RIMS conference: Analytic and Arithmetic Theory of Automorphic Forms

Abstract

15 Mon

13:30 – 14:30 **Kenji Makiyama (Kyoto Sangyo University)**

Title: A p-adic family of the D-th Saito-Kurokawa lifts for a Coleman family and the Bloch Kato conjecture.

Abstract: We will construct a p-adic family of the Saito-Kurokawa lifts for a Coleman family and extend the result of Agarwal and Brown on the Bloch-Kato conjecture for elliptic modular forms of low weights to higher weights. More precisely, we will see that the critical L-value of a Hecke eigenform f of low weight satisfying some assumptions gives a lower bound of the size of the Selmer group of a Hecke eigenform lying in a Coleman family passing through f.

14:45 – 15:45 **Ren-He Su (Kyoto University)**

Title: On linear relations between L-values and arithmetic functions.

Abstract: In 1975 Cohen constructed a series of modular forms of half-integral weights. Its q-coefficients contain special values of Dirichlet L-functions and were used by Cohen to create various equations of them with arithmetic functions. The modular forms are called Cohen-Eisenstein series and were later generalized to the case for Hilbert modular forms. Making use of the generalized forms one can also write down linear equations for the special values of Dirichlet L-functions with respect to certain general real number fields, even in terms of arithmetic functions on rational integers. In this talk I would like to introduce how this works. The idea was originally inspired by Ikeda.

16:00 – 17:00 **Takao Komatsu (Wuhan University)**

Title: Diophantine Frobenius problems from semigroup's series and identities for zeta functions.

Abstract: We study Diophantine Frobenius problems from the gaps values of numerical semigroup obtain some identities for zeta functions.

16 Tue

9:45 – 10:45 **Soumya Das (Indian Institute of Science)**

Title: Petersson norms of not necessarily cuspidal Jacobi modular forms and applications.

Abstract: We extend the usual notion of Petersson inner product on the space of cuspidal Jacobi forms to include non-cuspidal forms as well. This is done by examining carefully the relation between certain "growth-killing" invariant differential operators on the Siegel upper half space of degree 2 and those on $\mathbf{H} \times \mathbf{C}$. As applications, we can understand

better the growth of Petersson norms of Fourier Jacobi coefficients of Klingen Eisenstein series, which in turn has applications to finer issues about representation numbers of quadratic forms; and as a by-product we also show that any Siegel modular form of degree 2 is determined by its Fourier coefficients indexed by half-integral matrices with fundamental discriminants. This is a joint work with S. Boecherer.

11:00 – 12:00 Tomonori Moriyama (Osaka University)
Title: Theta series constructed from invariant harmonic polynomials.
Let $Q \in M(m, \mathbf{Z})$ be a positive definite symmetric matrix. Starting from a Q-harmonic homogeneous polynomial P, we can construct an elliptic modular form $\theta_Q(z, P)$ of weight $k = \deg(P) + m/2$. It is readily seen that we do not lose any modular forms if we assume that the polynomial P is invariant under the finite group $O(Q, \mathbf{Z})$. In this talk, we consider the case of $Q = E8$ and report that the linear map $P \mapsto \theta_Q(z, P)$ restricted to the space of invariant harmonic polynomials is injective for $k \leq 24$. This talk is based on Y. Funada's master thesis (2016, March) supervised by the speaker. If time permits, we will discuss some related topics and future problems.

13:30 – 14:30 Alexandru Ghitza (University of Melbourne)
Title: Differential operators on modular forms, and Galois representations.
Abstract: Since a modular form is a holomorphic function, it is natural to be tempted to take its derivative. However, this destroys the modularity property. Several approaches exist for "fixing" this problem, and the resulting objects have many arithmetic applications. I will discuss such differential operators on various types of modular forms (mod p), indicate a few ways of constructing them, and describe the effect of these operators on the Galois representations attached to Hecke eigenforms. (This is an amalgamation of various projects joint with Owen Colman, Max Flander and Angus McAndrew.)

14:45 – 15:45 Hiroki Aoki (Tokyo University of Science)
Title: On mixed weight Hilbert modular forms and their structure theorem.
Abstract: In this talk we discuss joint work with Sho Takemori on Hilbert modular forms over the real quadratic field of discriminant 5. We have a new simple way to construct Hilbert modular forms of lower weights. By using this way, we establish a structure theorem on mixed weight Hilbert modular forms.

