partition congruences, inspired by Ramanujan's discoveries for $p(n)$ over a century ago, remains a central topic in this field. This dissertation examines congruence properties in two restricted partition functions: $p(n, m)$, which counts partitions of n into at most m parts, and $p(n, m, N)$, which further limits the size of the largest part to be at most N. Building on Kronholm's 2007 result, now known as the *Interval Theorem*, and a recent result by Eichhorn, Engle, and Kronholm, we establish new infinite families of congruences for $p(n, m, N)$. This dissertation extends not only the recent results of Eichhorn, Engle, and Kronholm, but also reveals deeper and unexpected aspects of Kronholm's 2007 results. A key component in our approach is a two-colored partition function which leads to additional congruences.

We also investigate combinatorial witnesses, otherwise known as cranks for these congruences. We establish polynomial formulas for certain partition functions which are then used to test whether certain statistics evenly distribute partitions among residue classes. These results expand and reinforce a conjecture of Eichhorn, Engle, and Kronholm on cranks.

SPEAKER: **Kam Cheong Au** (University of Cologne)

TITLE: Witten zeta function at negative integers

ABSTRACT: The Witten zeta function for a simple Lie algebra $\mathfrak{g}$ is defined by the Dirichlet series

$$\zeta_{\mathfrak{g}}(s) := \sum_{\rho} \frac{1}{(\dim \rho)^s},$$

where ρ ranges over all irreducible representations of $\mathfrak{g}$. It has been popularized by Zagier to illustrate its special values at positive even integers.

Although not as nice as L-functions, it still satisfies several non-trivial properties with interesting consequences. In this talk, we prove a conjecture which says $\mathfrak{g}(s)$ vanishes at negative even integers, we also mention a connection to some non-trivial identities about Riemann zeta values and Eisenstein series.

SPEAKER: **Jacksyn Bakeberg** (Boston University)

TITLE: Excursion functions on p-adic SL_2

ABSTRACT: The representation theory of a p-adic reductive group is encoded in its Bernstein center, analogous to a finite group's algebra of class functions or the center of a real reductive group's universal enveloping algebra. In this talk, I will outline a strategy for writing down certain explicit elements of the Bernstein center as distributions on the group which encode Kaletha's supercuspidal local Langlands correspondence, including concrete formulas in the case of SL_2.

Speaker: **Koustav Banerjee** (University of Cologne)

Title: Laguerre inequalities for sequences arising from modular and (non) modular objects

Abstract: In this talk, I will discuss on Laguerre inequalities for sequences arising from Fourier coefficients of modular forms, for example, the integer partitions, and sequences related to non-modular objects, for instance, the plane partition function. In a broader set up, I will present how to build a framework to prove the Laguerre inequalities for a class of sequence irrespective of its origin from modular and/or non-modular world. This is an ongoing joint work with Kathrin Bringmann and Larry Rolen.

Speaker: **Dan Barake** (McMaster University)

Title: Characters in p-adic Vertex Operator Algebras via modular linear differential equations

Abstract: Vertex operator algebras (VOAs) play a central role in two-dimensional conformal field theory, however their number-theoretical properties have also garnered significant attention over the past two decades. In particular, a celebrated result of Zhu shows that the character map (i.e. 1-point correlation function or graded trace) on VOAs gives a surjection on the space of modular forms. In this talk, we will first give an introduction to these structures as well as their p-adic variants which were constructed recently by Franc and Mason. Then, we will discuss new results on the connections to p-adic modular forms, with the goal of establishing a Zhu-type theorem in this p-adic case.

Speaker: **Debmalya Basak** (University of Illinois at Urbana-Champaign)

Title: Surfaces associated to zeros of automorphic L-functions

Abstract: Assuming the Riemann Hypothesis, Montgomery established results concerning pair correlation of zeros of the Riemann zeta function. Rudnick and Sarnak extended these results to automorphic L-functions and all level correlations. We discover additional geometric structures associated to the zeros of automorphic L-functions. In the case of pair correlation, these structures form certain surfaces which display Gaussian behavior. For triple correlation, these structures exhibit characteristics of the Laplace and Chi-squared distributions, revealing an unexpected phase transition. This is joint work with Cruz Castillo and Alexandru Zaharescu.

Speaker: **Alexander Bauman** (University of Michigan)

Title: p-adic interpolation of Bessel periods on GSp_4

Abstract: The Bessel period is a certain period functional attached to an automorphic representation π of GSp_4 and a Hecke character χ of a quadratic extension $E/\mathbb{Q}$. When π is holomorphic (limit of) discrete series at infinity, and $E/\mathbb{Q}$ is imaginary, the Bessel period is (up to an elementary factor) a weighted average of certain Fourier coefficients, in particular it is algebraic. On the other hand, Furusawa-Morimoto showed, as conjectured by Y. Liu, that the Bessel period is related by an Ichino-Ikeda type formula to the degree-8

L value $L(1/2, \pi_E \times \chi)$. This formula was used by Hsieh-Yamana to construct a single-variable anticyclotomic p-adic L-function attached to a scalar-valued ordinary holomorphic Siegel modular form F, which interpolates $L(1/2, \pi_E \times \chi)$ as we vary χ among finite order characters. We extend this construction, in the case where p splits in E, to the setting where F itself varies in a 2-variable Hida family, and construct a p-adic L-function interpolating $L(1/2, \pi_E \times \chi)/L(1, \pi, \mathrm{Ad})$ where π corresponds to a holomorphic Siegel modular form of weight (k_1, k_2), and χ is an algebraic Hecke character of E with infinity type $(k_1 - k_2, 0)$. The main tools in our construction are an interpolated p-adic q-expansion for p-adic Siegel modular forms, and an interpolated period functional on the coefficient module for these q-expansions.

Speaker: **Saikat Biswas** (UT Dallas)

Title: On a refinement of the Cassels-Poitou-Tate dual exact sequence

Abstract: We present a refinement of the Cassels-Poitou-Tate dual exact sequence applied to an abelian variety A defined over a number field K. We then derive, as a consequence of this result, a special case of Greenberg-Wiles theorem on comparing Selmer groups and their dual. In particular, for an odd prime p we relate the orders of two Selmer groups attached to $A[p]$, the p-torsion subgroup of A, and those of their corresponding duals to the Tamagawa numbers of the dual abelian variety at primes v.

Speaker: **Abbey Bourdon** (Wake Forest)

Title: Polynomial bounds on torsion from rational geometric isogeny classes

Abstract: In 1996, Merel showed that for any elliptic curve defined over a number field F of degree d, the size of the torsion subgroup is bounded by a constant $B(d)$ that depends only on d. It is conjectured that one can choose $B(d)$ to be polynomial in the degree d. In this talk, I will discuss recent joint work with Tyler Genao which shows that such bounds exist for torsion from the family of elliptic curves which are geometrically isogenous to at least one rational elliptic curve. For the special case of elliptic curves with rational j-invariant, our result strengthens prior work of Clark and Pollack.

Speaker: **Walter Bridges** (University of North Texas)

Title: Mixed modularity, partitions and the circle method

Abstract: We say that a *product* of a modular form and a mock modular form (or false theta function) has *mixed* modularity. Such objects arise naturally as q-series generating functions in the theory of partitions.

I will discuss recent adaptations of the Hardy–Ramanujan–Rademacher circle method that provide precise asymptotic expansions for the Fourier coefficients of certain mixed modular objects. This includes so-called *partitions without sequences* and *ranks of unimodal sequences*. This is joint work with Kathrin Bringmann.

