Computations with Arithmetic Groups
Approche Calculatoire aux Groupes Arithmétiques
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CECILE ARMANA, Universite de Franche-Comte
Sturm bounds for Drinfeld-type automorphic forms over function fields

Sturm bounds say how many successive Fourier coefficients suffice to determine a modular form. For classical modular forms, they also provide bounds for the number of Hecke operators generating the Hecke algebra. I will present Sturm bounds for Drinfeld-type automorphic forms over the function field $\mathbb{F}_q(t)$. Their proof involve refinements of a fundamental domain for a corresponding Bruhat-Tits tree under the action of a congruence subgroup. This is a joint work with Fu-Tsun Wei.

AVNER ASH, Boston College
Cohomology of congruence subgroups of $SL_3(Z)$ and real quadratic fields

Given the congruence subgroup $\Gamma = \Gamma_0(N)$ of $SL_3(Z)$ and the real quadratic field $E = Q(\sqrt{d})$, we compare the homology of Γ with coefficients in the Steinberg modules of E and Q. This leads to a connecting homomorphism whose image H is a "natural" (in particular Hecke-stable) subspace of $H^3(\Gamma, Q)$. The units $O_E^\times$ are the main ingredient in the construction of elements of H. We performed computations to determine H for a variety of levels $N \leq 169$ and all $d \leq 10$. On the basis of the results we conjecture exactly what the image should be in general. This is joint work with Dan Yasaki.

ANGELICA BABEI, Centre de recherches mathématiques, Université de Montréal
Zeros of period polynomials for Hilbert modular forms

The study of period polynomials for classical modular forms has emerged due to their role in Eichler cohomology. In particular, the Eichler-Shimura isomorphism gives a correspondence between cusp eigenforms and their period polynomials. The coefficients of period polynomials also encode critical L-values for the associated modular form and thus contain rich arithmetic information. Recent works have considered the location of the zeros of period polynomials, and it has been shown that in various settings, their zeros lie on a circle centered at the origin. In this talk, I will describe joint work with Larry Rolen and Ian Wagner, where we introduce period polynomials for Hilbert modular forms of level one and prove that their zeros lie on the unit circle. In particular, I will detail some of the computational tools we used in our proof.

BEN BREEN, Clemson University
A trace formula for Hilbert modular forms

We present an explicit trace formula for Hilbert modular forms. The Jacquet-Langlands correspondence relates spaces of Hilbert modular forms to spaces of quaternionic modular forms; the latter being far more amenable to computations. We discuss how to compute traces of Hecke operators on spaces of quaternionic modular forms and provide explicit examples for some definite quaternion algebras.

NEIL DUMMIGAN, University of Sheffield
Congruences involving non-parallel weight Hilbert modular forms

When newforms are congruent, the modulus appears in a near-central adjoint L-value. When those newforms are complex conjugates, it actually appears in the other critical values too. The Bloch-Kato conjecture then demands non-zero elements of that order in the associated Selmer groups. These are provided by conjectural congruences involving non-parallel weight

Hilbert modular forms. An experimental example of such a congruence showed up following computations of algebraic modular forms for a definite orthogonal group, for the genus of even unimodular lattices of rank 12 over the golden ring.

GRAHAM ELLIS, National University of Ireland, Galway

An algorithm for computing Hecke operators

I will describe an approach to computing Hecke operators on the integral cuspidal cohomology of congruence subgroups of $SL_2(\mathcal{O}_d)$ over various rings of quadratic integers $\mathcal{O}_d$. The approach makes use of an explicit contracting homotopy on a classifying space for $SL_2(\mathcal{O}_d)$. The approach, which has been partially implemented, is also relevant for computations on congruence subgroups of $SL_m(\mathbf{Z})$, $m \geq 2$ (where it has been fully implemented for $m = 2$).

MATHILDE GERBELLI-GAUTHIER, Centre de Recherches Mathématiques

Limit multiplicity of non-tempered representations and endoscopy.

How fast do Betti numbers grow in a congruence tower of compact arithmetic manifolds? The question can be reformulated in terms of limit multiplicity of representations. If the representation is discrete series, the rate of growth is known to be proportional to the volume of the manifold; otherwise the growth is sub-linear in the volume. Sarnak-Xue have conjectured that bounds on multiplicity growth can be expressed in terms of the failure of representations to be tempered. I will confirm some instances of the Sarnak-Xue conjecture for unitary groups using the fact that some non-tempered representations arise as endoscopic transfer, and give applications to cohomology growth.

MARC MASDEU, Universitat Autònoma de Barcelona

Quaternionic rigid meromorphic cocycles

Rigid meromorphic cocycles were introduced by Darmon and Vonk as a conjectural p-adic extension of the theory of singular moduli to real quadratic base fields. They are certain cohomology classes of $\mathrm{SL}_2(\mathbb{Z}[1/p])$ which can be evaluated at real quadratic irrationalities and the values thus obtained are conjectured to lie in algebraic extensions of the base field.

I will present joint work with X.Guitart and X.Xarles, in which we generalize (and somewhat simplify) this construction to the setting where $\mathrm{SL}_2(\mathbb{Z}[1/p])$ is replaced by an order in an indefinite quaternion algebra over a totally real number field F. These quaternionic cohomology classes can be evaluated at elements in almost totally complex extensions K of F, and we conjecture that the corresponding values lie in algebraic extensions of K. I will show some new numerical evidence for this conjecture, along with some interesting questions allowed by this flexibility.

MARK MCCONNELL, Princeton University

FANG-TING TU, Louisiana State University

A Geometric Interpretation of a Whipple's ${}_7F_6$ Formula

This talk is based on a joint work with Wen-Ching Winnie Li and Ling Long. We consider hypergeometric motives corresponding to a formula due to Whipple which relates certain hypergeometric values ${}_7F_6(1)$ and ${}_4F_3(1)$. From identities of hypergeometric character sums, we explain a special structure of the Galois representation behind Whipple's formula leading to a decomposition that can be described by Hecke eigenforms. In this talk, I will use an example to demonstrate our approach and relate the hypergeometric values to periods of modular forms.