Abhishek Banerjee, Ohio State University:
"Hecke operators on line bundles over modular curves"

Abstract: Given a congruence subgroup Γ of $SL_2(\mathbb{Z})$, Connes and Moscovici have introduced a modular Hecke algebra $\mathcal{A}(\Gamma)$ that incorporates both the pointwise multiplicative structure of modular forms and the action of the classical Hecke operators. It is well known that modular forms of level Γ may be desrcibed as global sections of tensor powers of a certain line bundle $\mathcal{L}(\Gamma)$ over the modular curve $\Gamma\backslash\mathbb{H}$. In this talk, we will describe a theory of modular Hecke algebras for Hecke correspondences between the line bundles $\mathcal{L}(\Gamma)$ that lift the classical Hecke correspondences between modular curves.

Reinier Broker, Brown University:
"Abelian surfaces with extra endomorphisms"

Abstract: For elliptic curves, the modular polynomial $\Phi_p(X, Y)$ parametrizes elliptic curves together with a p-isogeny. The polynomial $\Phi_p(X, X)$ parametrizes elliptic curves together with an endomorphism of degree p. Kronecker discovered already that the irreducible factors of $\Phi_p(X, X)$ are Hilbert class polynomials.

In this talk we will consider abelian surfaces with extra endomorphisms. We will show which factors occur when you factor the 2-dimensional analogue of the modular polynomial $\Phi_p(X, X)$. In the case $p = 2$, everything can be explicitly computed and we will give a complete classification of abelian surfaces admitting a $(2, 2)$-endomorphism.

Luca Candelori, McGill University:
"The geometry of harmonic weak Maass forms"

Abstract: We present a geometric interpretation of harmonic weak Maass forms of integral weight. These smooth modular forms appear prominently in the study of mock modular forms and Borcherds lifts, and have been related to the vanishing of derivatives of L-series attached to weight 2 cusp forms (Bruinier-Ono 2008). So far only the analytic aspect of the theory has been investigated. The aim of this talk is to introduce an interpretation of harmonic weak Maass forms in terms of the algebraic geometry of modular curves, with a view towards future p-adic analytic developments of the subject. As an immediate application, we prove a conjecture of Bruinier, Ono and Rhoades about the field of definition of coefficients of harmonic weak Maass forms. This is joint work with my adviser Henri Darmon.

Francesc Castella, McGill University:
"On the higher weight specializations of Howard's Heegner classes"

Abstract: Ben Howard has constructed a canonical class in the cohomology of Hida's universal p-ordinary deformation of a modular form, obtained by patching together the Kummer images of classical Heegner points over a tower of modular curves. We discuss how a suitable extension of the recent p-adic Gross-Zagier formula of Bertolini, Darmon, and Prasanna could eventually be used to show that the higher weight specializations of Howard's class agree with classes obtained from the etale Abel-Jacobi images of Heegner cycles on Kuga-Sato varieties. This is a preliminary report on joint work in progress with Henri Darmon.

Cameron Franc, McGill University:
"Nearly rigid analytic modular forms and their CM values "

Abstract: The Shimura-Maass derivative is a differential operator which maps modular functions of weight k to modular functions of weight $k+2$, but which does not preserve holomorphy. Shimura was the first to notice that, modulo powers of a CM period, algebraic modular forms and their Shimura-Maass derivatives take algebraic values at CM points. In this talk we will define a p-adic analogue of the Shimura-Maass operator. We will then define the ring of nearly rigid analytic modular forms as a subring of the continuous $\mathbb{C}_p$-valued functions on the unramified points of the p-adic upper half plane; it is the smallest such ring containing the rigid analytic modular forms and which is closed under the rigid Shimura-Maass operator. We will conclude with a rigid analogue of Shimura's classical algebraicity result for CM values.

Hester Graves, Queen's University: "A Generalization of the Lagrange and Jacobi 4-Square Theorems"

Abstract: Lagrange proved that every natural number is a sum of 4 squares and Jacobi found a formula for the number of ways to write n as a sum of four squares. We will show ways to generalize Jacobi's formula to universal quaternary quadratic forms studied by Ramanujan.

Benjamin Linowitz, Dartmouth College:
" Decomposition Theorems for Hilbert Modular Newforms "

Abstract: Let $S_k^+(N, \Phi)$ denote the space generated by Hilbert modular newforms (over a fixed totally real field K) of weight k, level N and Hecke character Φ. We show how to decompose $S_k^+(N, \Phi)$ into direct sums of twists of other spaces of newforms. This sheds light on the behavior of a newform under a character twist: the exact level of the twist of a newform, when such a twist is itself a newform, and when a newform may be realized as the twist of a primitive newform. These results were proven for elliptic modular forms by Hijikata, Pizer and Shemanske by employing a formula for the trace of the Hecke operator $T_k(n)$. We obtain our results not by employing a more general formula for the trace of Hecke operators on spaces of Hilbert modular forms, but instead by using basic properties of newforms which were proven for elliptic modular forms by Li, and Atkin and Li, and later extended to Hilbert modular forms by Shemanske and Walling.

