Submittee: Clayton Petsche
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Title: Pacific Northwest Number Theory Conference
Event Type: Conference-Workshop

Location:
Oregon State University, Corvallis, OR, USA

Dates:
May 14-15 2016

Topic:
Number Theory

Methodology:
The meeting consisted of 10 invited lectures.

Objectives Achieved:
This meeting successfully achieved its objectives of allowing a diverse group of researchers to disseminate their results, and of giving young researchers and graduate students opportunities to network with other mathematicians from the Pacific Northwest region

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Organizers:
Bennett, Mike, Mathematics, University of British Columbia
Flahive, Mary, Mathematics, Oregon State University
Petsche, Clay, Mathematics, Oregon State University
Swisher, Holly, Mathematics, Oregon State University

Speakers:
Hao Chen (University of Washington, Mathematics), Title: Towards the computation of modular building blocks. Abstract: Modular building blocks are absolute simple factors of modular abliean varieties A_f attached to newforms f. Understanding the building blocks fits into the program of understanding modular abelian varieties. When the endomorphism algebra of A_f is isomorphic to a Matrix algebra, Gonzalez and Lario gives a formula for the building block of Af in terms of a splitting map. We generalise their formula to the remaining cases. We also present some some preliminary ideas toward an efficient algorithm to compute the building blocks. There will be explicit examples.

Derek Garton (Portland State University, Mathematics), Title: Dieudonne modules and the Cohen-Lenstra heuristics. Abstract: In recent years, the "Cohen-Lenstra philosophy", first used to predict the structure of ideal class groups, has been extended to predict the structure Jacobians of hyperelliptic curves, sandpile groups of random graphs, and (many) other things. In 2012, Cais, Ellenberg, and Zureick-Brown used this philosophy to predict the structure of Dieudonne modules of hyperelliptic curves, by studying a certain probability distribution on the set of isomorphism classes of principally quasi-polarized p-divisible groups over a finite field of characteristic p. However, they noticed interesting discrepancies between their predictions and the available data. I will describe an alternate model for these Dieudonne modules, one whose statistics may be in closer agreement to the available data.

Julia Gordon (University of British Columbia, Mathematics), Title: Class number formulas, volumes, and counting elliptic curves. Abstract: In 2003, E.-U. Gekeler gave a formula for the number of elliptic curves in an isogeny class, based on probabilistic and equidistribution considerations. This formula is in a sense similar to Siegel's formula expressing the size of a genus of a quadratic form in as a product of local densities. It is well-known that Siegel's formula is equivalent to the calculation of the Tamagawa volume of the orthogonal group. In the same spirit, there is a formula, due to Langlands and Kottwitz, expressing the cardinality of such an isogeny class as an orbital integral. I will discuss the connection between Gekeler's formula and the formula of Langlands and Kottwitz, and in the process, will survey the classical results related to Tamagawa measures. This is part of a joint project with Jeffrey Achter, Salim Ali Altug, and Luis Garcia.

Christopher Jennings-Shaffer (Oregon State University, Mathematics), Title: Partition rank functions transforming like their partition functions. Abstract: Recently Garvan revisited the transformation properties due to Bringmann and Ono for the rank of partitions as a mock modular form. The associated harmonic Maass form was found to transform like the partition function on a certain subgroup of the modular group. We show that this also occurs with the Dyson rank of overpartitions and the M2-rank of partitions without repeated odd parts transforming like the generating functions for overpartitions and partitions without repeated odd parts. We briefly discuss the utility of this fact in calculating identities involving partition ranks.

Jamie Juul (Amherst College, Mathematics), Title: Periodic points of rational maps over finite fields. Abstract: Let K be a number field and p be any prime in the ring of integers of K. Given a rational map with coefficients in K, we can define a map on the residue field of K modulo p via reduction mod p. It is natural to ask, what proportion of points in the residue field are periodic points of this map? Heuristics suggest that for most maps the proportion of periodic points should tend to 0 as p increases. In this talk we describe general conditions under which we are able to show that this holds.

Myrto Mavraki (University of British Columbia, Mathematics), Title: Simultaneous torsion points in a Weierstrass family of elliptic curves. Abstract: In 2010, Masser and Zannier proved that there are at most finitely many complex numbers t, not equaling 0 or 1, such that the two points on the Legendre elliptic curve y^2=x(x?1)(x?t) with x-coordinates 2 and 3 are simultaneously torsion. Recently, Stoll proved that there is in fact no such t, and it is his result that inspires our work. In this talk we will focus on the Weierstrass family of elliptic curves E_t: y^2=x^3+t, and show that in many instances there will be no parameter t such that the points (a,*) and (b,*) are simultaneously torsion in E_t. In contrast to the original approach of Masser and Zannier, our approach is dynamical. We focus on studying whether a and b are simultaneously preperiodic for a Latt\`es map.

Kevin McGown (California State University - Chico, Mathematics), Title: Statistics of genus numbers of cubic and quintic fields. Abstract: We investigate statistics of genus numbers of (noncyclic) cubic and quintic fields. In particular, we give the exact proportion of such fields whose genus number is equal to one. We will begin with an extended introduction on quadratic forms, quadratic fields, and genus theory. Then we will briefly discuss techniques one uses to count number fields, including the Davenport-Heilbronn Theorem and groundbreaking work of Bhargava. Finally, we will describe some of the ingredients that go into the proof of our result. The main tool in the cubic setting is the powerful theorem of Bhargava-Shankar-Tsimerman and Taniguchi-Thorne. Time permitting, we will talk about work in progress on the average genus number, as well as a related theorem on norm-Euclidean fields. This is joint work with Amanda Tucker.

Robert Osburn (University College Dublin, Mathematics), Title: q-series, modularity and knots. Abstract: There has been recent interest in connections between number theory, combinatorics and low-dimensional topology. In this talk, we prove conjectures due to Garoufalidis, Le and Zagier concerning Rogers-Ramanujan type identities associated to certain quantum knot invariants, namely tails of colored Jones polynomials. We also discuss a recent extension to all alternating knots up to 10 crossings. This is joint work with Adam Keilthy (TCD/Oxford) and Paul Beirne (UCD).

Vivek Pal (Columbia University/University of Oregon, Mathematics), Title: The Hasse principle for certain K3 surfaces. Abstract: The Hasse principle claims that if a variety defined over a number field K, has points over every completion of K, then it has points over K. The Hasse-Minkowski theorem shows that the Hasse principle holds for quadratic forms. In general there are many obstructions to the Hasse Principle, for example the Bauer-Manin obstruction. In this talk I will describe a process to unconditionally show that certain K3 surfaces satisfy the Hasse principle. Our method involves quadratic twists of elliptic curves and their 2-Selmer groups.

Renate Scheidler (University of Calgary, Mathematics), Title: A class of Artin-Schreier curves with many automorphisms. Abstract: Algebraic curves with many points are useful in coding theory, but are also of number theoretic and geometric interest in their own right. A large amount of information about these curves, such as the number of points and the size of their Jacobian over any field, is encoded in their zeta function; an object that is generally notoriously difficult to compute. In this talk, we describe a class of Artin-Schreier curves whose unusually big automorphism group contains a large extraspecial subgroup. Precise knowledge of this subgroup makes it possible to compute the zeta functions of these curves over the field of definition of all automorphisms in the subgroup. As a consequence, we obtain new examples of maximal curves. This is joint work with Irene Bouw, Wei Ho, Beth Malmskog, Padmavathi Srinivasan and Christelle Vincent.

Links:
http://people.oregonstate.edu/~petschec/PNWNT/index.html
