UNIVERSITY OF MICHIGAN
Department of Mathematics

Seminar & Events Bulletin: Group, Lie and Number Theory

01-01-2013 to 06-30-2013

Monday, January 14, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Florian Sprung (Brown University) *Pairs of p-adic analogues of the conjectures of Birch and Swinnerton-Dyer* -- 4096 East Hall

Monday, January 28, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Baiying Liu (University of Minnesota) *Fourier Coefficients of Automorphic Forms and Arthur Classification* -- 4096 East Hall

Monday, February 04, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Daniel Fiorilli (UM) *Unbounded ranks of elliptic curves, highly biased prime number races and the explicit formula* -- 4096 East Hall

Monday, February 11, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- AVAILABLE () *TBA* -- 4096 East Hall

Monday, February 18, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Bianca Viray (Brown University) *Reductions of CM j-invariants modulo p* -- 4096 East Hall

Monday, February 25, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Jeffrey Lagarias (UM) *Addition versus Multiplication* -- 4096 East Hall

Monday, March 18, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Ari Shnidman (UM) *p-adic heights of algebraic cycles* -- 4096 East Hall

Monday, March 25, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Igor Dolgachev (UM) *Cayley property of algebraic groups* -- 4096 East Hall

Monday, April 01, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Alexei Oblomkov (University of Massachusetts Amherst) *The elliptic Affine Springer Fibers in type A and the rational Cherednik Algebras* -- 4096 East Hall

Monday, April 08, 2013	
3:00pm-5:00pm	**Group, Lie and Number Theory** -- Pierre Debes (Universite Lille 1, France) *The Inverse Galois Problem with Local Conditions* -- 4096 East Hall

Monday, April 15, 2013	
3:00pm-4:00pm	**Group, Lie and Number Theory** -- Jiarui Fei (UC Riverside) *Categorical Homotopy from Quivers* -- 4096 East Hall

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Monday, April 22, 2013	
4:10pm-5:00pm	**Group, Lie and Number Theory** -- Hunter Brooks (UM) *Generalized Heegner cycles, Shimura curves, and special values of p-adic L-functions* -- 4096 East Hall

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Abstracts

Group, Lie and Number Theory
Monday, January 14, 2013, 3:00pm-5:00pm
4096 East Hall
Florian Sprung (Brown University)
Pairs of p-adic analogues of the conjectures of Birch and Swinnerton-Dyer

The classical conjectures of Birch and Swinnerton-Dyer relate the behavior of the Hasse-Weil L-function of an elliptic curve to its Q-rational points. For primes of good reduction, there are p-adic analogues of these conjectures due to Mazur, Tate, and Teitelbaum (ordinary case), and due to Bernardi and Perrin-Riou (supersingular case). In this talk, we would like to present a pair of convenient p-adic L-functions that can be used to rewrite (and thus unite) their conjectures. These p-adic L-functions provide us with growth formulas for the Tate-Shafarevich group along the cyclotomic Z_p extension. If time permits, there will be a picture describing the analogous behavior for weight two modular forms.

Group, Lie and Number Theory
Monday, January 28, 2013, 3:00pm-5:00pm
4096 East Hall
Baiying Liu (University of Minnesota)
Fourier Coefficients of Automorphic Forms and Arthur Classification

Seminar & Events Bulletin: Group, Lie and Number Theory

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Group, Lie and Number Theory
Monday, February 04, 2013, 3:00pm-5:00pm
4096 East Hall
Daniel Fiorilli (UM)
Unbounded ranks of elliptic curves, highly biased prime number races and the explicit formula

In 1853, Chebyshev remarked that there are more primes of the form 4n+3 than of the form 4n+1 in the interval [1,x], for many values of x. Rubinstein and Sarnak established under technical hypotheses that the logarithmic density of x for which Chebyshev's assertion is true is of 0.9959.... They also studied an even more biased race, and showed that the density of x such that Li(x)>\pi(x) is of 0.99999973... Since their 1994 paper, many other densities have been computed and none of these numbers were found to exceed this last value. A natural question to ask is whether this is the highest value one will ever find, or if on the contrary there exists highly biased prime number races whose associated density can be arbitrarily close to 1. Our goal is to discuss recent results on highly biased prime number races in two contexts. We will first establish a conditional equivalence between the existence of highly biased elliptic curve races and the existence of elliptic curves of arbitrarily large analytic rank. We will then show that highly biased prime number races do exist in the context of primes in arithmetic progressions, and describe how to construct such races. Finally we will describe how to weaken the technical hypotheses which are omnipresent in these types of problems. The central object on which this theory is built is the explicit formula, and if time allows, we will describe the techniques used in the proofs, which involve ideas from probability theory and from the theory of almost periodic functions.

