PAlmetto **N**umber **T**heory **S**eries **XL**

SCHEDULE OF ACTIVITIES

Talks will take place in Martin M1, Martin M301 (Saturday) and M105 (Sunday). Refreshments are available during all breaks in Martin M1.

Saturday, December 6, 2025

8:30–9:00	[Martin M1] Coffee and other refreshments
9:00–9:50	[Martin M1] **Edna Jones**, *On the local-global conjecture for 3-dimensional Kleinian sphere packings*
10:10–10:30	[Martin M1] **Saikat Biswas**, *On a refinement of the Cassels-Poitou-Tate dual exact sequence*
	[Martin M301] **Erick Ross**, *Zeros of even and odd period polynomials lie on the circle of symmetry*
10:40-11:00	[Martin M1] **Eun Hye Lee**, *Lower order terms in the shape of cubic fields*
	[Martin M301] **Haochen Wu**, *Hilbert modular forms from orthogonal modular forms on binary lattices*
11:10–11:30	[Martin M1] **Kenz Ismail Kallal**, *Algebraic theory of indefinite theta functions*
	[Martin M301] **Alejandro De Las Penas Castano** *Zero cycles on products of elliptic curves over local fields with supersingular reduction*
11:40–12:30	[Martin M1] **Nawapan Wattanawanichkul**, *Arithmetic and Holomorphic Quantum Unique Ergodicity*
12:30-2:00	Lunch
2:00–2:50	[Martin M1] **Wenzhi Luo**, *Central L-values of the cuspidal Asai lifts*
3:10-3:30	[Martin M1] **Gabrielle Scullard**, *Ihara zeta functions of isogeny graphs and modular curves*
	[Martin M301] **Tianyu Ni**, *Kernel functions of the symmetric square L-functions of modular forms*
3:40–4:00	[Martin M1] **Pan Yan**, *On the global Gan-Gross-Prasad conjecture for GSpin groups*
	[Martin M301] **Paresh Arora**, *Well-Poised Hypergeometric Functions and Their Decomposition*
4:10–4:30	[Martin M1] **Joseph DiCapua**, *Explicit Coleman Power Series*
	[Martin M301] **Sreejani Chaudhury**, *On a question of Totaro: Rational points and zero- cycles on torsors*
4:40–5:00	[Martin M1] **Larry Rolen**, *Inequalities for the partition function and other combinatorial sequences*
	[Martin M301] **Dalen Trent Dockery**, *Linking congruences for PED and POD partitions*

Sunday, December 7, 2025

9:00-9:30	[Martin M1] Coffee and other refreshments
9:30–10:20	[Martin M1] **Ramin Takloo-Bighash**, *Automorphic form twisted Shintani zeta function*
10:40–11:00	[Martin M1] **Maximiliano Sanchez Garza**, *The Geodesic Restriction Problem for Arithmetic Spherical Harmonics*
	[Martin M105] **Arindam Roy**, *TBA*
11:10–11:30	[Martin M1] **Joshua Lowrance**, *An Odd Covering System of the Perfect Powers*
	[Martin M105] **Yanhui Sua**, *Explicit generators of the space of modular forms*
11:40–12:00	[Martin M1] **Zachary Parker**, *Cohomology of* $\mathbb{Q}[I]$ *with Level*
	[Martin M105] **Jiaqi Hou**, *Kakeya-Nikodym norms of Maass forms*
12:10–12:30	[Martin M1] **Luis Finotti**, *Minimal Degree Liftings and Error-Correcting Codes*
	[Martin M105] **Sung Min Lee**, *On the Coprime Reductions of Elliptic Curves*
12:30	**END OF CONFERENCE**

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Abstracts

Paresh Singh Arora, Louisiana State University, *Well-Poised Hypergeometric Functions and Their Decomposition*

Hypergeometric functions can be interpreted as traces of Frobenius for certain Galois representations. In this talk, I will discuss how finite field hypergeometric functions decompose into lower-rank pieces when the underlying data satisfy a special symmetry known as the well poised condition. In particular, I will present explicit reduction identities for the well-poised finite-field analogues of ${}_3F_2(-1), {}_4F_3(1)$, and ${}_5F_4(-1)$, highlighting the modularity of associated Galois representations in certain cases.

