**Arithmetic Geometry and Related Topics**

**Date**
November 20 (Mon) – 23 (Thu), 2017

**Place**
Ehime University, Department of Mathematics, Seminar Room 201

**Organizer**
Masataka Chida (Tohoku), Yoichi Mieda (Tokyo), Tatsuya Ohshita (Ehime)

**Webpage**

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**Program**

**November 20 (Mon)**

8:45 – 9:30 Registration/Opening

9:30 – 10:30 Takashi Taniguchi (Kobe University)
*Uniformity in Landau’s method and applications*

10:30 – 11:00 Tea time

11:00 – 12:00 Yasuhiro Ishitsuka (Kyoto University)
*Arithmetic of rotationally symmetric determinantal representations*

12:00 – 13:30 Lunch

13:30 – 14:30 Yuya Matsumoto (Nagoya University)
*μₙ-actions on K3 surfaces in positive characteristic*

14:30 – 15:00 Tea time

15:00 – 16:00 Kazuhiro Ito (Kyoto University)
*On the supersingular reduction of K3 surfaces with complex multiplication*

16:15 – 17:15 Tetsushi Ito (Kyoto University)
*Foliations on orthogonal Shimura varieties and the Tate conjecture for products of K3 surfaces*

**November 21 (Tue)**

9:30 – 10:30 Noriyuki Abe (Hokkaido University)
*A classification theorem of irreducible admissible mod p representations and its consequences*

10:30 – 11:00 Tea time

11:00 – 12:00 Florian Herzig (University of Toronto)
*Ordinary representations and locally analytic socle for GLₙ(ℚₚ)*

Afternoon Free discussion
November 22 (Wed)

9:30 – 10:30 Shuji Yamamoto (Keio University)
Harmonic relation and integral expression for Kawashima functions

10:30 – 11:00 Tea time

11:00 – 12:00 Kaoru Sano (Kyoto University)
The arithmetic degree and an application to dynamical Mordell-Lang type problem

12:00 – 13:30 Lunch

13:30 – 14:30 Ryota Mikami (Kyoto University)
A tropical characterization of non-archimedean algebraic varieties

14:30 – 15:00 Tea time

15:00 – 16:00 Kai-Wen Lan (University of Minnesota)
Local systems over Shimura varieties: a comparison between two constructions

16:15 – 17:15 Sug Woo Shin (UC Berkeley)
Irreducibility of leaves in Shimura varieties

November 23 (Thu)

9:30 – 12:00 Free discussion
Title and abstract

Speaker: Takashi Taniguchi (Kobe University)
Title: Uniformity in Landau’s method and applications
Abstract: Suppose we have a zeta function (Dirichlet series) which satisfies a standard functional equation. A classical method of Landau gives an estimate of the partial sum of its coefficients with a power saving error term. In this talk, I will explain a uniform version of Landau’s theorem; the implied constant in the error term will depend only on the ‘shape’ of the functional equation. I also would like to discuss several applications of this result. This is a joint work with David Lowry-Duda and Frank Thorne.

Speaker: Yasuhiro Ishitsuka (Kyoto University)
Title: Arithmetic of rotationally symmetric determinantal representations
Abstract: Linear determinantal representation is a classical linear-algebraic interpretation of geometric object; triples consisting of curves, line bundles and a point of Jacobian variety of the curve. It appears in many contexts. In this talk, we will discuss an arithmetic nature of some special class of linear determinantal representations.

Speaker: Yuya Matsumoto (Nagoya University)
Title: $\mu_n$-actions on K3 surfaces in positive characteristic
Abstract: An automorphism of a K3 surface is called symplectic if it preserves the global 2-form of the surface (which is unique up to scalar). In characteristic 0, the quotient of a K3 surface by a finite group action is again a K3 surface (with rational double point singularities) if and only if the action is symplectic. But in characteristic $p > 0$ this does not hold for groups of order $p$. In this talk we consider, instead of actions of groups, actions of the group schemes $\mu_n$ on K3 surfaces, where $n$ may be divisible by $p$. We introduce the notion of symplecticness of such actions and show that the quotient by $\mu_n$ is a K3 surface if and only if the action is symplectic.

Speaker: Kazuhiro Ito (Kyoto University)
Title: On the supersingular reduction of K3 surfaces with complex multiplication
Abstract: As an analogue of the theory of complex multiplication (CM) for abelian varieties, Rizov proved the main theorem of CM for K3 surfaces. In this talk, we will study the good reduction modulo $p$ of K3 surfaces with CM. We will determine when the good reduction is supersingular. Moreover, for almost all $p$, we will calculate its Artin invariant. Our results generalize Shimada’s results on complex projective K3 surfaces with Picard number 20.

