第 10 回広島仙台整数論集会

2011 年 7 月 19 日 (火) – 7 月 22 日 (金)
広島大学理学部 (東広島キャンパス) B棟 B707

本研究集会は、科学研究費基盤研究 (A)「数論における幾何・トポロジーの新展開とアルゴリズム」(代表者　松本眞), 科研費基盤研究 (B)「p 進的手法を用いた数論的多様体の研究」(代表者　都築暢夫) からの援助を受けています。

プログラムの変更・講演のアブストラクト・会場までの交通手段などは、研究集会ホームページ[1] をご覧下さい。

プログラム

7 月 19 日 (火)

10:00 – 10:50 内田幸寛 (京都大学) Generalization of elliptic nets to hyperelliptic curves and its application to the Tate-Lichtenbaum pairing

11:00 – 11:50 奈良忠央 (東北大学) On the Mordell-Weil groups of twists of elliptic curves

12:00 – 12:50 三柴善範 (九州大学) On v-adic periods of t-motives

14:10 – 15:00 岡本亮彦 (早稲田大学) Relative Brauer groups of (2,2)-twist of an elliptic curve

15:10 – 16:00 町出智也 (近畿大学) Generators for vector spaces spanned by double zeta values with even weight

16:10 – 17:00 田坂浩二 (九州大学) Double Eisenstein series and period polynomials

17:10 – 18:00 宗野恵樹 (東京大学) On the zero distributions of the derivative of Epstein zeta functions

7 月 20 日 (水)

9:00 – 9:50 並川健一 (大阪大学) On special values of adjoint L-functions and the congruence of modular forms

10:00 – 10:50 高井勇輝 (東京大学) An analogue of Sturm's theorem for Hilbert modular forms

11:00 – 11:50 平野雄一 (東京大学) Congruences of modular forms and the Iwasawa λ-invariants

12:00 – 12:50 佐久川憲児 (大阪大学) Control theorem for torsion Selmer varieties

14:10 – 15:00 村上和明 (慶應義塾大学) On the isomorphism classes of Iwasawa modules with $\lambda = 3$ and $\mu = 0$

15:10 – 16:00 三浦崇 (慶應義塾大学) On the non-cyclic Galois action on the ideal class groups of CM-fields

16:10 – 17:00 小原まり子 (東北大学) Rational elliptic surfaces related to Beilinson's Tate conjecture

17:10 – 18:00 新井啓介 (東京電機大学) Points over quadratic fields on Shimura curves of $\Gamma_0(p)$-type

[1] http://www.math.sci.hiroshima-u.ac.jp/~m-mat/JSPS-CoreToCore/SEISURON11/hiroshima11.html

7 月 21 日 (木)

9:00 – 9:50 松本雄也 (東京大学) On good reduction of some K3 surfaces

10:00 – 10:50 太田和惟 (東北大学) A generalization of the theory of Coleman power series

11:00 – 11:50 中川貴裕 (千葉大学) Riccati differential equation for hypergeometric differential equation

12:00 – 12:50 大久保俊 (東京大学) On a horizontal analogue of the p-adic monodromy theorem

14:10 – 15:00 金城謙作 (東北大学), 宮坂宥憲 (東北大学) Hypergeometric series and arithmetic-geometric mean over 2-adic fields

15:10 – 16:00 杉山倫 (名古屋大学) Tate-Beilinson conjecture and Parshin conjecture for products of plane curves over finite fields

16:10 – 17:00 加藤裕基 (東北大学) The isomorphism between motivic cohomology and K-groups for equi-characteristic regular local rings

17:10 – 18:00 望月哲史 (中央大学) $\mathbb{A}^1$

18:30 – 懇談会

7 月 22 日 (金)

8:45 – 9:35 小出裕 (中央大学) On the cyclotomic twisted torus

9:45 – 10:35 藤井俊 (慶應義塾大学) On Iwasawa invariants of $\mathbb{Z}_p$-extensions of an imaginary quadratic field