SPEAKER: **Matt Broe** (Boston University)

TITLE: The Beilinson-Bloch conjecture over function fields

ABSTRACT: Let k be a field and X a smooth projective variety over k. When k is a number field, the Beilinson–Bloch conjecture relates the ranks of the Chow groups of X to the order of vanishing of certain L-functions. We consider the same conjecture when k is a global function field, and give a criterion which implies the conjecture for X. In particular, the conjecture over k would follow from longstanding conjectures on the geometry of varieties over finite fields. We use the criterion to prove the conjecture in a range of special cases, and give generalizations of some classical results on the Birch and Swinnerton-Dyer conjecture over k.

SPEAKER: **Glenn Bruda** (University of Florida) & **Raul Marquez** (UT Rio Grande Valley)

TITLE: Optimizing test functions to bound the lowest zeros of cuspidal new forms

ABSTRACT: In the 1970s, Dyson and Montgomery noticed that the spacing between the zeros of L-functions far from the central point shares similar behavior to eigenvalues of random matrix ensembles. However, the lowest zeros, which have many applications in number theory, are difficult to analyze through these methods. The Katz-Sarnak Density Conjecture relates the behavior of these to the eigenvalues near 1 of the classical compact groups. To date, theorems can only be proved for test functions where the support of its Fourier transform is limited; a large body of research is trying to increase the support, and thus the strength of these results.

Previous research has obtained upper bounds on the height of the first normalized zero above the central point for various L-functions. We obtain lower results by bounding the lowest first zero in families of cupsidal newforms by creating good test functions to use in the Katz-Sarnak density formulas.

SPEAKER: **Cruz Castillo** (University of Illinois at Urbana-Champaign)

TITLE: Arithmetic properties of m-colored Frobenius partitions

ABSTRACT: Ramanujan proved three famous congruences for the partition function modulo 5, 7, and 11. Ahlgren and Boylan proved that these congruences are the only ones of this type. I will present analogous results for m-colored Frobenius partitions, which are natural generalizations of the partition function. For $m = 5$, 7, and 11, there are six congruences akin to Ramanujan's congruences; we prove that these are the only congruences of this type. Our method is a blend of theory and computations with modular forms. This is joint work with Scott Ahlgren.

SPEAKER: **Arijit Chakraborty** (UC San Diego)

TITLE: A power-saving error term in counting $C_2 \wr H$ number fields

ABSTRACT: One of the central problems in Arithmetic Statistics is counting number field extensions of a fixed degree with a given Galois group, parameterized by discriminants. This talk focuses on $C_2 \wr H$ extensions over an arbitrary base field. While Jürgen Klüners has established the main term in this setting, we present an alternative approach that provides improved power-saving error terms for the counting function.

SPEAKER: **Adithya Chakravarthy** (University of Toronto)

TITLE: Iwasawa μ-invariants of elliptic curves

ABSTRACT: In the 1990s, Ralph Greenberg formulated a striking conjecture about the Iwasawa μ-invariants of elliptic curves over the rational numbers. In this talk, I will introduce this conjecture and discuss some recent results surrounding it.

SPEAKER: **Himanshi Chanana** (Indian Institute of Technology Kanpur)

TITLE: Asymptotics for the Fourier coefficients attached to automorphic forms along polynomial sequences

ABSTRACT: In analytic number theory, a classical problem is to study the hidden structures underlying the Fourier coefficients of an automorphic form. An effective approach is to observe its summatory function over specific sequences. While the individual values of the n-th Fourier coefficient fluctuate irregularly with n, the corresponding summatory function exhibits significantly more regular behavior. The derivation of an asymptotic formula that provides highly accurate approximations for the averages of arithmetical functions lies at the core of numerous central problems in number theory. The fundamental objective within the theory of automorphic forms is to assess sums comprising Hecke-eigenvalues. Among the various sequences considered in this context, polynomial sequences over $\mathbb{Z}$ have received significant attention. Averaging over such sparse sequences has important applications, including the study of moments of L-functions and proving non-vanishing results. In this talk, we will use Jutila's variant of the circle method to derive asymptotic estimates for the Fourier coefficients of $GL(3)$ automorphic forms along polynomial sequences.

SPEAKER: **Holly Paige Chaos** (University of Vermont)

TITLE: Weierstrass points on hyperelliptic Shimura curves

ABSTRACT: Roughly speaking, Weierstrass points are certain special points defined on curves of genus , and modular curves are curves whose points parametrize objects of interest. For this reason, it is natural to be curious about what can be said about Weierstrass points on modular curves. Work was done in this direction by Rohrlich and Ahlgren-Ono for classical modular curves, and by Vincent for Drinfeld modular curves. In this talk we present some preliminary results on the Weierstrass points of Shimura curves for , prime, and hyperelliptic.

SPEAKER: **Jonathan Cohen** (University of North Texas)

TITLE: Bessel models of depth zero supercuspidal representations of p-adic $GSp(4)$

ABSTRACT: There has been significant work by several authors on Bessel models for $GSp(4)$ over local and global fields, as well as their applications to Siegel modular forms and automorphic representations. For a p-adic field , Roberts and Schmidt determined the Bessel models of all nonsupercuspidal irreducible representations of $GSp(4)$. In this talk we explain the determination of these Bessel models for any depth zero supercuspidal representation. This is joint work with Ralf Schmidt.

SPEAKER: **William Craig** (United States Naval Academy)

TITLE: Integer partitions detect the primes

ABSTRACT: This talk presents a partition-theoretic approach to the idea of Diophantine equations motivated by the famous resolution of Hilbert's Tenth Problem by Matiyasevich. We resolve questions of Schneider on detecting important sets of integers using 'Diophantine equations with partition function'. The Diophantine equations we consider involve equations of partition functions considered by MacMahon and their natural generalizations in the emerging theory of q-multiple zeta values. Here we explicitly construct infinitely many Diophantine equations in partition functions whose solutions are the prime numbers. We conclude that prime numbers can be detected from partitions and symmetric polynomials alone. This is joint work with Jan-Willem van Ittersum and Ken Ono.

SPEAKER: **Steven Creech** (Brown University)

TITLE: Explicit zero free regions of automorphic L-functions

ABSTRACT: The Riemann hypothesis says that all zeros of $\zeta(s)$ lie on the line $\mathrm{Re}(s) = \frac{1}{2}$. While the Riemann hypothesis is far from being solved, one could ask if there is some region where we know that there are no zeros, such regions are called zero-free regions. In this talk, I will talk about the analogous problem for automorphic L-functions, and describe two tricks that can be done to improve explicit zero-free regions. Namely, I shall discuss a Stetchkin's trick and the use of higher degree polynomials to improve zero-free regions. This is joint work with Alia Hamieh, Simran Khunger, Kaneenika Sinha, Jakob Streipel, and Kin Ming Tsang.

SPEAKER: **Gefei Dang** (University of Oklahoma)

TITLE: Newforms for local unitary groups

ABSTRACT: Local newforms were first introduced by Casselman for representations of GL(2) and later generalized to GL(n) by Jacquet, Piatetski-Shapiro, and Shalika. More recently, Atobe, Oi, and Yasuda defined and studied newforms for representations of odd unitary groups, and later Atobe studied the even unitary group case. In this talk, I will present an alternative definition of newforms for unitary groups over p-adic fields, compare it with existing definitions, and show that our definition gives rise to test functions of a local spherical character.

SPEAKER: **Agniva Dasgupta** (UT Dallas)

TITLE: Analytic ranks of elliptic curves over cyclotomic fields

ABSTRACT: We show that for an elliptic curve E defined over $\mathbb{Q}$, its analytic rank over the q^{th} cyclotomic field K_q is bounded above by $q^{\frac{45}{52}+\varepsilon}$, as q varies over primes. Under the assumption of a weak version of the Birch and Swinnerton-Dyer conjecture, this would imply the same bound for the (algebraic) rank of the set of K_q rational points of E. Our result follows from a more general statement on nonvanishing of central values of L-functions of newforms twisted by Dirichlet characters in sufficiently large Galois orbits. Our method builds on prior work of Chinta, and our improvement stems from a more careful treatment of certain combination of Kloosterman sums. This is joint work with Rizwanur Khan.