Saikat Biswas, University of Texas at Dallas, *On a refinement of the Cassels-Poitou-Tate dual exact sequence*

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 orders of the component groups of the dual abelian variety.

Sreejani Chaudhury, Emory University, *On a question of Totaro: Rational points and zero-cycles on torsors*

For a linear algebraic group G, several of its fundamental problems can be unified into the problem of characterizing G-torsors over an arbitrary field k. In 1994, Serre asked the question : For a smooth connected linear algebraic group G over a field k, if a G-torsor X admits a zero cycle of degree 1, does it have a k-rational point?
Since a G-torsor X has a k-rational point if and only if its corresponding cohomology class in $H^1(k, G)$ is trivial, the cohomological version of this question is of great interest. Pioneering results by Springer, Bayer-Lenstra, Jodi, Nivedita have shown several affirmative answers to this question.
In 2004, Totaro generalized Serre's question for zero cycles of degree $d \geq 1$. In its generality, Totaro's question has counterexamples due to Parimala (projective homogeneous spaces), Reed and Suresh (PHS under adjoint groups) in special cases. However, Jodi and Parimala's work shows affirmative results to Totaro's question for semi-simple simply connected groups in low rank. In this talk, I plan to give a survey of the works done related to these questions and some glimpse of my work with Parimala on Totaro's question for low rank absolutely simple adjoint classical linear algebraic groups.

Alejandro De Las Penas Castano, University of Virginia, *Zero cycles on products of elliptic curves over local fields with supersingular reduction*

For a product of two elliptic curves over a p-adic field with good supersingular reduction, we produce infinitely many rational equivalences in the Chow group of zero cycles via genus 2 covers of the elliptic curves. We use this to obtain evidence for a conjecture of Colliot-Th elène about the structure of the Albanese kernel.

Joseph Dominick DiCapua, Louisiana State University, *Explicit Coleman Power Series*

Coleman power series are fundamental objects in Iwasawa theory and local class field theory. They have applications ranging from constructing p-adic L-functions to proving one version of the main conjecture of Iwasawa theory. In this talk, we use certain eigenspaces of the module of norm compatible sequences of principal units in order to find certain Coleman power series explicitly in terms of isomorphisms of Lubin-Tate formal group laws. This talk is joint work with Victor Kolyvagin.

Dalen Trent Dockery, University of Tennessee Knoxville, *Linking congruences for PED and POD partitions*

Recent work of Garvan, Sellers, Smoot, and others has made connections between infinite families of congruences for various partition functions. Here, we apply this approach to families of congruences for PED and POD partitions and find that they are naturally linked to congruence families for overpartitions into odd parts and overpartitions. This is joint work with Marie Jameson.

Luis Renato Finotti, University of Tennessee, *Minimal Degree Liftings and Error-Correcting Codes*

Voloch and Walker used canonical liftings of elliptic curves to construct error-correcting codes. The idea was generalized to the concept of minimal degree liftings of hyperelliptic curves, which potentially can give better codes. After a brief introduction to the theory, we will discuss the applications and present a more recent analysis of non-binary codes obtained by these methods.

Jiaqi Hou, Louisiana State University, *Kakeya-Nikodym norms of Maass forms*

I will talk about the problems on bounding L^p norms of Laplace eigenfunctions on Riemannian manifolds, and, in particular, Maass forms on locally symmetric spaces. The classical result was proved by Sogge, which is sharp on spheres but is expected to be improved with some curvature assumption. When p is small, Blair and Sogge showed that the problem can be reduced to studying the Kakeya-Nikodym norms, which measure the concentration near geodesic tubes. Using the amplification method, we can prove some power savings for Kakeya-Nikodym norms of Hecke-Maass forms in some cases. In this talk, I will present the results for SL(2,C) and U(2,1).

Edna Luo Jones, Tulane University, *On the local-global conjecture for 3-dimensional Kleinian sphere packings*

We will discuss the local-global conjecture for certain integral Kleinian sphere packings, such as Soddy sphere packings and orthoplicial Apollonian sphere packings. Sometimes each sphere in a Kleinian sphere packing has a bend (1/radius) that is an integer. When all the bends are integral, which integers appear as bends? In 2019, Kontorovich proved the local-global conjecture for Soddy sphere packings. Work towards proving a local-global conjecture for orthoplicial Apollonian sphere packings has been done by Dias and Nakamura. We extend their work to say more about the local-global conjecture for orthoplicial Apollonian sphere packings.

