

CONFERENCE PROGRAM

WEDNESDAY, JUNE 2

8:00-8:30 Coffee

8:30-9:30 MICHAEL HOPKINS

Title: "Convenient deformation parameters for formal groups"

9:30-10:00 Break

10:00-11:00 NICHOLAS KATZ

Title: "Sato-Tate Theorems for finite-field Mellin transforms"

11:00-11:30 Break

11:30-12:30 CURTIS McMULLEN

Title: "Algebraic integers, Hodge theory and dynamics".

12:30-2:00 Lunch

2:00-3:00 DOUGLAS ULMER

Title: "Explicit points on the Legendre curve"

Abstract: We consider abelian varieties over function fields, especially over $K = \mathbb{F}_p(t)$. There are now several constructions of abelian varieties A over K such that the rank of $A(K)$ (and the order of vanishing of $L(A/K, s)$ at $s=1$) are arbitrarily large. The first part of the talk will be an overview this context. Then I will give a new, remarkably simple and explicit construction of an elliptic curve E over K with $E(K)$ of arbitrarily large rank. Applying the more advanced techniques of the first part leads to a beautiful formula for a Tate-Shafarevich group and a number of interesting open questions.

3:00-3:30 Break

3:30-4:30 MARIE-FRANCE VIGNERAS

Title: "The Satake transform modulo \mathfrak{p} with weight"

Abstract: Let $\{H\}_{\{k'\}}(G, K, V)$ be the Hecke algebra associated to a connected reductive group G over a local non archimedean field F with a finite residue field k of characteristic \mathfrak{p} , a special parahoric subgroup K of $G(F)$, and an absolutely irreducible smooth representation V of K over a large extension k' of k .

I will speak about my recent work with Guy Henniart on these Hecke algebras $\{H\}_{\{k'\}}(G, K, V)$. Florian Herzig showed, when G is unramified and K hyperspecial, the existence of a Satake transform and applied it to the classification of the absolutely irreducible representations of $GL(n, F)$ modulo \mathfrak{p} in terms of supersingular ones. We show that the Satake transform is valid in the general case although the Hecke algebras are non necessarily commutative, and that they are commutative when G is split on an unramified extension.

5:00-8:00 DRINKS AT QUEENS HEAD PUB

THURSDAY, JUNE 3

8:00-8:30 Coffee

8:30-9:30 HENRI DARMON

Title: "Elliptic curves over real quadratic fields and the Birch and Swinnerton-Dyer conjecture".

9:30-10:00 Break

10:00-11:00 SAMIT DASGUPTA

Title: On Gross-Stark units for totally real fields

Abstract: In 1981, Tate stated an analogue of Stark's conjecture for finite primes p . A special case of this conjecture states the existence of \mathfrak{p} -units in abelian extensions of totally real fields with \mathfrak{p} -adic valuations related to the values at zero of partial zeta functions. Gross gave a refinement of this statement by conjecturing a specific relationship between the \mathfrak{p} -adic logarithms of the norms of these units and the special values of \mathfrak{p} -adic zeta functions. In later work, Gross generalized his conjecture with a formulation involving group rings.

In this talk, I will survey some work on these conjectures. I will describe a conjectural exact formula for Gross-Stark units, and explain its relationship to Gross's group ring conjecture. Secondly, I will describe a proof of Gross's conjecture on the \mathfrak{p} -adic logarithm of the norm of the units in certain cases. This latter result is joint work with Darmon and Pollack.

11:00-11:30 Break

11:30-12:30 STEPHEN KUDLA

Title: "Values of Green functions at **CM** points"

*Abstract: I will discuss a method for obtaining explicit values of Borcherds forms and Green functions at **CM** points on Shimura varieties of orthogonal type. The resulting formula involves a combination of Fourier coefficients of central derivatives of (pullbacks of) incoherent Eisenstein series of weight 1 and the central derivative of a certain type of L-function.*

This is survey of the work of various people, including recent joint work with Jan Bruinier and Tonghai Yang.

12:30-2: Lunch

2:00-3:00 SHOU-WU ZHANG

Title: "Linear forms, algebraic cycles, and derivatives of L-series."

Abstract: In this talk, I will state some conjectures and examples concerning the central derivatives of L-series in terms of invariant linear forms on automorphic representations with inner products defined by integrations of matrix coefficients, and algebraic cycles on Shimura varieties with Beilinson--Bloch height pairings.

3:00-3:30 Break

3:30-4:30 JEAN-PIERRE SERRE

Title: "Linear representations and number of points mod \mathfrak{p} "

6:00-7:00 DINNER IN THE 4TH FLOOR COMMON ROOM

7:00-8:00 PANEL DISCUSSION OF OPEN PROBLEMS (ROOM 507)

The panelists are: Jordan Ellenberg, David Kazhdan, Barry Mazur, Sophie Morel, Fernando Rodriguez-Villegas.