SPEAKER: **Thomas Driscoll-Spittler** (TU Darmstadt)

TITLE: Automorphic forms associated with Conway's group

ABSTRACT: We show that there is a bijection between reflective automorphic forms of singular weight and the conjugacy classes of Conway's group Co_0 with non-trivial fixed-point sublattice. The classification of 1-dimensional cusps of type 0 of the corresponding modular varieties gives a new proof for Schellekens' classification of affine structures of holomorphic vertex operator algebras of central charge 24. This is joint work in progress with Nils Scheithauer and Janik Wilhelm.

SPEAKER: **Alex Dunn** (Gerogia Tech)

TITLE: Non-vanishing for cubic Hecke L-functions

ABSTRACT: In this talk I will discuss a recent result that establishes an unconditional proportion of non-vanishing at the central point $s = 1/2$ for cubic Hecke L-functions over the Eisenstein quadratic number field (in a thin family). This result comes almost 25 years after Soundararajan's (2000) breakthrough result for the positive proportion of non-vanishing for primitive quadratic Dirichlet L-functions over the rational numbers.

Our proof goes through the method of first and second mollified moments. Our principal new contribution is an asymptotic evaluation of the mollified second moment with power saving error term. No asymptotic formula for the mollified second moment of a cubic family was previously known (even over function fields).

I will explain why the non-vanishing problem (via moments) for cubic L-functions has starkly different features to the corresponding problem for quadratic Dirichlet L-functions. The natural connections this problem has to cubic metaplectic forms, Gauss sums, and Heath-Brown's cubic large sieve will also be discussed.

This is a joint work with A. De Faveri (Stanford), C. David (Concordia), and J. Stucky (Georgia Tech).

SPEAKER: **David Farmer** (AIM)

TITLE: Patterns in the landscapes of L-functions

ABSTRACT: L-functions of a given degree and conductor can be further classified by the shape of the Γ-factors in their functional equation. What remains to be determined are the spectral parameters appearing within the Γ-factors. We will show example sets of spectral parameters, exhibited as a scattering of points on a "landscape". Several patterns appear in those images, which are partially explained by interactions among the zeros of the L-functions.

SPEAKER: **Claire Frechette** (Boston College)

TITLE: Large sums of divisor-bounded multiplicative functions

ABSTRACT: Given a multiplicative function f, let $S(x, f) = \sum_{n \leq x} f(n)$ be the associated partial sum. In this talk, we extend our prior work on bounding the partial sums of multiplicative functions arising in number theory, such as coefficients of modular forms, to discuss how partial sums of individual functions affect the partial sum of the product. Specifically, we show that lower bounds on partial sums of divisor-bounded functions result in magnified lower bounds on the partial sums associated to their products. Inspired by analytic techniques of Granville and Soundararajan for Dirichlet characters, we show that this type of bound can be extended not only to coefficients of modular forms, but to any pair of functions bounded by the same power of the divisor function.

Speaker: **Meghali Garg** (IIT Indore)

Title: Equivalent criteria for the Riemann hypothesis for a general class of L-functions

Abstract: A noteworthy equivalent criterion, attributed to Riesz in 1916 has shown that the Riemann hypothesis is equivalent to the following bound,

$$P_2(x) := \sum_{n=1}^{\infty} \frac{\mu(n)}{n^2} \exp\left(-\frac{x}{n^2}\right) = O_\epsilon\left(x^{-\frac{3}{4}+\epsilon}\right), \quad \text{as } x \to \infty, \tag{1}$$

for any positive ϵ. Driven by this motivation, Hardy and Littlewood established another equivalent criterion for the Riemann hypothesis while rectifying an identity of Ramanujan. Mainly, they showed that

$$P_1(x) := \sum_{n=1}^{\infty} \frac{\mu(n)}{n} \exp\left(-\frac{x}{n^2}\right) = O_\epsilon\left(x^{-\frac{1}{4}+\epsilon}\right), \quad \text{as } x \to \infty. \tag{2}$$

Recently, along with Maji, we extended the above bound for the generalized Riemann hypothesis for Dirichlet L-functions and gave a conjecture for a class of "nice" L-functions. We have resolved this conjecture and in particular, we give equivalent criteria for the Riemann hypothesis for L-functions associated to cusp forms. We also obtain an entirely novel form of equivalent criteria for the Riemann hypothesis of $\zeta(s)$. Furthermore, we generalize an identity of Ramanujan, Hardy and Littlewood for Chandrasekharan-Narasimhan class of L-functions.

Speaker: **Louis Gaudet** (University of Massachusetts Amherst)

Title: Counting biquadratic number fields that admit quaternionic and dihedral extensions

Abstract: Many interesting problems in arithmetic statistics involve counting number fields (ordered by their discriminants, say) with certain properties. In joint work with Siman Wong (UMass Amherst), we establish asymptotic formulae for the number of biquadratic extensions of $\mathbb{Q}$ that admit a degree-2 extension with Galois group G, where G is either the quaternion group or the dihedral group (of order 8). We will discuss these results and how they are proved, and we will discuss their significance with regard to a theorem of Tate on lifts of projective Galois representations.

SPEAKER: **Pico Gilman** (UC Santa Barbara)

TITLE: On the density of low-lying zeros of a large family of automorphic L-functions

ABSTRACT: Under the generalized Riemann Hypothesis (GRH), Baluyot, Chandee, and Li nearly doubled the range in which the density of low lying zeros predicted by Katz and Sarnak is known to hold for a large family of automorphic L-functions. Generalizing their results, we prove the Katz-Sarnak density predictions hold for the n-th centered moments for test functions whose Fourier transform is compactly supported in $(-\sigma, \sigma)$ for $\sigma = \min\{3/2(n-1), 4/(2n - \mathbf{1}_{2\nmid n})\}$. For $n = 3$, our results improve the previously best known $\sigma = 2/3$ to $\sigma = 3/4$. We also prove the two-level density agrees with Katz-Sarnak when $\sigma_1 = 3/2$ and $\sigma_2 = 5/6$, respectively, extending the previous best-known sum of supports $\sigma_1 + \sigma_2 = 2$. This work is the first evidence of a new phenomenon: by taking different test functions, we extend the range in which the Katz-Sarnak density predictions are known to hold. Our techniques have applications to understanding related quantities containing sums over multiple primes.

SPEAKER: **Jena Gregory** (UT Rio Grande Valley)

TITLE: Cranks witnessing an infinite family of congruences for a sum of partition functions

ABSTRACT: In 2007, Kronholm established infinite families of congruences in arithmetic progression, modulo any prime ℓ, for $p(n, m)$, the function enumerating the partitions of n into parts whose sizes come from the set $[m]$. In 2022, Eichhorn, Kronholm, and Larsen proved there are combinatorial statistics, known as cranks, that witness Kronholm's infinite families of congruences.

In this talk, we explore an extension of these results and consider cranks witnessing a sum/difference congruence of the form

$$p(n, m) \pm p(n', m) \equiv 0 \pmod{\ell},$$

where n' is determined by n.

By an analysis of Ehrhart's h^*-vector, we have established that for certain primes and small values of m, there are cranks witnessing this sum/difference congruence.

SPEAKER: **Asimina Hamakiotes** (University of Connecticut)

TITLE: Abelian extensions arising from elliptic curves with complex multiplication

ABSTRACT: Let K be an imaginary quadratic field, and let $\mathcal{O}_{K,f}$ be an order in K of conductor $f \geq 1$. Let E be an elliptic curve with complex multiplication by $\mathcal{O}_{K,f}$, such that E is defined by a model over $\mathbb{Q}(j(E))$, where $j(E)$ is the j-invariant of E. Let $N \geq 2$ be an integer. The extension $\mathbb{Q}(j(E), E[N])/\mathbb{Q}(j(E))$ is usually not abelian; it is only abelian for $N = 2, 3$, and 4. Let p be a prime and let $n \geq 1$ be an integer. In this talk, we will classify the maximal abelian extension contained in $\mathbb{Q}(E[p^n])/\mathbb{Q}$.