Group, Lie and Number Theory
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Group, Lie and Number Theory
Monday, February 18, 2013, 3:00pm-5:00pm
4096 East Hall
Bianca Viray (Brown University)
Reductions of CM j-invariants modulo p

The moduli space of elliptic curves contains infinitely many algebraic points that correspond to curves with complex multiplication. In 1985, Gross and Zagier proved that the pp-adic valuation of the difference of two CM j- invariants is exactly half the sum (over n) of the number of isomorphisms between the corresponding elliptic curves modulo pp^n. Using this relation, Gross and Zagier proved an elegant formula for the factorization of the norm of a difference of CM j-invariants, assuming that the CM orders are maximal and have relatively prime discriminants. We generalize their result to the case where one order has squarefree discriminant and the other order is arbitrary. If time permits, we will explain how this result can be used to answer a similar question in genus 2. This is joint work with Kristin Lauter.

Group, Lie and Number Theory
Monday, February 25, 2013, 3:00pm-5:00pm
4096 East Hall
Jeffrey Lagarias (UM)
Addition versus Multiplication

A fundamental theme in mathematics is the interaction of addition and multiplication. This talk gives some examples of such interaction from logic and complexity theory, group theory, lie theory, and number theory.

Group, Lie and Number Theory
Monday, March 18, 2013, 3:00pm-5:00pm
4096 East Hall
Ari Shnidman (UM)
p-adic heights of algebraic cycles

The Gross-Zagier formula is a key tool in the proof of the Birch and Swinnerton- Dyer conjecture (BSD) for elliptic curves over Q of analytic rank less than 2. I'll tell this story and discuss generalizations to higher dimensional varieties. In this setting, BSD is replaced by a beautiful conjecture of Beilinson and Bloch which relates ranks of Chow groups to the order of vanishing of L-functions attached to cohomology groups. In the second hour I'll discuss recent work generalizing Nekovar's p-adic version of the Gross-Zagier formula (the weight two case is due to Perrin-Riou).

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Group, Lie and Number Theory
Monday, March 25, 2013, 3:00pm-5:00pm
4096 East Hall
Igor Dolgachev (UM)
Cayley property of algebraic groups

As is well-known, any orthogonal matrix with determinant 1 and no eigenvalues equal to -1 can be obtained as the Cayley transform C(A) = (I-A)(I+A)^{-1} of a skew-symmetric matrix A. This establishes a birational isomorphism between the real orthogonal group and its Lie algebra that is equivariant with respect to the adjoint action of the group on itself and on its Lie algebra. By definition, a linear algebraic group over a field k has the Cayley property is there is exists such a equivariant birational map over k between the group and its Lie algebra. I will discuss some recent work on investigating which algebraic groups satisfy the Cayley property.

Group, Lie and Number Theory
Monday, April 01, 2013, 3:00pm-5:00pm
4096 East Hall
Alexei Oblomkov (University of Massachusetts Amherst)
The elliptic Affine Springer Fibers in type A and the rational Cherednik Algebras

Group, Lie and Number Theory
Monday, April 08, 2013, 3:00pm-5:00pm
4096 East Hall
Pierre Debes (Universite Lille 1, France)
The Inverse Galois Problem with Local Conditions

The results that I will present are part of a program, pursued by my students N. Ghazi, F. Legrand and myself, on the Galois extensions E/Q that can be obtained from a Galois extension F/Q(T) by specializing T. Beyond the Galois group of the specialized extensions, we have investigated their local behavior (inertia groups, decomposition groups) at given primes. I will also explain the implications of the results on classical topics from Inverse Galois Theory, like the Regular Inverse Galois Problem, the Noether program, the Beckmann-Black problem, the Grunwald Problem, the Inverse Galois Problem, etc.

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Group, Lie and Number Theory
Monday, April 15, 2013, 3:00pm-4:00pm
4096 East Hall
Jiarui Fei (UC Riverside)
Categorical Homotopy from Quivers

One question puzzled me for long time is "why do we do homological algebras on a `line' -- a linear complex?". If we want to deal with "n-stuff" instead of "bi-stuff", usually linear complexes are not enough. In this talk, I try to convince you that there are many other possibilities. I first quiver interpret the classical simplicial theory - including the cosimplex category, Dold-Kan correspondence, and Hochschild homology - as a certain Q-homotopy theory of type A. For the cyclic and cubical theories, we can proceed analogously. The point is that linear quivers can be replaced by other families of quivers. I will explain how to use representation theory of quivers to construct meaningful new theories. You will see a lot of examples. No knowledge on quiver representation is needed, just some homological algebra. (Joint with the Algebra Seminar.)

Group, Lie and Number Theory
Monday, April 22, 2013, 4:10pm-5:00pm
4096 East Hall
Hunter Brooks (UM)
Generalized Heegner cycles, Shimura curves, and special values of p-adic L-functions

The Gross-Zagier formula relates special values of the derivative of a Rankin-Selberg L-function to heights of "Heegner points" on elliptic curves. The existence of these points requires an arithmetic assumption (the "Heegner hypothesis"), but Zhang established an analogue with this assumption dropped. The geometric object of interest in Zhang's work is a compact quotient of the upper half plane called a Shimura curve. We give a p-adic formula which relates a p-adic logarithm of a Heegner cycle on a variety fibered over a Shimura curve to special values of a p-adic L-function, removing the Heegner hypothesis from work of Bertolini, Darmon, and Prasanna over modular curves. This formula follows from a "q-expansion-free" approach to p-adic modular forms coming from the deformation theory of ordinary abelian varieties in characteristic p.