10:45 – 11:35 森澤貴之 (早稲田大学) On the ℓ-part of the $\mathbb{Z}_{p_1} \times \cdots \times \mathbb{Z}_{p_s}$-extension of $\mathbb{Q}$

11:45 – 12:35 許斐豊 (学習院大学) On pairs of quadratic fields $\mathbb{Q}(\sqrt{D})$ and $\mathbb{Q}(\sqrt{mD})$ both of whose class numbers are divisible by 5

13:40 – 14:30 伊東杏希子 (名古屋大学) On certain infinite families of imaginary quadratic fields whose Iwasawa λ-invariant is equal to 1

14:40 – 15:30 小関祥康 (九州大学) Cartier duality for Liu modules

※最終日は研究集会開始時間が早くなっていますのでご注意下さい。

世話人：平之内 俊郎 (広島大学)・松本 眞 (東京大学)・高橋 浩樹 (広島大学)・都築 暢夫 (東北大学)・ 雪江 明彦 (東北大学)

第 10 回仙台広島整数論集会

7 月 19 日 (火)

内田幸寛 (京都大学大学院理学研究科数学教室 学振 PD)

Generalization of elliptic nets to hyperelliptic curves and its application to the Tate-Lichtenbaum pairing

Recently, Stange defined elliptic nets and gave an algorithm to compute the Tate pairing on an elliptic curve via elliptic nets. Elliptic nets are maps from a free Abelian group of finite rank to a ring that satisfy a certain recurrence relation. For example, elliptic divisibility sequences are a special case of elliptic nets. In this talk, we first define hyperelliptic nets as a generalization of elliptic nets to hyperelliptic curves. Next, we give an expression for the Tate-Lichtenbaum pairing in terms of hyperelliptic nets. Finally, we describe an algorithm to compute the Tate-Lichtenbaum pairing on a curve of genus 2 by using hyperelliptic nets.

奈良忠央（東北大学理学研究科 D3）

On the Mordell-Weil groups of twists of elliptic curves

In the talk, we describe how to compute bounds of the canonical heights of points on twists. Using the estimates, we consider the Mordell-Weil group of specific families with explicit integral points. For example, we study an infinite family of Mordell curves with three explicit integral points. We show that any pair in the three points can always be a part of a basis of the free part of the Mordell–Weil group. This is joint work with Y. Fujita.

三柴善範（九州大学大学院数理学府 D1）

On v-adic periods of t-motives

In this talk, we prove the equality between the transcendental degree of the field generated by the v-adic periods of a t-motive M and the dimension of the Tannakian Galois group for M, where v is a "finite" place of the rational function field over a finite field.

岡本亮彦（早稲田大学教育学部 助手）

Relative Brauer groups of (2,2)-twist of an elliptic curve

We study the relative Brauer groups of function fields of genus one curves. Ciperiani and Krashen develop techniques for computing the relative Brauer groups of a family of genus one curves. These genus one curves are cyclic twist of its Jacobian, and the relative Brauer groups are parametrized by the group of rational points of the Jacobian. In this talk, we will explain how to compute the relative Brauer groups of (2,2)-twist type of an elliptic curve. The main tool we apply here is the period-index obstruction map.

町出智也（近畿大学総合理工学研究科量子コンピュータセンター PD）

Generators for vector spaces spanned by double zeta values with even weight

Let $\mathcal{DZ}_k$ be the $\mathbb{Q}$-vector space spanned by double zeta values with weight k, and $\mathcal{DM}_k$ be its quotient space divided by the space $\mathcal{PZ}_k$ spanned by the zeta value $\zeta(k)$ and products of two zeta values with total weight k. When k is even, an upper bound for the dimension of $\mathcal{DM}_k$ is known. By adding the dimensions of $\mathcal{DM}_k$ and $\mathcal{PZ}_k$, we get an upper bound of $\mathcal{DZ}_k$ which equals $k/2$ minus the dimension of the space of modular

forms of weight k on the modular group. In this talk, we obtain some specific sets of generators for $\mathcal{DM}_k$ which represent the upper bound. Since $\mathcal{DM}_k$ is a quotient space of $\mathcal{DZ}_k$, these sets yield the corresponding sets and the upper bound for $\mathcal{DZ}_k$.