Speaker: **Michael Hanson** (University of North Texas)

Title: Eisenstein series modulo p^2

Abstract: Joint with Scott Ahlgren, Martin Raum, and Olav Richter. We will discuss congruences for classical Eisenstein series E_k of level 1 modulo the square of a prime $p \geq 5$. It is known that such Eisenstein series are determined mod p^2 by those of weight at most $p^2 - p + 2$. We refine this result by showing that, up to powers of E_{p-1}, each Eisenstein series is determined mod p^2 by a modular form of weight at most $2p - 4$.

Speaker: **Robert Hough** (Stony Brook University)

Title: Lower order terms in the shape of cubic fields

Abstract: The ring of integers of a degree n number field may be viewed as an n-dimensional lattice within the canonical embedding. Spectrally expanding the space of lattices, we study the distribution of lattice shapes of rings of integers when cubic fields are ordered by discriminant by studying the Weyl sums testing the lattice shape against the real analytic Eisenstein series and Maass cusp forms. In the case of Eisenstein series we identify a lower order main term of order $X^{11/12}$ when fields of discriminant of order X are counted with a smooth weight. Joint work with Eun Hye Lee.

Speaker: **Paul Jenkins** (BYU)

Title: Modular forms with only nonnegative coefficients

Abstract: We study modular forms for SL(2, Z) with no negative Fourier coefficients. Let $A(k)$ be the positive integer where if the first $A(k)$ Fourier coefficients of a modular form of weight k for SL(2, Z) are nonnegative, then all of its Fourier coefficients are nonnegative. We give upper and lower bounds for $A(k)$, as well as an upper bound on the nth Fourier coefficient of a form with no negative Fourier coefficients. This is joint work with Jeremy Rouse.

Speaker: **Abhash Jha** (IIT(BHU) Varnasi)

Title: Fourier coefficients of Jacobi Poincare series over Cayley half space and applications

Abstract: We compute the Fourier coefficients of Jacobi Poincare series over Cayley half space and obtain an estimate for the Jacobi cusp form over Cayley half space. We also compute certain Petersson scalar products involving Jacobi cusp forms and Poincare series. This is a joint work with Animesh Sarkar.

Speaker: **Jayashree Kalita** (Vanderbilt)

Title: On conjectures of Andrews

Abstract: In a famous 1986 paper, Andrews made a number of conjectures on the signs and growth rate of q-series arising from partition theory. Andrews made these conjectures based on computer experiments. The first of these functions, the famous function $\sigma(q) := \sum_{n\geq 0} \frac{q^{n(n+1)/2}}{(-q;q)_n}$, had remarkable growth and vanishing behavior which was finally proven by Andrews-Dyson-Hickerson by tying this series to the arithmetic of the field $\mathbb{Q}(\sqrt{6})$. Cohen further uncovered that the numerical phenomenon was due to the q-series being what we would now call, thanks to work of Lewis-Zagier, a period integral of a Maass waveform. This was also an early example of the new theory of Zwegers mock Maass theta functions, and of a quantum modular form. In the same paper, Andrews also made conjectures on remarkable sign behavior of partition theoretic functions, such as $v_1(q) := \sum_{n\geq 0} \frac{q^{n(n+1)/2}}{(-q^2;q^2)_n}$. Recent work by Folsom, Males, Rolen and Storzer established some of these. In recent work joint with Kundu, Storzer and Wang, we have been investigating related conjectures from Andrews paper. In this talk, we will recall these new and recent results. The methods will highlight analytic techniques such as the methods of sleepest descent and the circle method. No prior knowledge of these techniques is assumed, and I will give a non-technical overview of the main ideas.

Speaker: **Kim Klinger-Logan** (Kansas State University)

Title: String theory and differential equations involving automorphic forms

Abstract: In the early 2000's physicists discovered that the graviton scattering amplitude is expressed in terms of differential equations involving Eisenstein series. In this talk, I will give a bit of the physics motivation for solving differential equations in automorphic form and discuss some of the recent results and open questions that remain. The work referenced is in collaboration with Ksenia Fedosova, Steven D. Miller, Danylo Radchenko, and Don Zagier.

Speaker: **Krishnarjun Krishnamoorthy** (Beijing Institute of Mathematical Sciences and Applications (BIMSA))

Title: Large Fourier coefficients of half integral weight Hilbert modular forms

Abstract: We show that half-integral weight Hilbert modular forms have large Fourier coefficients, by modifying the resonance method first introduced by Soundararajan. Our proof is modeled on that of Gun-Kohnen-Soundararajan.

SPEAKER: **Brandt Kronholm** (UT Rio Grande Valley)

TITLE: New generating functions for Gaussian polynomials

ABSTRACT: The function $p(n,m,N)$ enumerates the partitions of n into at most m parts with no part larger than N. For $m,N \geq 0$, the standard generating function for $p(n,m,N)$ is given by the Gaussian polynomial, also known as the q-binomial coefficient: $\begin{bmatrix} N+m \\ m \end{bmatrix}_q$.

$$\begin{bmatrix} N+m \\ m \end{bmatrix}_q = \sum_{n=0}^{mN} p\big(n,m,N\big)q^n = \frac{(q;q)_{N+m}}{(q;q)_m(q;q)_N}$$

In this talk we will establish a completely new set of generating functions for $p(n,m,N)$. For example:

PROPOSITION 1. *For all $N, A \geq 0$*

$$\sum_{N=0}^{\infty} p\big(2N-A,4,N\big)z^N = \begin{cases} \displaystyle\sum_{N=0}^{\infty} p\big(2N-2a,4,N\big)z^N = \frac{z^a\left(1+z^2-z^{a+1}\right)}{(1-z)^2\left(1-z^2\right)\left(1-z^3\right)} \\ \displaystyle\sum_{N=0}^{\infty} p\big(2N-(2a+1),4,N\big)z^N = \frac{z^a\left(z+z^2-z^{a+2}\right)}{(1-z)^2\left(1-z^2\right)\left(1-z^3\right)}. \end{cases}$$

As A spans the integers, we obtain each and every coefficient of each and every Gaussian polynomial of the form $\begin{bmatrix} N+4 \\ 4 \end{bmatrix}_q$.

With these new generating functions established, we are able to quickly prove a host of identities such as the following surprising example.

EXAMPLE 1. *Let N be any nonnegative integer. Then*

$$p(2N-2,4,N) = p(2N-1,4,N) = p(2N+1,4,N) = p(2N+2,4,N).$$

Very recently Example 1 was proved independently by Lie algebra researchers D. Burde and F. Wagemann.

SPEAKER: **Shilin Lai** (UT Austin)

TITLE: Relative Satake isomorphism and Euler systems

ABSTRACT: Starting from the inversion formula for the relative Satake isomorphism due to Sakellaridis, we observe a simple divisibility property. We will then explain how this gives a computation-free construction of Euler systems in some settings. This is joint work with Li Cai and Yangyu Fan.

SPEAKER: **Eun Hye Lee** (TCU)

TITLE: Automorphic form twisted Shintani zeta functions over number fields

ABSTRACT: In this talk, we will be exploring the analytic properties of automorphic form twisted Shintani zeta functions over number fields. I will start by stating some basic facts from classical Shintani zeta functions and then we will take a look at the adelic analogues of them. Joint with Ramin Takloo-Bighash.

