

Workshop on arithmetic geometry, Tokyo-Princeton at Komaba

March 18-22, 2019,

School of Mathematical Sciences, the University of Tokyo, room 123

March 18, Monday

10:00-11:00 Will Sawin : The sup-norm problem and stalks of perverse sheaves

11:00-11:30 coffee break

11:30-12:30 Chris Skinner : Some recent results on Euler systems

15:30-16:30 Hiroki Kato : ℓ -independence of traces of local monodromy in a relative case

16:30-17:00 coffee break

17:00-18:00 Takeshi Tsuji : (φ, Γ) -modules and formal moduli for Lubin-Tate formal groups

March 19, Tuesday

10:00-11:00 Atsushi Shiho : On the finiteness problem of integral overconvergent de Rham-Witt cohomology modulo torsion

11:00-11:30 coffee break

11:30-12:30 Yunqing Tang : Reductions of abelian surfaces over global function fields

free afternoon

March 20, Wednesday

10:00-11:00 Charlotte Chan : Periods identities of CM forms on quaternion algebras

11:00-11:30 coffee break

11:30-12:30 Yoichi Mieda : On the formal degree conjecture for simple supercuspidal representations

15:30-16:30 Masao Oi : On depth in the local Langlands correspondence

16:30-17:00 coffee break

17:00-18:00 Jun Su : Automorphy of coherent cohomology of Shimura varieties

18:30-20:30 Official Dinner at Common Room on the 2nd floor.

March 21, Thursday (spring equinox)

10:00-11:00 Levent Alpoge : The average number of rational points on odd genus two curves over \mathbf{Q} is bounded.

11:00-11:30 coffee break

11:30-12:30 Tomohide Terasoma : Degeneration of elliptic motives and depth filtration

15:30-16:30 Congling Qiu : The Gross-Zagier-Zhang formula over function fields

16:30-17:00 coffee break

17:00-18:00 Shouwu Zhang : Admissible pairing of algebraic cycles

March 22, Friday

9:45-10:45 Remy van Dobben de Bruyn : A variety that cannot be dominated by one that lifts.

11:00-12:00 Shuji Saito : Rigid analytic K -theory and p -adic Chern character

This workshop is supported by the Strategic Partnership between Princeton University and the University of Tokyo

organizers N. M. Katz, T. Saito

Abstracts

Monday 18

Will Sawin (Columbia) : The sup-norm problem and stalks of perverse sheaves

In number theory, modular forms are certain functions on modular curves. The sup-norm problem asks how large a value this function can take. An analogue of the modular curve is the space of rank two vector bundles on a curve over a finite field, and we can formulate the same problem there. In this setting, Drinfeld showed that modular forms arise from perverse sheaves, and a natural approach to the problem is by studying the stalk cohomology of these sheaves. We will explain the first steps of this approach, making some progress beyond what is known on the original problem.

Chris Skinner (Princeton) Some recent results on Euler systems

Euler systems remain one of the best tools for understanding the orders of Selmer groups and for relating Selmer groups to L-values. In this talk we describe some recent work on Euler systems, which includes some results in the anticyclotomic setting as well as some constructions of new Euler systems in the cyclotomic setting.

Hiroki Kato (Tokyo) : ℓ -independence of traces of local monodromy in a relative case

I will discuss the alternating sum of traces for ℓ -adic cohomology. One of the motivating results is Ochiai's one; for a variety over a local field, the alternating sum of the traces of the inertia action on the ℓ -adic cohomology groups is an integer independent of ℓ . I proved a relative version of his result inspired by Vidal's result for relative curves.

Takeshi Tsuji (Tokyo) : (φ, Γ) -modules and formal moduli for Lubin-Tate formal groups

We construct a lifting of the theory of Lubin-Tate (φ, Γ) -modules by Kisin-Ren to the universal deformation of the Lubin-Tate formal group, and study its properties. We lift the description of the Iwasawa module in terms of (φ, Γ) -module by Schneider-Venjakob, and the Wach module associated to an F -analytic crystalline representation V with length of Hodge filtration less than $p - 1$. These liftings allow us to construct Coates-Wiles homomorphisms for V in multiple variable directions. This is a joint work in progress with Laurent Berger.

Tuesday 19

Atsushi Shiho (Tokyo) : On the finiteness problem of integral overconvergent de Rham-Witt cohomology modulo torsion

The integral overconvergent de Rham-Witt cohomology is a p -adic cohomology for smooth varieties of characteristic p defined by Davis-Langer-Zink which is isomorphic to the rigid cohomology when tensored with \mathbf{Q} and which is isomorphic to the de Rham-Witt cohomology in proper smooth case. We discuss the finiteness problem of integral overconvergent de Rham-Witt cohomology modulo torsion. This is a joint work with Veronika Ertl.

Yunqing Tang (Princeton) : Reductions of abelian surfaces over global function fields

For a non-isotrivial ordinary abelian surface A over a global function field with everywhere good reduction, under mild assumptions, we prove that there are infinitely many places modulo which A is geometrically isogenous to the product of two elliptic curves. This result can be viewed as a generalization of a theorem of Chai and Oort. This is joint work with Davesh Maulik and Ananth Shankar.