Álvaro Lozano-Robledo, University of Connecticut:
" On the field of definition of p-torsion points on elliptic curves over the rationals "

Abstract: Let $S_{\mathbb{Q}}(d)$ be the set of primes p for which there exists a number field K of degree $\leq d$ and an elliptic curve E/K, with $j(E) \in \mathbb{Q}$, such that the order of the torsion subgroup of $E(K)$ is divisible by p. We give bounds for the primes in the set $S_{\mathbb{Q}}(d)$. In particular, we show that, if $p \geq 11$, $p \neq 13, 37$, and $p \in S_{\mathbb{Q}}(d)$, then $p \leq 2d + 1$. Moreover, we determine $S_{\mathbb{Q}}(d)$ for all $d \leq 42$, and give a conjectural formula for all $d \geq 1$. If Serre's uniformity question is answered positively, then our conjectural formula is valid for all sufficiently large d. Under further assumptions on the non-cuspidal points on modular curves that parametrize those j-invariants associated to Cartan subgroups, the formula is valid for all $d \geq 1$.

Bogdan Petrenko, SUNY Brockport:
"Generalizations of V.I. Arnold's version of Euler's Theorem for matrices"

Abstract: In this talk I will go over my recent paper with Marcin Mazur. We have proved that for a square matrix A with integer entries, a prime number p, and a positive integer k, one has that the characteristic polynomials of the matrices A^{p^k} and $A^{p^{k-1}}$ are congruent modulo p^k. Therefore, the traces of these two matrices are congruent modulo p^k. V.I. Arnold conjectured this latter result in 2004, and he proved it for $k = 1, 2, 3$. In 2006, A.V. Zarelua proved it for an arbitrary positive integer k. In our paper we also generalize Euler's Theorem for 2-by-2 integer matrices and an arbitrary modulus $n > 1$. If n is a power of a prime number, then our generalization reduces to the statement in the second sentence of this abstract where A is now a 2-by-2 integer matrix.

Patrick Rault, SUNY Geneseo:
"On uniform bounds for lattice points in intersections of hyperbolic plane regions"

Abstract: We will present upper bounds for the number of primitive lattice points in hyperbolic plane regions. Specifically, we study regions in the plane bounded by equations $|f(x, y)| = B$ and $|g(x, y)| = C$, where f and g are indefinite quadratic forms. Gauss' Circle Theorem and related results are applicable to convex regions like ellipses; we will briefly discuss the results of recent Undergraduate work in this area. However, the hyperbolic regions require alternate methods because they are nonconvex and nonsmooth. The bound obtained may be made independent of the choice of hyperbolas as it is inversely proportional to a positive power of $R(f, g)$, the resultant. We will briefly discuss a corollary on counting rational points on plane curves, which improves on certain cases of a theorem of Heath-Brown.

Lola Thompson, Dartmouth College:

"Variations on the practical numbers"
Abstract: Following Srinivasan, we say that a positive integer n is practical if every integer m with $1 \leq m \leq n$ can be written as a sum of distinct positive divisors of n. We will discuss

a polynomial analoue of the practical numbers, called φ-*practical* numbers and answer some statistical questions about the φ-practical numbers. If time permits we will discuss an extension of these results to other polynomial rings.

John Willis, University of Vermont:
"Power Series solutions to modular forms"

Abstract: A modular form satisfies an automorphy identity under the action of a Fuchsian group. Also, modular forms have simple expansions under the action of Hecke operators. We use both of these facts in recovering the coefficients of power series expansions of modular forms. We consider examples including the Eisenstein series and $SL_2(\mathbb{Z})$, as well as a subgroup of the modular group with a cocompact fundamental domain. We numerically verify the theory utilizing methods for stable computation in arbitrary precision.

Xiao Xiao, Binghamton University:
"New upper bounds of the isomorphism number of F-crystals "

Abstract: Let k be an algebraically closed field of characteristic $p > 0$. The classical Dieudonne theory says that the category of p-divisible groups D over k is antiequivalent to the category of Dieudonne modules (M, F) over k. Manin proved that there exists a smallest integer n such that the isomorphism type of D is determined by its n-truncation $D[p^n]$ when k is algebraically closed. The isomorphism number of an arbitrary F-crystal is a generalization of such n for p-divisible groups. Lau, Nicole and Vasiu have found an optimal upper bound in the case of Dieudonne modules in 2009. In this talk, we will discuss how to compute the isomorphism number for general F-crystals.