SPEAKER: **Juan-Pablo Llerena-Cordova** (University of Ottawa)

TITLE: Numerical study of refined conjectures of the Birch-Swinnerton-Dyer type

ABSTRACT: In 1987, Mazur and Tate stated conjectures which, in some cases, resemble the classical Birch-Swinnerton-Dyer conjecture and its p-adic analog. We will present some of these refined conjectures, which we studied numerically using SageMath. Later, we will mention some discrepancies that we found in the original statement of these conjectures. Lastly, we will talk about a slight modification of these conjectures that appear to hold numerically.

SPEAKER: **Weixiao Lu** (MIT)

TITLE: The global Gan-Gross-Prasad conjecture for the Fourier-Jacobi periods on the unitary groups

ABSTRACT: We will explain the proof of global GGP conjecture for the Fourier-Jacobi period on unitary groups based on relative trace formula. This is joint work with Paul Boisseau and Hang Xue.

SPEAKER: **Shilpi Mandal** (Emory University)

TITLE: Strong u-invariant for complete ultrametric fields

ABSTRACT: Let K be a field with $char(K)$ not 2. The u-invariant of K, is the maximal dimension of anisotropic quadratic forms over K. For example, the u-invariant of $\mathbb{C}$ is 1; for F a non-real global or local field, the u-invariant is 1, 2, 4, or 8, etc.

Considerable progress has been made in the computations of the u-invariant of function fields of p-adic curves due to Parimala and Suresh, and by Harbater, Hartmann, and Krashen regarding the u-invariants in the case of function fields of curves over complete discretely valued fields.

In this talk, I will present similar bounds for the strong u-invariant of a complete non-Archimedean valued field K with residue field k.

SPEAKER: **Marcella Manivel** (University of Minnesota)

TITLE: Automorphic Dirac operators

ABSTRACT: Adrienne Sands in her 2020 thesis describes an automorphic Hamiltonian, whose lowest eigenfunction, enticingly, relates to Kronecker's limit formula. Automorphic Dirac operators are necessary to understand the characterization of this operator. Specifically, its potential is given by requiring a scalar commutator with the automorphic Dirac operator. Moreover, the associated raising and lowering operators require the automorphic Dirac operator. Recall that Dirac operators are first order differential operators whose square is the Laplacian, and while the Dirac operator is well understood when applied to functions on the real numbers, its automorphic analogue is more nuanced. In this talk, I explain what Dirac operators are, highlight the importance in understanding the automorphic analogues for Sands' Hamiltonian, and touch on their relevance in my thesis work.

SPEAKER: **Jaban Meher** (National Institute of Science Education and Research Bhubaneswar)

TITLE: On the zeros of generalized Ramanujan polynomials

ABSTRACT: In this talk we will discuss about the location of the zeros of generalized Ramanujan polynomials.

SPEAKER: **Michael Mertens** (RWTH Aachen University)

TITLE: On balanced holomorphic VOAs of central charge 32

ABSTRACT: In 1993, Schellekens published a list of 71 Lie algebras which may occur as graded components of strongly regular holomorphic vertex operator algebras (VOAs) of central charge 24, one of which is the famous Moonshine VOA featured in the proof of Monstrous Moonshine by Frenkel-Lepowski-Meurman and Borcherds. In recent years, it was proven by Höhn, Möller, Scheithauer, van Ekeren et al. that indeed all of these Lie algebras are realized by such VOAs. Similar results had already been obtained for VOAs of central charges 8 and 16. An analogous classification for strongly regular VOAs of central charge 32 at first seems hopeless due to the vast number of even unimodular lattices of that rank, each one of which gives rise to just such a VOA. However, an additional, rather natural, condition, which I will discuss in my talk, makes this classification manageable. In my talk, I will report on this classification result, which is joint work in progress with Maneesha Ampagouni and Geoffrey Mason.

SPEAKER: **Lance Miller** (University of Arkansas)

TITLE: An introduction to delta-modular forms

ABSTRACT: This talk will introduce an enhancement of Katz's theory for modular forms. Specifically, Buium systematically incorporated, via p-derivations, a generalization that include new modular forms of higher order. Some of these forms have remarkable transformation properties along isogenies that no Katz form enjoys. Time permitting we will discuss work in progress on adapting this to adic spaces. No knowledge of p-derivations will be assumed.

SPEAKER: **Steven Miller** (Williams College) & Akash Narayanan (UC Berkeley)

TITLE: An excised orthogonal model for families of cusp forms

ABSTRACT: The Katz-Sarnak philosophy states that statistics of zeros of L-function families near the central point as the conductors tend to infinity agree with those of eigenvalues of random matrix ensembles as the matrix size tends to infinity. For finite conductors, very different behavior can occur, as observed by S. J. Miller for zeros near the central point in elliptic curve families. This led to the excised model of Dueñez, Huynh, Keating, Miller, and Snaith, which accurately fits the data for quadratic twists of elliptic curves. This model accounts for the discretization of values of elliptic curve L-function at the central point by excising matrices whose characteristic polynomial at 1 is below a corresponding threshold. We extend this model to families of quadratic twists of holomorphic cuspidal newforms of odd prime level, seeing the impact the weight, which controls the discretization of the values at the central point, has on the behavior of nearby zeros. In this talk, we will focus on highlighting the key ideas of the theoretical model; time-permitting, we will discuss some experimental results.

Speaker: **Andreas Mono** (Vanderbilt Univ.)

Title: A modular framework for generalized Hurwitz class numbers

Abstract: We discover a neat linear relation between the mock modular generating functions of the level 1 and level N Hurwitz class numbers. This relation gives rise to a holomorphic modular form of weight $\frac{3}{2}$ and level $4N$ for $N > 1$ odd and square-free. We extend this observation to a non-holomorphic framework and obtain a higher level analog of Zagier's Eisenstein series as well as a preimage under the ξ-operator. All of these observations are deduced from a more general inspection of the weight $\frac{1}{2}$ Maass–Eisenstein series of level $4N$ at its spectral point $s = \frac{3}{4}$. This idea goes back to Duke, Imamoḡlu and Tóth in level 4 and relies on the theory of so-called sesquiharmonic Maass forms. Furthermore, we connect the aforementioned results to a regularized Siegel theta lift as well as a regularized Kudla–Millson theta lift for odd prime levels, which builds on earlier work by Bruinier, Funke and Imamoḡlu. This is joint work with Olivia Beckwith.

Speaker: **Manuel Müller** (TU Darmstadt)

Title: The Picard group of the Baily-Borel compactification of orthogonal Shimura varieties

Abstract: Orthogonal Shimura varieties arise from symmetric domains attached to orthogonal groups. We show that the Picard group of the Baily-Borel compactification of an orthogonal Shimura variety has rank one if the corresponding lattice splits two hyperbolic planes globally and three hyperbolic planes locally. One of the main ingredients of the proof is the basis problem for modular forms for the Weil representation.

Speaker: **Kumar Murty** (University of Toronto)

Title: L-functions and Poincare series

Abstract: We will discuss the interconnected themes of L-functions and the distribution of their zeros, arithmetic and distribution properties of Fourier coefficients of modular forms, and Poincare series.

Speaker: **Ajith Nair** (Arizona State University)

Title: Explicit composition identities for higher composition laws

Abstract: In 2001, Manjul Bhargava gave a new proof of Gauss composition of binary quadratic forms by using 2x2x2 integer cubes. Moreover, he showed that there are five higher composition laws which are related to quadratic rings similar to the case of binary quadratic forms. The proof of these higher composition laws relies on bijections between certain orbits of the spaces on which the composition is defined under some natural group action and certain (tuples of) ideal classes of quadratic rings. In my PhD thesis, under the supervision of Gautam Chinta, we formulated the higher composition laws in a manner similar to Gauss' formulation of composition of binary quadratic forms. More precisely, we provided explicit composition identities for the higher composition laws in the quadratic case. In this talk, I will briefly outline Bhargava's work on composition laws in the quadratic case and describe our results on the composition identities.