FRIDAY, JUNE 4

Coffee 8:00-8:30

8:30-9:30 WEE TECK GAN

Title: "Representations and Automorphic Forms of metaplectic groups"

Abstract: *The Shimura correspondence relates modular forms of integral weights with those of half integral weights.*

The work of Waldspurger from 30 years ago gave a representation theoretic treatment of this, by giving a classification of the irreducible (automorphic) representations of the 2-fold cover of $SL(2) = Sp(2)$ over local fields and number fields. I will discuss some conjectural extensions of these to the 2-fold cover of $Sp(2n)$. More precisely, I will discuss various joint work of mine with Gross, D. Prasad, Savin, Whitehouse and Zorn. If time permits, I will discuss the foundational work of Wenwei Li on the theory of endoscopy for metaplectic groups.

9:30-10:00 Break

10:00-11:00 DIPENDRA PRASAD

Title: "L and epsilon factors in branching laws for Classical groups over local fields."

Abstract: *In a work with Gan and Gross, several branching laws were formulated involving classical groups, many of which are now proven by Waldspurger, and Mœglin-Waldspurger. These earlier branching laws involved generic parameters, and used epsilon factors in their formulation. In this continuation, we look at nongeneric parameters where L-factors as well as epsilon factors are involved. We will discuss several examples.*

11:00-11:30 Break

11:30-12:30 GORDAN SAVIN

Title: "Geometry of integral binary hermitian forms"

Abstract: *In the book "The sensual quadratic form" Conway gives an elegant approach to binary quadratic forms. The main tool is a 3-valent tree which is an $SL(2, \mathbf{Z})$ -invariant retract of the hyperbolic plane. Let \mathbf{A} be the ring of integers in a quadratic imaginary field. Then there is a $GL(2, \mathbf{A})$ -invariant retract \mathbf{X} of the 3-dimensional hyperbolic space. \mathbf{X} is a $CAT(0)$ complex whose 2-cells are Euclidean polygons. I will show how \mathbf{X} can be used to study hermitian binary forms. This is a joint work with Mladen Bestvina.*

**12:30–2:00 WOMEN IN MATHEMATICS LUNCHEON
(4TH FLOOR COMMON ROOM)**

2:00–3:00 JIU-KANG YU

Title: “Invariant theory and unrefined minimal \mathbf{K} -types”

Abstract: *We will describe a connection between Vinberg's invariant theory of theta-groups, and Moy-Prasad's theory of unrefined minimal \mathbf{K} -types.*

This allows us to apply the former to resolve long standing questions about the latter.

This is a joint work with Gross and Reeder.

3:00-3:30 Break

3:30–4:30 MARK REEDER

Title: “Regular elements in Weyl groups, invariant theory and supercuspidal representations”

Abstract: *Certain Langlands parameters of a reductive \mathfrak{p} -adic group \mathbf{G} give rise to conjugacy classes in the Weyl group of \mathbf{G} whose elements \mathbf{w} act freely on roots and have no invariants in the root lattice. The action of \mathbf{w} (or a lift of \mathbf{w} in \mathbf{G}) on the Lie algebra of \mathbf{G} determines a pair (\mathbf{H}, \mathbf{V}) consisting of a reductive group \mathbf{H} over a finite field, and a rational representation \mathbf{V} of \mathbf{H} for which there exist stable vectors, in the sense of Geometric Invariant Theory. From each stable vector in \mathbf{V} we can construct a supercuspidal representation of \mathbf{G} whose relation to the Langlands parameter is consistent with the local Langlands conjecture.*

This is joint work with Dick Gross and Jiu-Kang Yu.

6:00–6:30 RECEPTION AT FACULTY CLUB

6:30–9:00 DINNER AT FACULTY CLUB

SATURDAY, JUNE 5

8:30-9:00 Coffee

9:00–10:00 MANJUL BHARGAVA

Title: "Orbits of group representations, and arithmetic applications"

10:00-10:30 Break

10:30-11:30 NOAM ELKIES

Title: "A $K3$ sampler"

Abstract: Combining some new computational techniques with the rich theory of $K3$ surfaces and their moduli yields diverse arithmetic applications, ranging from the study of specific Diophantine equations to explicit modular curves and surfaces to record ranks and point counts of curves of low genus over number fields. Fittingly for this conference, the theory and applications involve a range of topics that arise in Gross's mathematics, such as CM points, supersingular abelian varieties, and quadratic forms.

11:30-1:00 Lunch

1:00-2:00 JOSEPH HARRIS

Title: "Uniformity of rational points on curves"

Abstract: Faltings' theorem says that there are only finitely many solutions to a diophantine equation of genus 2 or more. This has naturally led to speculation about possible extensions: how the theorem might be generalized to higher dimensions, and how the number of solutions behaves when we vary the coefficients of the problem, to name two. In this talk we'll discuss some of these generalizations, and describe a remarkable logical connection between them.

2:00-2:30 Break

2:30-3:30 DON ZAGIER

Title: "Teichmüller curves on Hilbert modular surfaces"