Speaker: Tetsushi Ito (Kyoto University)
Title: Foliations on orthogonal Shimura varieties and the Tate conjecture for products of K3 surfaces
Abstract: In the beginning of the 21st century, Oort introduced an important notion of ”foliations” in the Newton polygon strata of moduli spaces of abelian varieties in positive characteristics, and give several striking applications. In this talk, we try to apply Oort’s ideas to study orthogonal Shimura varieties and Kuga-Satake morphisms, including their boundaries. We also give applications to semistable families of K3 surfaces, and the Tate conjecture for certain products of K3 surfaces (joint work with Kazuhiro Ito and Teruhis Koshikawa).

Speaker: Noriyuki Abe (Hokkaido University)
Title: A classification theorem of irreducible admissible mod $p$ representations and its consequences
Abstract: I explain a theorem which classifies irreducible admissible mod $p$ representations in terms of supersingular representations. This theorem enable us to prove some properties of irreducible admissible representations. I will give some of such properties. This talk is based on joint works with G. Henniart, F. Herzig and M.-F. Vigneras.
Speaker: Florian Herzig (University of Toronto)
Title: Ordinary representations and locally analytic socle for GL\(_n(\mathbb{Q}_p)\)
Abstract: Suppose that \(\rho\) is an irreducible automorphic \(n\)-dimensional global \(p\)-adic Galois representation that is upper-triangular locally at \(p\). In previous work with Breuil we constructed a unitary representation of \(GL_n(\mathbb{Q}_p)\) on a \(p\)-adic Banach space (depending only on \(\rho\) locally at \(p\)) that is an extension of finitely many principal series, and we conjectured that this representation occurs globally in a space of \(p\)-adic automorphic forms cut out by \(\rho\). In work in progress we prove many new cases of this conjecture, assuming that \(\rho\) is moreover crystalline with distinct Hodge-Tate weights.

Speaker: Shuji Yamamoto (Keio University)
Title: Harmonic relation and integral expression for Kawashima functions
Abstract: In 2009, Gaku Kawashima introduced a family of analytic functions, which we call the Kawashima functions, and used them to obtain a large class of algebraic relations among the multiple zeta values. One of key properties is the harmonic relation, which expresses the product of two Kawashima functions as a linear combination of Kawashima functions. In this talk, after reviewing the Kawashima functions and their relationship with the multiple zeta values, I give a new proof of the harmonic relation based on certain integral expression.

Speaker: Kaoru Sano (Kyoto University)
Title: The arithmetic degree and an application to dynamical Mordell-Lang type problem
Abstract: The Weil height functions measure the arithmetic complexity of rational points of a smooth projective variety. Silverman defined the arithmetic degree of a rational self-map at a rational point which measures the asymptotic behavior of height of the image of the rational point. In this talk, we give a summary of recent progress about the arithmetic degree and its application to dynamical Mordell-Lang type problem.

Speaker: Ryota Mikami (Kyoto University)
Title: A tropical characterization of non-archimedean algebraic varieties
Abstract: Tropical geometry is a combinatorial shadow of algebraic geometry. In this talk, we show that a Zariski closed analytic subvariety of a normal toric variety over a complete non-archimedean valuation field is algebraic if its tropicalization is a finite union of polyhedra. Previously, the converse direction was known by the theorem of Bieri and Groves.

Speaker: Kai-Wen Lan (University of Minnesota)
Title: Local systems over Shimura varieties: a comparison between two constructions
Abstract: Given a Shimura variety \(X\) associated with some algebraic group \(G\), and some algebraic representation \(V\) of \(G\) (satisfying some conditions when restricted to the center), we can define two kinds of filtered vector bundles with integrable connections, over \(X\). The first one is based on the classical complex analytic construction using double quotients, while the second one is a new \(p\)-adic analytic construction based on the \(p\)-adic Riemann-Hilbert correspondence in the recent work by Ruochuan Liu and Xinwen Zhu. We know how to relate these two when \(X\) is of Hodge type, using the relative cohomology of some family of abelian varieties over \(X\). But what should we do when \(X\) is a general Shimura variety, in which case no convenient family of algebraic varieties (or, rather, "motives") are available? In this talk, we shall review the background materials and formulate the problem more precisely, and give an answer.

Speaker: Sug Woo Shin (UC Berkeley)
Title: Irreducibility of leaves in Shimura varieties
Abstract: Oort defined central leaves in the special fiber of Shimura varieties as the locus on which the isomorphism class of the universal \(p\)-divisible group is constant (when Shimura varieties parametrize abelian varieties with additional structure). Then Chai and Oort proved irreducibility of leaves for Siegel Shimura varieties by geometric methods. In this talk I report on an ongoing work with Arno Kret on proving the irreducibility for Hodge-type Shimura varieties via a different approach using more automorphic input.