

Spring 2019

- **January 29 (Tuesday)**

Speaker: N/A

Title: Organizational Meeting

Abstract: We will discuss schedule and speakers for this semester

- **February 4 (Monday)**

Speaker: Xiao Xiao (Utica College)

Title: Automorphism group schemes at finite level of F -cyclic F -crystals

Abstract: Let M be an F -crystal over an algebraically closed field of positive characteristic. For every integer $m \geq 1$, let $\gamma_M(m)$ be the dimension of the automorphism group scheme $\mathrm{Aut}_m(M)$ of M at finite level m . In 2012, Gabber and Vasiu proved that $0 \leq \gamma_M(1) < \gamma_M(2) < \dots < \gamma_M(n_M) = \gamma_M(n_M+1) = \dots$ where n_M is the isomorphism number of M , and that $\gamma_M(m+1) - \gamma_M(m) \leq \gamma_M(m) - \gamma_M(m-1)$ for all $m \geq 1$ if M is a Dieudonné module over k . We generalize the same result to arbitrary F -crystals in 2014. Questions have been asked whether $\gamma_M(m+1) - \gamma_M(m) < \gamma_M(m) - \gamma_M(m-1)$ for all $1 \leq m \leq n_M$ for any F -crystal M . In this talk, we will discuss a combinatorial formula that calculates $\gamma_M(m)$ for a certain family of F -crystals called F -cyclic F -crystals. This formula allows to give a negative answer to the aforementioned question in general but a positive answer to some family of Dieudonné modules.

- **February 19 (Tuesday)**

Speaker: Alexander Borisov (Binghamton)

Title: An update on the Keller map search

Abstract: I will describe in detail several possible frameworks for Keller maps, that is solutions to the combinatorial problem related to a possible counterexample to the two-dimensional Jacobian Conjecture. The talk will be based on my recent preprint, <https://arxiv.org/abs/1901.04073> with some even newer results.

- **February 25 (Monday)**

Speaker: Liang Xiao (UConn Storrs)

Title: Bloch-Kato conjecture for some Rankin-Selberg motives.

Abstract: The Birch and Swinnerton-Dyer conjecture is known in the case of rank 0 and 1 thanks to the foundational work of Kolyvagin and Gross-Zagier. In this talk, I will report on a joint work in progress with Yifeng Liu, Yichao Tian, Wei Zhang, and Xinwen Zhu. We study the analogue and generalizations of Kolyvagin's result to the unitary Gan-Gross-Prasad paradigm. More precisely, our ultimate goal is to show that, under some technical conditions, if the central value of the Rankin-Selberg L-function of an automorphic representation of $U(n) \times U(n+1)$ is nonzero, then the associated Selmer group is trivial; Analogously, if the Selmer class of certain cycle for the $U(n) \times U(n+1)$ -Shimura variety is nontrivial, then the dimension of the corresponding Selmer group is one.

- **March 5 (Tuesday)**

Speaker: Alexander Borisov (Binghamton)

Title: Classification of finitely generated abelian groups and Singular Value Decomposition Theorem

Abstract: The Classification Theorem for finitely generated abelian groups is one of the basic theorems in Abstract Algebra. The Singular Value Decomposition Theorem is a basic fact in Linear Algebra, especially popular in applied mathematics. We will show that these two theorems, and also the classification theorem for finitely generated modules over a discrete valuation ring, are very much related to each other. In fact, they are similar

not just in statement but also in proof. The talk is aimed primarily at graduate students, no advanced background is assumed.

▪ **March 12 (Tuesday)**

Speaker: Vaidehee Thatte (Binghamton)

Title: N/A

Abstract: Organizational meeting of the new “No Theory” seminar for number theory and related areas

▪ **March 26 (Tuesday)**

Speaker: Andrew Lamoureux

Title: Arithmetic Differential Operators on \mathbb{Z}_p

Abstract: We will examine a paper of A. Buium discussing an analogue of the derivative for the p -adic integers. The corresponding notion of “analytic” turns out to be equivalent to that of an arithmetic differential operator, essentially a power series where variables are replaced with iterations of the derivative. Moreover, the number of variables in such a series is related to the radius of the power series making the function analytic. Time allowing, I'll explain how I'm working on generalizing this result.