SPEAKER: **Alexis Newton** (Emory University)

TITLE: Low-degree points on some rank 0 modular curves

ABSTRACT: Let E be an elliptic curve defined over a number field K. We present some new progress on the classification of the finite groups which appear as the torsion subgroup of $E(K)$ for low-degree number fields. In particular, we concentrate on determining the quartic, quintic and sextic points on certain modular curves $X_1(N)$ for which the rank of the Jacobian is zero.

SPEAKER: **Amit Ophir** (UC San Diego)

TITLE: Projective smooth mod-p representations of p-adic groups

ABSTRACT: Let F be a local field of residual characteristic p, and let G be the group of F-rational points of a connected reductive group over F. The category of smooth representations of G over a characteristic p field, along with its derived category, has been studied in connection with the Langlands philosophy. I will discuss a joint work with Claus Sorensen in which we provide an elementary proof that the category of smooth representations of G over a field of characteristic p has no nonzero projective objects. This result was recently established by Sorensen-Schneider using cohomological methods. However, our approach generalizes it in two ways: allowing F to have characteristic p and allowing central characters.

At the heart of our approach lies a group-theoretic condition we call 'fairness', which admits a simple characterization in terms of the Chabauty space of all closed subgroups of G.

SPEAKER: **Shubham Nikam** (Kansas State University)

TITLE: Poincaré series solution to differential equations involving integer-valued Eisenstein series

ABSTRACT: In the 2025 paper of Fedosova, Klinger-Logan, and Radchenko, the authors showed certain shifted convolution sums of even index of divisor functions result in the Fourier coefficient of Hecke eigenforms. This result is motivated by a conjecture from physics, and it is expected that the result can be extended to odd index divisor functions. However, the proof in Fedosova, Klinger-Logan, and Radchenko fails to extend. We will examine the analogous physical setting, which should lead to convolution sums involving odd index divisor sums in the hopes of formulating a conjecture analogous to the result of Fedosova, Klinger-Logan, and Radchenko.

SPEAKER: **Qi Peikai** (Michigan State University)

TITLE: An analogue of the Greenberg pseudo-null conjecture for CM fields

ABSTRACT: We will give an analogue of Greenberg's pseudo-null conjecture for CM fields. Let K be a CM field and K^+ be the unique totally real subfield of K. Assume that primes above p in K^+ all splits in K. Let $\mathfrak{P}_1, \mathfrak{P}_2, \cdots, \mathfrak{P}_s, \tilde{\mathfrak{P}}_1, \tilde{\mathfrak{P}}_2, \cdots, \tilde{\mathfrak{P}}_s$ be prime ideas in K above p, where $\tilde{\mathfrak{P}}_i$ is the complex conjugation of $\mathfrak{P}_i$. We show that there is unique $\mathbb{Z}_p$-extension

of K unramified outside $\mathfrak{P}_1, \mathfrak{P}_2, \cdots, \mathfrak{P}_s$ if Leopoldt's conjecture holds for K. We also show that such $\mathbb{Z}_p$-extension for CM field has similar properties as cyclotomic $\mathbb{Z}_p$-extension of a totally real field. We also give some criteria for Iwasawa invariant $\mu = \lambda = 0$. The work is joint with Matt Stokes.

SPEAKER: **Hao Peng** (MIT)

TITLE: Fargues-Scholze vs. classical parameters, and applications

ABSTRACT: For general reductive groups over a p-adic local field, Fargues and Scholze constructed a (semi-simplified) local Langlands with many good properties. On the other hand, classical local Langlands correspondences are known for classical groups via endoscopy theory and theta lifting. We review the construction of Fargues-Scholze and related geometric objects, and prove these two correspondences are compatible for all unramified special orthogonal and unitary groups. As an application, we prove torsion vanishing results for orthogonal Shimura varieties, generalizing results of Caraiani-Scholze, Koshikawa, Santos and Hamann-Lee, etc..

SPEAKER: **Erin Pierce** (University of North Texas)

TITLE: Fourier coefficients of Siegel Eisenstein series

ABSTRACT: Eisenstein series play an important role in number theory, particularly in the study of automorphic forms. It is an interesting problem to calculate the Fourier coefficients of various types of Eisenstein series. In this talk, we will introduce an Eisenstein series derived from the Siegel parabolic of $GSp(4)$, discuss the adelic method for computing its Fourier coefficients, and present a novel approach for calculating them.

SPEAKER: **Zachary Porat** (Wesleyan University)

TITLE: Advances in computations on the cohomology of congruence subgroups of $\mathrm{SL}(3, \mathbb{Z})$

ABSTRACT: At the 36th Automorphic Forms Workshop, we introduced a technique for computing the action of Hecke operators directly on the cuspidal cohomology of congruence subgroups of $\mathrm{SL}(3, \mathbb{Z})$. In this talk, we will report further developments, highlighting data for prime level greater than 1500, our previous computational limit. We will discuss how to detect nonzero cuspidal cohomology classes, thereby detecting cuspidal automorphic forms on $\mathrm{GL}(3)$, and how to determine local factors of the L-functions associated to these cusp forms.

SPEAKER: **Parimala Ramen** (Emory University)

TITLE: A Hasse principle for reductive groups over function fields

ABSTRACT: A classical theorem of Hasse and Minkowski says that a quadratic form over a number field represents zero nontrivially if it does over all its completions at places of the number field. We review results from Hasse principle for homogeneous spaces under reductive groups over number fields. We motivate similar questions for function fields of curves over number fields and local fields. We describe progress towards these questions over function fields of curves over p-adic fields.

Speaker: **Martin Raum** (Chalmers University of Technology)

Title: Theta cycles of modular forms modulo p^2

Abstract: Based on joint work with Scott Ahlgren and Olav Richter.

The theta operator, which is $q\partial_q$ on q-series, is quasi-periodic on modular forms with coefficients in positive characteristic. The resulting self-repeating structure is called a theta cycle. Weights, i.e. weight filtrations, of modular forms in theta cycles modulo primes are well understood and of simple shape. They are reflected in Serre's weight conjecture, and impact for instance combinatorial number theory, where they help to characterize U_p-congruences and Ramanujan-like congruences. Close to nothing is known about theta cycles modulo prime squares. In this talk we first illustrate by experimental data how erratic they are indeed. Then we give several statements that exhibit islands of regularity in them, on which we can determine the weight filtration exactly.

Speaker: **Ken Ribet** (UC Berkeley)

Title: Cyclotomic torsion points on abelian varieties

Abstract: Let A be an abelian variety over a number field K. Long ago, I proved that there are only a finite number of torsion points of A that are rational over the maximal cyclotomic extension of K. In other words, the group of cyclotomic torsion points of A is finite. This result has been extended in different directions over the ensuing decades. What happens if we specialize, rather than extend? In particular, if K is the rational field $\mathbb{Q}$ and A is an abelian variety of special interest, can we describe the group of cyclotomic torsion points of A explicitly? I will discuss the case where A is the abelian variety $J_0(N)$ that was studied in Barry Mazur's celebrated "Eisenstein ideal" article of 1977.

Speaker: **Berend Ringeling** (Universite de Montreal)

Title: Zeros of modular forms

Abstract: Typically, the results on zeros of modular forms can be put into two categories: The zeros of Eisenstein series and the zeros of Hecke eigenforms. In the first case, all zeros are confined to an arc of the unit circle. In the second case, the zeros become equidistributed as the weight increases. In this talk we focus on the first case. We discuss the beautiful and elementary proof of Rankin and Swinnerton-Dyer and its generalization to arbitrary congruence groups. This is joint ongoing work with Gunther Cornelissen and Sebastián Carrillo Santana.

Speaker: **Erick Ross** (Clemson)

Title: When exactly will the newspaces exist?