田坂浩二（九州大学大学院数理学府 D1）

Double Eisenstein series and period polynomials

We introduce the 'double Eisenstein series' which was defined by Gangle-Kaneko-Zagier. It has very interesting connections to double zeta values and the period polynomials of modular forms. In this talk, we define the double Eisenstein series for the congruence subgroup $\Gamma_0(2)$ and see its relation to the period polynomials for $\Gamma_0(2)$.

宗野恵樹 (東京大学大学院数理科学研究科 D3)

On the zero distributions of the derivative of Epstein zeta functions

In my talk, we investigate the distributions of the zeros of the derivative of Epstein zeta functions of general rank. In 2005, J. Studing (Math. Ann. 333) obtained the asymptotic formulas of the summation of the real part of zeros of $\zeta(s;Q)$ and the number of zeros $\sigma = \beta + i\gamma$ such that$|\gamma| \leq T$ of $\zeta(s;Q)$, where $\zeta(s;Q)$ is the Epstein zeta function attached to the positive definite matrix Q of general rank. We extend his method to the k-th derivative of $\zeta(s;Q)$, and give the asymptotic formulas of the summation of the real part of zeros of $\zeta^{(k)}(s;Q)$ and the number of zeros $\sigma^{(k)} = \beta^{(k)} + i\gamma^{(k)}$ of $\zeta^{(k)}(s;Q)$ whose $|\gamma^{(k)}| \leq T$.

7 月 20 日 (水)

並川健一 (大阪大学大学院理学研究科 特任研究員)

On special values of adjoint L-functions and the congruence of modular forms

Around 1980, K. Doi and H. Hida found a meaning of the special value of certain degree 3 L-functions, so called adjoint L-functions of cusp forms. They discovered that if a prime divides "algebraic part" of the adjoint L-function of a cusp form, the prime is a congruence prime for the cusp form. E. Ghate and M. Dimitrov proved analogues of Hida's theorem in Hilbert modular case. E. Urban also proved a similar result in case of cusp forms on $GL(2)$ over imaginary quadratic fields. In this talk, we prove such a result in case of cusp forms on $GL(2)$ over number fields.

高井勇輝 (東京大学数理科学研究科 GCOE 特任研究員)

An analogue of Sturm's theorem for Hilbert modular forms

Sturm proved that mod ℓ elliptic holomorphic modular forms of weight k and level $\Gamma_1(N)$ are determined by the first $(k/12)[\Gamma_1(1) : \Gamma_1(N)]$ Fourier coefficients modulo ℓ. In this talk, I will present a result on analogue of Sturm's result for Hilbert modular forms. The proof uses the positivity of intersection numbers of ample line bundles.

平野雄一 (東京大学大学院数理科学研究科 D2)

Congruences of modular forms and the Iwasawa λ-invariants

We consider the problem to show how congruences between the Fourier coefficients of Hecke eigenforms of weight $k \geq 2$ and Eisenstein series of weight $k \geq 2$ give rise to corresponding congruences between the special values of the associated L-functions. In

the case of weight $k = 2$, Vatsal obtained the congruences of L-functions. In this talk, we explain a recent result which generalizes his work to the case of higher weight $k \geq 2$.

Then we apply it to the Iwasawa main conjecture for cusp forms of weight $k \geq 2$ in the special case where p-adic Galois representations attached to cusp forms are residually reducible. This is a partial generalization of the results of Greenberg–Vatsal in the case of weight $k = 2$.