Kenz Ismail Kallal, Princeton University, *Algebraic theory of indefinite theta functions*

Jacobi's theta function $\Theta(q) := 1 + 2q + 2q^4 + 2q^9 + \cdots$, and more generally the theta functions associated to positive-definite quadratic forms, have the property that they are modular forms of half-integral weight. The usual proof of this fact is completely analytic in nature, using the Poisson summation formula. However, Θ was originally invented by Fourier (*Théorie analytique de la chaleur*, 1822) for the purpose of studying the diffusion of heat on a uniform circle-shaped material: it is the fundamental solution to the heat equation on a circle. By algebraically characterizing the heat equation as a specific flat connection on a certain bundle on a modular curve, we produce a completely algebraic technique for proving modularity of theta functions.
More specifically, we produce a refinement of the algebraic theory of theta functions due to Moret-Bailly, Faltings–Chai, and Candelori. As a consequence of the algebraic nature of our theory and the fact that it applies to indefinite quadratic forms / non-ample line bundles (which the prior algebraic theory does not), we also generalize the Kudla–Millson analytic theory of theta functions for indefinite quadratic forms to the case of torsion coefficients.
This is joint work in progress with Akshay Venkatesh.

Eun Hye Lee, Texas Christian University, *Lower order terms in the shape of cubic fields*

In this talk, we demonstrate equidistribution of the lattice shape of cubic fields when ordered by discriminant, giving an estimate in the Eisenstein series spectrum with a lower order main term, based on the joint project with R. Hough.

Sung Min Lee, Wake Forest University, *On the Coprime Reductions of Elliptic Curves*

Let E be an elliptic curve over $\mathbb{Q}$. For a good prime p, let E_p denote the reduction of E modulo p. The distribution of the sizes $|E_p(\mathbb{F}_p)|$ has been extensively studied. For example, Koblitz investigated how often $|E_p(\mathbb{F}_p)|$ is prime, and Cojocaru showed that the density of primes for which $|E_p(\mathbb{F}_p)|$ is divisible by a fixed integer m is approximately $1/m$.
We consider a natural extension: given two non-isogenous curves E and E', how often are $|E_p(\mathbb{F}_p)|$ and $|E'_p(\mathbb{F}_p)|$ coprime as p varies? Based on a classical result in number theory, one might expect the density to be $6/\pi^2$. In this talk, we show that the actual density is smaller, and we provide both heuristic and numerical evidence supporting this observation.
This is a joint work with Hamakiotes, Mayle, and Wang.

Joshua Lowrance, University of South Carolina, *An Odd Covering System of the Perfect Powers*

A covering system is a finite collection of congruences where every integer satisfies at least one of the congruences in the set. Furthermore, a distinct odd covering system is a covering system where all moduli are odd, distinct, and greater than 1. Erdos posed the open question of whether a distinct odd covering system exists. A variation to this question instead asks, given an odd number n, what is the smallest integer $t(n)$ for which there exists a covering system where $t(n)$ congruences have n as a moduli while all other moduli are distinct, odd, and greater than 1. In this talk, we show an upper bound of $t(n)$ for all odd n, and discuss shortcuts for constructing large covering systems. We also use one of these odd coverings to show that there exists a distinct odd covering system that covers every perfect power of an integer.

Wenzhi Luo, Ohio State University, *Central L-values of the cuspidal Asai lifts*

For an Hilbert-Hecke cusp form over a real quadratic extension of $\mathbb{Q}$, its Asai lift is an automorphic form on GL(4) over $\mathbb{Q}$, whose associated degree 4 L-function is obtained by restricting the Fourier coefficients on rational integers. This is an important known example of Langlands' far-reaching functoriality conjectures. In this talk we'll describe some interesting analytic aspects of Asia lifts, in particular our recent work on sharp bound for the second moment of their central L-values.