▪ **April 2 (Tuesday)**

Speaker: Changwei Zhou (Binghamton)

Title: Effective upper bound on analytic torsion for Arakelov metric

Abstract: In this talk I will review analytic torsion and show a proof that it has an upper bound only depending on genus when we give the surface Arakelov metric. To my knowledge this is the first result of this type in the literature. The work is a direct corollary of Jorgenson and Kramer's work on the non-completeness of Arakelov metric on the moduli space and Selberg zeta functions. I will also discuss some relevant earlier work by Wilms, Bost, Soule, Wentworth and Faltings.

▪ **April 9 (Tuesday)**

Speaker: Renee Bell (UPenn)

Title: Local-to-Global Extensions for Wildly Ramified Covers of Curves

Abstract: Given a Galois cover of curves $X \rightarrow Y$ with Galois group G which is totally ramified at a point x and unramified elsewhere, restriction to the punctured formal neighborhood of x induces a Galois extension of Laurent series rings $k((u))/k((t))$. If we fix a base curve Y , we can ask when a Galois extension of Laurent series rings comes from a global cover of Y in this way. Harbater proved that over a separably closed field, every Laurent series extension comes from a global cover for any base curve if G is a p -group, and he gave a condition for the uniqueness of such an extension. Using a generalization of Artin-Schreier theory to non-abelian p -groups, we fully characterize the curves Y for which this extension property holds and for which it is unique up to isomorphism, but over a more general ground field.

▪ **April 15 (Monday)**

Speaker: Samantha Wyler (Binghamton)

Title: Perfect Numbers, Amicable Numbers, and More

Abstract: A Perfect number, a positive integer that is equal to the sum of its proper divisors. The discovery of such numbers is lost in prehistory. However, mathematics going as far back as the Pythagoreans (founded c. 525 BCE) studied perfect numbers for their “mystical” properties. We will go over a few examples, and facts about these numbers. We will also look at amicable numbers, two numbers are amicable to each other if the sum of the proper divisors of each is equal to the other number. We will conclude with looking at a new definition I made up called “pseudo amicable numbers” and go over some examples and consequences.

▪ Special talk - Thesis Defense**April 23 (Tuesday)**

Speaker: Changwei Zhou (Binghamton)

Title: Some results on Arakelov theory of arithmetic surfaces

Abstract: In 1997, Gillet and Soule proposed a conjecture suggesting there is an upper bound of regularized determinant of Laplacian (analytic torsion) for any metrized line bundle over a Riemann surface independent of the metric. Here we verify it for the Arakelov metric and trivial line bundle. Our result indicates there is an asymptotic upper bound of order g for genus large enough. This is built upon work of Bost, Deligne, Jorgenson, Kramer, Wilms, Wentworth. We also discuss some preliminary constructions we tried for constructing cohomology space on arithmetic surfaces.

▪ April 29 (Monday)

Speaker: Serin Hong (Michigan)

Title: Surjective bundle maps and bundle extensions over the Fargues-Fontaine curve

Abstract: Vector bundles on the Fargues-Fontaine curve play a pivotal role in recent development of p -adic Hodge theory and related fields, as they provide geometric interpretations of many constructions in these fields. The most striking example is the geometrization of the local Langlands correspondence due to Fargues where the correspondence is stated in terms of certain sheaves on the stack of vector bundles on the Fargues-Fontaine curve.

In this talk, we give two classification theorems regarding vector bundles on the Fargues-Fontaine curve: a classification of all pairs of vector bundles with a surjective bundle map between them and a classification of extensions of two given vector bundles satisfying certain conditions. We also explain several applications of our classification theorems, some of which are closely related to the geometrization of the local Langlands correspondence. This talk is based on my recent work plus a previous joint work with C. Birkbeck, T. Feng, D. Hansen, Q. Li, A. Wang and L. Ye.

▪ April 30 (Tuesday)

Speaker: Evangelia Gazaki (Michigan)

Title: A structure theorem for zero-cycles on products of elliptic curves over p -adic fields.

Abstract: In the mid 90's Colliot-Thélène formulated a conjecture about zero-cycles on smooth projective varieties over p -adic fields. A weaker form of this conjecture was recently established, but the general conjecture is only known for very limited classes of varieties. In this talk I will present some recent joint work with Isabel Leal, where we prove this conjecture for products of elliptic curves, under some assumptions on their reduction type. Our methods often allow us to obtain very sharp results about the structure of the group of zero-cycles on such products and also give us some promising global-to-local information.

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