Abstract: Consider $N \geq 1$, $k \geq 2$, and χ a Dirichlet character modulo N such that $\chi(-1) = (-1)^k$. Then one can define the space of modular forms $S_k(\Gamma_0(N), \chi)$. It is not too difficult to show that this space is non-trivial for all but finitely many triples (N, k, χ). A natural question then might be to ask if the same property holds for the newspace

$S_k^{\text{new}}(\Gamma_0(N), \chi)$. In this presentation, we show that the newspace does not enjoy this property; there exists an infinite family of triples (N, k, χ) for which $\dim S_k^{\text{new}}(\Gamma_0(N), \chi) = 0$. However, we classify this case entirely. In order to show these results, we derive an explicit dimension formula for the newspace $S_k^{\text{new}}(\Gamma_0(N), \chi)$.

SPEAKER: **Sug Woo Shin** (UC Berkeley)

TITLE: Endoscopic classification for classical groups

ABSTRACT: This talk is intended as a gentle introduction to the problem of classifying automorphic representations (globally) and irreducible admissible representations (locally) via endoscopy following Arthur, Kottwitz, Langlands, Shelstad, et al. I will focus on the case of quasi-split classical groups, highlighting Arthur's monumental work as well as some recent progress by Hiraku Atobe, Wee Teck Gan, Atsushi Ichino, Tasho Kaletha, Alberto Mingeuz, and myself.

SPEAKER: **Joshua Stucky** (Georgia Tech)

TITLE: The fourth moment of quadratic Dirichlet L-functions

ABSTRACT: We prove an asymptotic formula with four main terms for the fourth moment of quadratic Dirichlet L-functions unconditionally. Our proof is based on the work of Li, Soundararajan, and Soundararajan-Young. Our proof requires several new ingredients. These include a modified large sieve estimate for quadratic characters where we consider a fourth moment, rather than a second, as well as observing cross cancellations between diagonal and off-diagonal terms, which involves somewhat delicate combinatorial arguments.

SPEAKER: **Ergun Suer** (University of Oklahoma)

TITLE: Self-Dual Representations of $SL(n, F)$

ABSTRACT: Let F be a non-Archimedean local field, and let $G = SL(n, F)$. Consider any irreducible (smooth, complex) self-dual representation (π, V) of G. The underlying space V admits a unique (up to scaling) non-degenerate $G-$invariant bilinear form, which is necessarily either symmetric or skew-symmetric. We define $\epsilon(\pi) = \pm 1$ accordingly. In this talk, we show that if n is odd or $n \equiv 0 \mod 4$, then $\epsilon(\pi) = 1$.

SPEAKER: **Swati** (University of South Carolina)

TITLE: Explicit images for the Shimura Correspondence

ABSTRACT: For $(r, 6) = 1$ with $1 \le r \le 23$, and a non-negative integer s, we define

$$\mathcal{A}_{r,s,N} = \{\eta(z)^r f(z) : f(z) \in M_s(N, \chi)\}.$$

In 2014, Yang showed that for $F \in \mathcal{A}_{r,s,1}$, the r-th Shimura image associated to the theta-multiplier $\mathrm{Sh}_r(F \mid V_{24}) = G \otimes \chi_{12}$ where $G \in S_{r+2s-1}^{new}\left(6, -\left(\frac{8}{r}\right), -\left(\frac{12}{r}\right)\right)$. He proved a similar result for $(r, 6) = 3$. His proofs rely on trace computations in integral and half-integral weights.

In this talk, we provide a constructive proof of Yang's result. We obtain explicit formulas for the r-th Shimura image associated to the eta-multiplier $\mathcal{S}_r(F)$ in case of $(r,6)=1$ and $(r,6)=3$. We also prove a Rankin-Cohen bracket analogue for the first Shimura image $\mathcal{S}_1$ in this case. We conclude the talk by showing a list of explicit formulas for $\mathcal{S}_1$ of normalized Hecke eigenform times eta-quotients that are theta series, transforming with respect to a power of eta-multiplier. This is a joint work with Matthew Boylan.

SPEAKER: **Holly Swisher** (Oregon State)

TITLE: Modular functions and the monstrous exponents

ABSTRACT: In 1973 Ogg initiated the study of monstrous moonshine with the observation that the prime divisors of the monster group are exactly those for which the Fricke quotient $X_0(p)+p$ of the modular curve $X_0(p)$ has genus zero. Here, motivated by Deligne's theorem on the p-adic rigidity of the elliptic modular j-invariant, we present a modular function-based approach to explaining some of the exponents that appear in the prime decomposition of the order of the monster.

SPEAKER: **Ramin Takloo-Bighash** (University of Illinois at Chicago)

TITLE: Recent progress on the distribution of rational and integral points on homogeneous varieties

ABSTRACT: In this talk I'll give a survey of some works studying the distribution of rational points on compactifications of semisimple groups. Time allowing, I'll state a conjecture about the distribution of Campana points on Fano varieties and discuss some evidence using homogeneous varieties. The newer results in this talk are joint work with Chow-Loughran-Tanimoto, and Tanimoto-Tschinkel.

SPEAKER: **Karen Taylor** (Bronx Community College)

TITLE: Sturm bound for cuspidal quaternionic modular forms on $SO(4,3)$

ABSTRACT: In this talk, we will describe work in progress computing a Sturm bound for cuspidal modular forms on $SO(4,3)$. This is a joint project, with Ilesanmi Adeboye, Charles Burnette and Aaron Pollack, initiated at ADJOINT at SLMath.

SPEAKER: **Kalani Thalagoda** (Tulane University)

TITLE: Summation formula for Hurwitz class numbers

ABSTRACT: Analytic number theorists frequently use summation formulas to study the asymptotic and statistical behavior of interesting (sometimes erratic) arithmetic functions. For the Dirichlet series satisfying a certain functional equation, including the Dirichlet series of modular forms, Chandrasekharan and Narasimhan proved a formula for a weighted sum of the first n coefficients. In this talk, I will discuss a summation formula for mock modular forms of moderate growth and apply it to Hurwitz class numbers. The proof utilizes L-functions defined by Shankadhar and Singh and modifies the method of Chandrasekharan and Narasimhan. This is joint work with Olivia Beckwith, Nicholas Diamantis, Rajat Gupta, and Larry Rolen.

SPEAKER: **Mohit Tripathi** (Texas Tech University)

TITLE: Hypergeometric functions and their applications

ABSTRACT: Hypergeometric functions are special functions that play significant roles in various branches of mathematics and physics. Their deep connections with modular forms have been extensively studied, revealing rich structures and profound applications. In this talk, we will explore summation formulas for hypergeometric functions and discuss their applications in different mathematical contexts.

SPEAKER: **Wade Twyford** (UC Berkeley)

TITLE: Arithmetic connections to Mathieu moonshine in weight 3/2

ABSTRACT: Moonshine refers to unexpected connections between dimensions of irreducible representations of finite simple groups and coefficients of the Fourier expansion of modular forms. The most well known example of this is monstrous moonshine, but observations by physicists have led to the conjecture of another type of moonshine called Mathieu moonshine. Recently, there have been works on the arithmetic applications of more general instances of moonshine on the number of rational points on certain elliptic curves. In this talk, we outline our proof for the existence of a module for the largest Mathieu group and apply current results as well as numerical methods describing the arithmetic connections of weight 3/2 modular forms.

SPEAKER: **Mahendra Verma** (IIT Roorkee)

TITLE: Distinguished representations and symplectic period

ABSTRACT: Let F be a number field and A its ring of adeles. Consider $G = GL(n, F)$ and its closed subgroup $H = Sp(n, F)$. Consider the period integral of an automorphic form defined on $G(F)\backslash G(A)$, called symplectic period. Further, let D be a quaternion division algebra over F. By considering inner forms of G and H, we can define symplectic period n this setting also. In this talk we will present that symplectic period is preserved under the global Jacquet-Langlands correspondence.