Tianyu Ni, Clemson University, *Kernel functions of the symmetric square L-functions of modular forms*

Let $S_k(N,\chi)$ be the space of cusp forms of weight k, level N and nebentypus χ. Denote by $\{f_1, ..., f_d\}$ the basis $S_k(N,\chi)$ consisting of normalized Hecke eigenforms. For integers s in the critical strip, consider the representing functions

$$\Phi_s = \sum_{j=1} \frac{f_j}{\langle f_j, f_j \rangle} L(f_j, s).$$

A well-studied question is about the dimensions of the subspaces of $S_k(N,\chi)$ generated by Φ_s for various subsets of integers s (say, even or odd, etc). There are many variations of this question (e.g., whether one can generate $S_k(N,\chi)$ with various Rankin-Cohen brackets of smaller weight Eisenstein series) and quite a few results obtained in various settings in the literature.

In this talk, we consider a parallel question about special values of the symmetric square L-function $\mathcal{D}(s,f)$. By a result of Zagier, the representing functions (instead of the products of Eisenstein series above) are Cohen brackets of the theta-function and Cohen's half-integral weight Eisenstein series. Specifically, for a positive square-free discriminant $D \equiv 1 \pmod 4$, we consider the space of cuspforms (all newforms) $S_k(D,\chi_D)$, where χ_D is the quadratic character asssociated with $\mathbb{Q}(\sqrt{D})$. The representing function for the special values (s,f) will now be

$$\Psi_s := \sum_{j=1}^{d} \frac{f_j}{\langle f_j, f_j \rangle} \mathcal{D}(f_j, s).$$

The principal result is that, for $D > 2^{k-2}$, the functions Ψ_s for odd numbers $3 \le s \le k-3$ are linearly independent.

Zachary Parker, University of North Carolina at Greensboro, *Cohomology of* $\mathbb{Q}[I]$ *with Level*

Automorphic forms are intimately linked to the cohomology of arithmetic groups. In this talk, we give an overview of how to explicitly compute such forms. We motivate the objects of interest, then visit the classical case where we illustrate the general approach. We conclude with some collected data, highlighting some exciting surprises, and describe future directions for this work. This project is supervised by Dan Yasaki and is joint with Kalani Thalagoda.

Larry Rolen, Vanderbilt University, *Inequalities for the partition function and other combinatorial sequences*

The study of asymptotic properties of sequences is of fundamental interest in number theory and combinatorics. We are especially interested in proving inequalities among sequences of numbers. This topic has seen a large outpouring of work in recent years. For instance, Nicolas and DeSalvo–Pak independently proved that the partition function $p(n)$ is eventually log-concave. Specifically, they showed that $p^2(n) - p(n-1)p(n+1) \ge 0$ for $n \ge 26$. Work of Griffin, Ono, Zagier, and myself placed this in a larger context by proving that related polynomial zero properties follow from a general phenomenon dictated by Hermite polynomials.

In this talk, describing ongoing joint work with Koustav Banerjee and Kathrin Bringmann, I will present a unified framework to prove a wide class of inequalities of sequences. We use this framework to resolve a number of open conjectures.

Erick Ross, Clemson University, *Zeros of even and odd period polynomials lie on the circle of symmetry*

To each newform $f \in S_k(\Gamma_0(N))$, one can associate the corresponding even/odd period polynomial $r_f^{\pm}(X)$ (constructed from special values of the L-function associated to f). These period polynomials $r_f^{\pm}(X)$ turn out satisfy a certain functional equation with circle of symmetry $|X| = \frac{1}{\sqrt{N}}$. For sufficiently large level and weight, we show that the zeros of $r_f^{\pm}(X)$ all lie on this circle of symmetry.

Arindam Roy, University of North Carolina at Charlotte, *TBA*

TBA.

Maximiliano Sanchez Garza, University of Virginia, *The Geodesic Restriction Problem for Arithmetic Spherical Harmonics*

Given a Riemannian manifold M and an L^2-normalized Laplacian eigenfunction ψ on M with eigenvalue λ^2, a general problem in analysis is to understand how the mass of ψ distributes around M as $\lambda \to \infty$. There are different ways to attack this problem. One of them is to bound the L^p-norm of ψ restricted to a submanifold of M. There are results in this direction by Burq, Gérard, and Tzvetkov, shown to be optimal in general. In this talk, I will discuss an improvement on these results in the case of the 2-sphere. For this improvement, we restrict to geodesics associated to CM points on the sphere and consider ψ to be an arithmetic spherical harmonic, i.e. a Laplacian eigenfunction that is additionally an eigenfunction of all the Hecke operators.