Wednesday 20

Charlotte Chan (Princeton) : Periods identities of CM forms on quaternion algebras

Waldspurger's formula gives an identity between the norm of a torus period and an L-function of the twist of an automorphic representation on $GL(2)$. For any two Hecke characters of a fixed quadratic extension, one can consider the two torus periods coming from integrating one character against the automorphic induction of the other. Because the corresponding L-functions agree, (the norms of) these periods—which occur on different quaternion algebras—are closely related. In this talk, we will discuss a direct proof of an explicit identity between the torus periods themselves and mention applications to p -adic automorphic forms.

Yoichi Mieda (Tokyo) : On the formal degree conjecture for simple supercuspidal representations

The formal degree conjecture due to Hiraga-Ichino-Ikeda predicts that the formal degree of a discrete series representation of a p -adic reductive group can be expressed by means of its Langlands parameter. Recently, Masao Oi proved that this conjecture holds for simple supercuspidal representations of $Sp(2n)$, under some condition on n and p . In this talk, I will explain how to remove this condition (unfortunately, I still need to assume that p is odd). The idea is to pass to the equal characteristic case and to use theory of the Kloosterman sheaves.

Masao Oi (Tokyo) : On depth in the local Langlands correspondence

Let G be a classical group over a p -adic field F . Then the local Langlands correspondence gives a natural correspondence between the irreducible smooth representations of $G(F)$ and L-parameters of G . It is believed that this correspondence satisfies a lot of good properties beyond its characterization. One of such phenomena is the depth preserving property. We can define the notion of the depth, which is a numerical invariant, for both of irreducible representations and L-parameters. Then it is expected that the local Langlands correspondence preserves these invariants at least in a large residual characteristic. In this talk, I will give a partial answer to this problem by investigating the endoscopic character relation, which is the characterization of the local Langlands correspondence for classical groups.

Jun Su (Princeton) : Automorphy of coherent cohomology of Shimura varieties

Abstract: Various kinds of cohomology of Shimura varieties make bridges connecting Galois and automorphic representations. For example, modular forms of weight $k \geq 2$ can be seen in H^1 of local systems on modular curves, while weight 1 modular forms are global sections of line bundles on compactified modular curves. It's important to understand the Hecke module structures of these cohomology groups. In the local system case a clean answer in terms of relative Lie algebra cohomology of automorphic forms has been given by Borel and Franke. Inspired by their work, we prove a parallel formula for the cohomology of appropriate vector bundles on toroidal compactifications of Shimura varieties. In this talk we'll explain the involved constructions and shed some light on the proof.

Thursday 21

Levent Alpoge (Princeton) : The average number of rational points on odd genus two curves over \mathbf{Q} is bounded.

We prove that, when monic quintic integral polynomials $f \in \mathbf{Z}[x]$ with nonzero discriminant are ordered by height, the average number of solutions to $y^2 = f(x)$ is bounded.

Tomohide Terasoma (Tokyo) : Degeneration of elliptic motives and depth filtration

To a family of elliptic curves, we can associate a category of mixed elliptic motives. We consider the degeneration of the universal elliptic curve which yields an object of mixed Tate category. The filtration coming from weight filtration of mixed elliptic motives give rise to a "shifted" depth filtration which is related to the depth filtration of multiple zeta values. By this structure, we discuss a relation between Broadhurst-Kreimer conjecture and mixed elliptic motives. Using "sandwich resolution", we explain how these two subjects are related.

Congling Qiu (Princeton) : The Gross-Zagier-Zhang formula over function fields

The Gross-Zagier formula relates Neron-Tate heights of Heegner points on elliptic curves and central derivatives of Rankin L-series associated to modular forms. This formula is generalized by S. Zhang and Yuan-Zhang-Zhang. Over global function fields of arbitrary characteristics, we prove such a formula in the format of Yuan-Zhang-Zhang's work and in full generality. In particular, we allow arbitrary "weight" at "infinity". Our proof is based on an arithmetic variant of a relative trace identity of Jacquet. This approach is proposed by W. Zhang.

Shouwu Zhang (Princeton) : Admissible pairing of algebraic cycles

Abstract: For a smooth and projective variety X over a global field of dimension n with an adelic polarization, we propose canonical local and global height pairings for two cycles Y, Z of pure codimension p, q satisfying $p + q = n + 1$. We will discuss some application to algebraic dynamical systems and Shimura varieties.

Friday 20

Remy van Dobben de Bruyn (Princeton) : A variety that cannot be dominated by one that lifts.

Abstract: In the sixties, Serre constructed a smooth projective variety in characteristic p that cannot be lifted to characteristic 0. If a variety does not lift, a natural question is whether some variety related to it does. We construct a smooth projective variety that cannot be rationally dominated by a smooth projective variety that lifts.

Shuji Saito (Tokyo) : Rigid analytic K -theory and p -adic Chern character

I will explain a joint work with Moritz Kerz and Georg Tamme on a newly developed theory of K -theory for rigid analytic spaces and p -adic Chern character maps to syntomic cohomology.