佐久川憲児 (大阪大学理学研究科数学専攻 D2)

Control theorem for torsion Selmer varieties

Minghyong Kim defined Selmer varieties which is a non-abelian generalization of $\mathbb{Q}_p$ Selmer groups of galois representations. In this talk, we define $\mathbb{Q}_p/\mathbb{Z}_p$ coefficient Selmer varieties. We study behavior of Selmer varieties in a $\mathbb{Z}_p$ extension of a number field and prove control theorem under some assumptions.

村上和明 (慶應義塾大学大学院 D2)

On the isomorphism classes of Iwasawa modules with $\lambda = 3$ and $\mu = 0$

For an odd prime number p, we classify the isomorphism classes of finitely generated torsion $\Lambda = \mathbb{Z}_p[\![T]\!]$-modules with $\lambda = 3$ and $\mu = 0$, which are free over $\mathbb{Z}_p$. We apply this classification to the Iwasawa module associated to the cyclotomic $\mathbb{Z}_p$-extension of an imaginary quadratic field.

三浦崇 (慶應義塾大学大学院 D3・学振 DC2)

On the non-cyclic Galois action on the ideal class groups of CM-fields

In this talk, we will study two problems as stronger versions of Brumer's conjecture: whether the Stickelbeger element belongs to the Fitting ideal of the class group and whether it belongs to the Fitting ideal of the Pontrjagin dual of the class group. It is known that these two properties hold in many cases but this is not true in general. We construct systematically examples for which both these two properties do not hold simultaneously and also give numerical examples.

小原まり子 (東北大学理学研究科数学専攻 D1)

Rational elliptic surfaces related to Beilinson's Tate conjecture

In this talk we present a rational elliptic surface over a field which satisfies Beilinson's Tate conjecture for K-groups of degree 2 but the boundary map arising from the localization sequence is not surjective in positive characteristic. We consider the case that the base field is positive characteristic and transcendental over its prime subfield.

新井啓介 (東京電機大学工学部 助教)

Points over quadratic fields on Shimura curves of $\Gamma_0(p)$-type

Mazur and Momose studied points on the modular curve $X_0(p)$ for a prime p. They showed that over a quadratic field there are only cusps on $X_0(p)$ if p is sufficiently large. In this talk we show a similar result for Shimura curves.

7 月 21 日 (木)

松本雄也 (東京大学大学院数理科学研究科 D1)

On good reduction of some K3 surfaces

Let X be a variety over a local field K. If X is an abelian variety, a theorem of Serre–Tate shows that X has good reduction if and only if its l-adic etale cohomology is unramified (a Galois representation of K is unramified if the action of the inertia group is trivial). In this talk, I prove that similar results holds if X belongs to certain classes of K3 surfaces.

太田和惟 (東北大学大学院理学研究科数学専攻 M2)

A generalization of the theory of Coleman power series

The classical theory of Coleman power series says that every norm compatible system of local units in a Lubin-Tate extension is interpolated by an integral power series. It has been generalized in various ways such as the Perrin-Riou map, and plays important roles in a generalization of Iwasawa theory. On the other hand, recently Kobayashi found a new generalization of the Coleman power series theory for elliptic curves at supersingular primes related to the norm construction of p-adic height functions. It seems important to generalize his theory to p-adic representations in order to investigate p-adic height functions. In this talk, we show the generalization for 1-dimensional formal groups of height $h \geq 2$.

中川貴裕 (千葉大学理学研究科 D3)

Riccati differential equation for hypergeometric differential equation

In this talk, we consider the solutions of Riccati differential equation for p-adic differential equation which is solvable on generic disc. We see that the Riccati differential equation for some globaly nilpotent differential equation has for almost all prime, a solution of rational function field over finite field but no algebraic solutions.

大久保俊 (東京大学大学院数理科学研究科 D3・学振 DC2)

On a horizontal analogue of the p-adic monodromy theorem

Let K be a complete discrete valuation field of mixed characteristic $(0, p)$ and G_K be an absolute Galois group of K. When the residue field of K is imperfect, there is a variation of p-adic Hodge theory, called horizontal p-adic Hodge theory. We will prove a "horizontal" analogue of the p-adic monodromy theorem for p-adic representations of G_K. As an application of this theorem, we will calculate H^1 of horizontal de Rham representations of Hodge-Tate weights strictly positive.