SPEAKER: **Nawapan Wattanawanichkul** (University of Illinois at Urbana-Champaign)

TITLE: Holomorphic quantum unique ergodicity and weak subconvexity for L-functions

ABSTRACT: Quantum unique ergodicity (QUE) describes the equidistribution of the L^2-mass of eigenfunctions of the Laplacian as their eigenvalues approach infinity. My focus lies on a specific variant of QUE known as holomorphic QUE, which concerns the distribution of the L^2-mass of normalized Hecke eigenforms of even weight k (where $k \geq 2$). In 2010, Holowinsky and Soundararajan proved the equidistribution of normalized Hecke eigenforms as k tends to infinity. In my talk, I will briefly discuss their proof ideas, explore the connection with the subconvexity problem, and present my new results on the topic.

Speaker: **Clayton Williams** (University of Illinois at Urbana-Champaign)

Title: Hecke relations for eta multipliers and congruences for higher-order smallest parts functions

Abstract: We derive identities from Hecke operators acting on a family of Eisenstein-eta quotients, giving explicit equalities relating the coefficients of these quotients. From these equalities we derive congruences for the coefficients of these Eisenstein-eta quotients modulo powers of primes. As an application we derive systematic congruences for several higher-order smallest parts functions modulo prime powers, resolving a question of Garvan for these cases. We also relate moments of cranks and ranks to the partition function modulo prime powers. Some of our results strengthen and generalize those of a 2023 paper by Wang and Yang.

Speaker: **Tian An Wong** (University of Michigan-Dearborn)

Title: Periods of Bianchi modular forms: progress and problems

Abstract: Bianchi modular forms are generalizations of classical modular forms to imaginary quadratic fields. In this talk, I will present recent work with undergraduate students on periods of Bianchi modular forms in two flavors: (1) rationality results for periods of L-functions of Bianchi modular forms over Euclidean fields, and (2) experiments with zeroes of Bianchi period polynomials, which notably appear to diverge from classical results.

Speaker: **Haochen Wu** (Dartmouth College)

Title: Hilbert modular forms from orthogonal modular forms on binary lattices

Abstract: We show the explicit connection between Hilbert modular forms and orthogonal modular forms arising from positive definite binary lattices over the ring of integers of a totally real number field. Our work uses the even Clifford algebra to generalize Gauss composition in a categorical way over a Dedekind domain. This allows us to classify the class sets of different types of genera in terms of the class groups of the associated quadratic algebras. This is joint work with John Voight.

Speaker: **Chris Xu** (UC San Diego)

Title: Special cycles on G_2

Abstract: On the symmetric space for G_2, there exist various submanifolds G_D corresponding to the stabilizer of a norm D vector. We show that when a suitable automorphic form is integrated against the G_D, the resulting numbers assemble to give a half-integral weight classical modular form. Although this is already implied by a result of Kudla-Millson, we give a simpler proof that avoids the complications in their paper.

SPEAKER: **Hui Xue** (Clemsen University)

TITLE: A strong multiplicity one theorem and applications

ABSTRACT: We discuss a linear form strong multiplicity one result for $GL(n)$. For $n = 2$, we give some unconditional result. At last, we apply this multiplicity one to study linear independence of central values of Rankin-Selberg convolutions.

SPEAKER: **Ajmain Yamin** (CUNY Graduate Center)

TITLE: Quaternionic analogues of Zagier's sums of binary quadratic forms

ABSTRACT: We investigate sums of binary Hamiltonian forms, analogous to Zagier's sums of binary quadratic forms and Karabulut's sums of binary Hermitian forms. We prove that these sums live in finite dimensional vector spaces and compute explicit bases for some of these spaces. This results in new identities satisfied by certain elementary arithmetic functions. This talk presents work done in collaboration with Gautam Chinta (CCNY). The speaker is a current PhD student at the CUNY Graduate Center.

SPEAKER: **Pan Yan** (University of Arizona)

TITLE: L-functions for $Sp(2n)xGL(k)$ via non-unique models

ABSTRACT: In the usual paradigm of the Rankin-Selberg method, the Eulerian factorization of a global integral relies on the uniqueness of a model such as the Whittaker model, or the uniqueness of an invariant bilinear form between an irreducible representation and its contragredient. Examples of Rankin-Selberg integrals which unfold to non-unique models are very rare because standard tools for local unramified computation such as the Casselman-Shalika formula are not applicable. In this talk we derive new global integrals for $Sp(2n)xGL(k)$ where n is even, from the generalized doubling method of Cai, Friedberg, Ginzburg and Kaplan, following a strategy and extending a previous result of Ginzburg and Soudry on the case $n = k = 2$. We show that these new global integrals unfold to non-unique models on $Sp(2n)$. Using the New Way method of Piatetski-Shapiro and Rallis, we show that these new global integrals represent the L-functions for $Sp(2n)xGL(k)$, generalizing a previous work of Piatetski-Shapiro and Rallis on $Sp(2n)xGL(1)$. This is joint work with Yubo Jin.

SPEAKER: **Mulun Yin** (UC Santa Barbara)

TITLE: Anticyclotomic Iwasawa theory of newforms at good and bad Eisenstein primes

ABSTRACT: Since the work of Castella–Grossi–Lee–Skinner on anticyclotomic Iwasawa theory of elliptic curves at Eisenstein primes in 2022, much progress has been made in this direction, with applications to the Birch–Swinnerton-Dyer conjecture and arithmetic statistics. Their results have now been generalized to higher weight newforms as well as to primes of multiplicative reduction and in some situations additive reduction. In this talk, we will discuss recent progress in the Eisenstein case. This is joint work with Timo Keller.

Speaker: **Bobby (Zixuan) Zhang** (Duke University)

Title: Orthogonal Friedberg-Jacquet periods

Abstract: Getz and Wambach proposed a general principle that one should be able to classify cuspidal automorphic representations of classical groups distinguished by symmetric subgroups in terms of their twisted endoscopic transfers to general linear groups. They verified a special case involving unitary groups using the technique of comparison of trace formulae. In this talk, I will focus on another special case of this phenomenon, the so-called "orthogonal" linear periods. We will set up the matching diagram and prove the fundamental lemma. This is an ongoing work with Raphael Beuzart-Plessis and Jayce Getz.

Speaker: **Zhiyu Zhang** (Stanford)

Title: On twisted Gan-Gross-Prasad conjecture

Abstract: Let E/F and K/F be two distinct quadratic extensions of number fields, and $L = EK$. Assuming E and K have no common ramification places, with conditions on local representations, we prove the twisted Gan-Gross-Prasad conjecture on automorphic Asai L-function for $(Res_{L/E}GL_{n,L}, L/E)$. This is based on refined understandings of Weil representations and relative trace formulas. Joint work with Weixiao Lu and Danielle Wang.

Speaker: **Alan Zhao** (Columbia)

Title: Siegel modular forms and moduli

Abstract: A priori, the Rankin-Cohen bracket seems like a tool used only to study modular forms and their representations. Recently, I came across a paper that, for the first time (to me, at least) illustrated its geometry. Concretely, it may be used to study cones of ample divisors on the moduli space $\mathcal{A}_g$. This talk will use the first three sections of the paper Differentiating Siegel Modular Forms and the Moving Slope of $\mathcal{A}_g$.

Speaker: **Shifan Zhao** (The Ohio State University)

Title: Low-lying zeros of Hilbert modular L-functions weighted by powers of central L-values

Abstract: The famous Katz-Sarnak philosophy predicts that the distribution of low-lying zeros of families of L-functions follow certain symmetry through a Random Matrix Model. Recent studies in this field focus on the change of symmetry type once the distribution is weighted by central L-values. In this talk I will present recent results towards this problem for L-functions of Hilbert modular forms defined over totally real number fields, weighed by first, second, and third powers of central L-values, respectively. This is based on joint work with Zhining Wei and Liyang Yang.