Gabrielle Scullard, University of Georgia, *Ihara zeta functions of isogeny graphs and modular curves*

The Ihara zeta function of a graph G can be thought of as a generating function which counts the cycles of G, keeping track of the lengths of the cycle. When G is undirected, connected, and regular, Ihara proved a determinant formula, which expresses the Ihara zeta function as a rational function determined by the adjacency matrix of G and the Euler characteristic. Studying cycles in the supersingular l-isogeny graph G(p,l) is closely linked to computationally hard problems such as computing endomorphism rings of supersingular elliptic curves, which naturally motivates studying Ihara zeta functions of isogeny graphs. But the Ihara determinant formula fails for these graphs in general: when there are ”extra” automorphisms, there is no way to consider G(p,l) as a directed, regular graph; and worse, even when there are no extra automorphisms, G(p,l) may still fail to be a graph in the definition used by Ihara (and first considered by Serre), who requires a fixed-point free involution on edges.

In this talk, we review the notion of a graph according to Serre and explain the ways isogeny graphs fail to meet the definition; define the more general notion of an "abstract isogeny graph", which captures most isogeny graphs considered in the literature; and prove an analogue of the Ihara determinant formula for abstract isogeny graphs. In the special case that G is an isogeny graph with level structure, under certain conditions on the level structure, we also relate the Ihara zeta function of G to the Hasse-Weil zeta functions of modular curves, extending and correcting work of Sugiyama and Lei-Muller. This is joint work with Jun Bo Lau, Travis Morrison, Eli Orvis, and Lukas Zobernig.

Yanhui Su, Clemson University, *Explicit generators of the space of modular forms*

Let S_κ be the space of cusp forms of weight κ and level one, and let S_κ^* denote its dual space. In this paper, we find explicit spanning sets of S_κ consisting of Rankin-Cohen brackets of Eisenstein series and sets of periods that span S_κ^*.

Ramin Takloo-Bighash, University of Illinois at Chicago, *Automorphic form twisted Shintani zeta function*

In this talk I will explain a new result joint with Eun Hye Lee in which we prove the analytic continuation of the Shintani zeta function of the prehomogeneous space of binary cubic forms twisted with an automorphic form over an arbitrary number field to the domain $\Re s > 3/4$, independent of all data. The main potential application of this result is the effective equidistribution of shapes of cubic extensions of arbitrary number fields.

Nawapan Wattanawanichkul, University of Illinois Urbana-Champaign, *Arithmetic and Holomorphic Quantum Unique Ergodicity*

Quantum Unique Ergodicity (QUE) concerns how the L^2-mass of high-energy Laplace eigenfunctions distributes, and in the arithmetic setting, it reveals deep connections between spectral theory and number theory. My focus lies on two variants: arithmetic QUE, concerning the L^2-mass distribution of Hecke-Maass cusp forms, and holomorphic QUE, concerning the L^2-mass distribution of holomorphic Hecke eigenforms of even weight $k \geq 2$. In this talk, I will outline the main ideas behind these problems and their variations, and describe how my work contributes to the ongoing development of arithmetic and holomorphic QUE.

Haochen Wu, Dartmouth College, *Hilbert modular forms from orthogonal modular forms on binary lattices*

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 Clifford algebra to generalize Gauss composition, and this allows us to classify the class sets of genera in terms of the class groups of the associated quadratic algebras. This is joint work with John Voight.

Pan Yan, University of Arizona, *On the global Gan-Gross-Prasad conjecture for GSpin groups*

We prove one direction of the global Gan-Gross-Prasad conjecture for generic representations of GSpin groups, namely the implication from the non-vanishing of the Bessel period to the non-vanishing of the central value of L-function. The proof is based on a new Rankin-Selberg integral for GSpin groups using Bessel models.