金城謙作 (東北大学大学院理学研究科 D4),
宮坂宥憲 (東北大学大学院理学研究科 D3・学振 DC2)

Hypergeometric series and arithmetic-geometric mean over 2-adic fields

Dwork proved that the Gaussian hypergeometric function on p-adic numbers can be extended to a function which takes values of the unit roots of ordinary elliptic curves over a finite field of characteristic $p > 2$. We present an analogous theory in the case $p = 2$. As an application, we give a relation between the canonical lift and the unit root of an elliptic curve over a finite field of characteristic 2 by using the 2-adic arithmetic-geometric mean.

杉山倫（名古屋大学多元数理科学研究科 D3・学振 DC2）

Tate-Beilinson conjecture and Parshin conjecture for products of plane curves over finite fields

Tate has conjectured that for projective smooth varieties over finite fields, an ℓ-adic cycle class map is surjective. Beilinson furthermore has conjectured that the cycle class map is also injective. In this talk, we prove that the Tate-Beilinson conjecture holds for products of certain plane curves. As a consequence, we obtain that the Parshin conjecture holds for such products. Our main result has some applications to products with Fermat variety, and to a zeta value of products of four curves.

加藤裕基 (東北大学大学院理学研究科 研究支援者)

The isomorphism between motivic cohomology and K-groups for equi-characteristic regular local rings

One of the well-known problems in the algebraic K-theory is the comparison of higher Chow groups and K-groups. Using the motivic complex defined by Friedlander–Suslin–Voevodsky, we prove the comparison theorem for equicharacteristic regular local rings.

望月哲史（中央大学理工学部数学科 研究員）

$\mathbb{A}^1$

In the lecture, I will look into the $\mathbb{A}^1$-homotopy invariance property for algebraic varieties in the view of derived algebraic geometry.

7 月 22 日 (金)

小出裕 (中央大学理工学研究科情報セキュリティ専攻 D2)

On the cyclotomic twisted torus

Let K/k be a Galois extension of degree n with the cyclic group G generated by σ. And let m be the value of the Euler function of n. Let ζ be the primitive n-th root of unity and I the representing matrix of multiplication of ζ in $\mathbb{Z}[\zeta]$. Then we define an action of I to the algebraic torus of dimension m in a suitable way. We obtain the group scheme which is the Galois descent to k by this action. We call it a cyclotomic twisted torus and denote it by $G(n)_k$. On the other hand the group scheme which K. Rubin and A. Silverberg treat in the cryptography is denoted by $T(n)_k$. In this talk I will show that $G(n)_k \cong T(n)_k$ in natural way. And I will give the coordinate ring of $G(n)_k$ explicitly. This is a joint work with Professor T. Sekiguchi.

藤井俊 (慶應義塾大学理工学部 学振 PD)

On Iwasawa invariants of $\mathbb{Z}_p$-extensions of an imaginary quadratic field

Let p be an odd prime number. To ask the behavior of λ- and μ-invariants is a basic problem in Iwasawa theory of $\mathbb{Z}_p$-extensions. Sands showed that if p does not divide the class number of an imaginary quadratic field k and if the λ-invariant of the cyclotomic $\mathbb{Z}_p$-extension of k is 2, then μ-invariants vanish for all $\mathbb{Z}_p$-extensions of k, and λ-invariants are less than or equal to 2 for $\mathbb{Z}_p$-extensions of k in which all primes above p are totally ramified. In this talk, we show results similar to Sands' results without the assumption that p does not divide the class number of k. (For the vanishing of μ, we need some technical conditions.) When μ-invariants vanish, we also give an explicit upper bound of λ-invariants of all $\mathbb{Z}_p$-extensions.

森澤貴之 (早稲田大学基幹理工学研究科数学応用数理専攻 D2・学振 DC1)

On the ℓ-part of the $\mathbb{Z}_{p_1} \times \cdots \times \mathbb{Z}_{p_s}$-extension of $\mathbb{Q}$

Let p and ℓ be distinct prime numbers. It is an interesting problem to consider whether ℓ does not divide the class number of all intermediate fields of the cyclotomic $\mathbb{Z}_p$-extension of $\mathbb{Q}$. Moreover, this problem is generalized to the compositum of $\mathbb{Z}_{p_i}$-extensions for distinct prime numbers $p_1, \cdots, p_s$. In this talk, we consider the ℓ-indivisibility of the class number of all intermediate fields of it.

許斐豊（学習院大学理学部 客員研究員）

On pairs of quadratic fields $\mathbb{Q}(\sqrt{D})$ and $\mathbb{Q}(\sqrt{mD})$ both of whose class numbers are divisible by 5

For any square-free integers $m \neq 1$, Toru Komatsu presents an infinite family of pairs of quadratic fields $\mathbb{Q}(\sqrt{D})$ and $\mathbb{Q}(\sqrt{mD})$ both of whose class numbers are divisible by 3. In this talk, we prove a similar result on the divisibility by 5 for small square-free integers $m \neq 1$. By Sato's criterion on the divisibility by 5 of the class numbers of quadratic fields, such pairs of quadratic fields can be parameterized by rational points on a certain elliptic curve. In this manner, we may finally reduce the problem to computation of the rank of elliptic curves. (joint work with Yoshichika Iizuka and Shin Nakano)

伊東杏希子 (名古屋大学大学院多元数理科学研究科 D3・学振 DC2)

On certain infinite families of imaginary quadratic fields whose Iwasawa λ-invariant is equal to 1

In this talk, we state the existence of certain infinite families of imaginary quadratic fields whose Iwasawa λ-invariant is equal to 1. Let p be a prime number and k be an algebraic number field of finite degree over $\mathbb{Q}$. If p does not divide the class number of k and p does not split at all in k, then $\lambda_p = \mu_p = \nu_p = 0$ for all $\mathbb{Z}_p$-extension over k. This theorem is proved by K. Iwasawa. It is known that for any prime p which splits in the imaginary quadratic field $\mathbb{Q}(\sqrt{D})$, $\lambda_p(D) \geq 1$, where $\lambda_p(D)$ denotes the Iwasawa λ-invariant of cyclotomic $\mathbb{Z}_p$-extension over $\mathbb{Q}(\sqrt{D})$. We consider how often the trivial λ-invariant appears for such a prime. D. Byeon proved that for any odd prime p, if there exists one imaginary quadratic field $\mathbb{Q}(\sqrt{D_0})$ with $\lambda_p(D_0) = 1$ and $\chi_{D_0}(p) = 1$, then there exists an infinite number of such imaginary quadratic fields. Concerning his result, we consider the following question ;
(i) For given odd prime number p, are there $\mathbb{Q}(\sqrt{D_0})$ satisfies the above condition?
(ii) Let $a \bmod b$ be a generic arithmetic progression containing infinitely many fundamental discriminants. Are there infinite many imaginary quadratic fields $\mathbb{Q}(\sqrt{D})$ such that $D \equiv a \bmod b$ and $\lambda_p(D) = 1$?

For these two questions, we obtain some results. First, we state a result of explicit construction of imaginary quadratic fields whose Iwasawa λ-invariant is equal to 1. Secondly, we state a partial result about question (ii) concerning the result of D. Byeon. For this proof, we mainly use properties of p-adic L function and half integral weight modular form. We also state a result of the Iwasawa λ-invariant of non cyclotomic $\mathbb{Z}_p$-extension over imaginary quadratic field concerning the result of M. Ozaki.

小関祥康 (九州大学数理学研究院 博士研究員)

Cartier duality for Liu modules

In this talk, we prove the Cartier duality for torsion (resp. free) Liu modules which are defined by Tong Liu in 2010 to classify semi-stable Galois representations.