16:00 – 17:00 Chia-Fu Yu (Institute of Mathematics, Academia Sinica)
Title: Reduced unit groups in totally definite quaternion algebras over real quadratic fields.
Abstract: Consider totally definite quaternion algebras D over totally real number fields F. For any maximal order O in D, the reduced unit group of O is the finite group $O^\times / O_F^\times$. In this talk we study the counting problem of ideal classes with reduced unit group equal to a given G. K. Hasihmoto gave a complete answer for the real quadratic field $F = Q(\sqrt{p})$ and $p \equiv 1 \pmod 4$. Our goal is to generalize Hashimoto's results to an arbitrary real quadratic field. This is joint work with Qun Li and Jiangwei Xue.

17 Wed

9:45 – 10:45 Isao Ishikawa (RIKEN AIP/Keio University)

Title: On explicit interpolation formulas of twisted triple product p-adic L-functions.

Abstract: A twisted triple product L-function is an L-function defined by automorphic forms on GL_2/F and GL_2/Q, where F/Q is a quadratic extension. Our aim is to construct a twisted triple product p-adic L-function which interpolates central values of twisted triple L-functions along Hida deformations. This is a twisted analogue of a split triple product p-adic L-function constructed by Harris-Tilouine, Darmon-Rotger, and Hsieh. Combining Hida theory with a formula proved by Ichino, which describe the central value of the twisted triple product L-function as a ratio of a global period integral and a product of local period integrals, we construct a desired p-adic L-function and prove its explicit interpolation formula. This interpolation formula is compatible with the conjectural p-adic L-function associated with the corresponding Galois representation. We also prove an explicit relation between the Galois side and the automorphic side of epsilon factors of Asai representations and twisted triple product representations.

11:00 – 12:00 Soma Purkait (Tokyo University of Science)

Title: Minus space of half-integral weight.

Abstract: Let M be odd and square-free. Ueda-Yamana generalizing Kohnen's work defined plus space of $S_{k+1/2}(8M)$ and proved that $S_{k+1/2}^{+,new}(8M)$ is Hecke isomorphic to $S_{2k}^{new}(2M)$. We define the minus subspace of $S_{k+1/2}(8M)$ and show that it is Hecke isomorphic to $S_{2k}^{new}(4M)$. Our approach is to describe genuine Hecke algebra of the double cover of $SL_2(Q_p)$ with respect to certain open compact subgroups by generators and relations and translate them to obtain classical operators on $S_{k+1/2}(8M)$. We characterize our minus space as a common -1 eigenspace of certain pairs of conjugate operators so obtained, for each prime dividing $2M$. It turns out that the minus space of level $8M$ satisfies Fourier coefficient condition exactly opposite to that of the plus space, although the minus space of level $4M$ does not seem to satisfy any Fourier coefficient condition. This is a joint work with E. M. Baruch.

13:30 – 14:30 Yumiko Hironaka (Waseda University)

Title: Spherical functions on the space of p-adic quaternion hermitian forms.

Abstract: We define spherical functions on the space of p-adic quaternion hermitian forms, and study their relation to local densities, their functional equations and location of possible poles, and their explicit form, using a series of symmetric polynomials. This situation is similar to other sesquilinear forms, and we will explain the common points and differences.

14:45 – 15:45 Jan Bruinier (TU Darmstadt)

Title: Generating series of special divisors on arithmetic ball quotients.

Abstract: A celebrated result of Hirzebruch and Zagier states that the generating series of Hirzebruch-Zagier divisors on a Hilbert modular surface is an elliptic modular form with values in the cohomology. We discuss some generalizations and applications of this result. In particular, we prove an analogue for special divisors on integral models of ball quotients. In this setting the generating series takes values in an arithmetic Chow group in the setting of Arakelov geometry. If time permits, we address some applications to

arithmetic theta lifts and the Colmez conjecture. This is joint work with B. Howard, S. Kudla, M. Rapoport, and T. Yang.

16:00 – 17:00 **Tamotsu Ikeda (Kyoto University),**
　　　　　Hidenori Katsurada (Muroran Institute of Technology)
Title: On the Gross-Keating invariant for hermitian forms.
Abstract: Let F be a non-archimedean local field of characteristic 0. The Siegel series attached to a quadratic form over the integer ring of F is determined by the Gross-Keating invariant and related invariants. We discuss the Gross-Keating invariant for a hermitian form over a quadratic extension of F.

18 Thu
9:45 – 10:45 **Yosuke Irie (Kyushu University)**
Title: Hyperbolic Eisenstein series on n-dimensional hyperbolic spaces.
Abstract: The hyperbolic Eisenstein series is the non-holomorphic Eisenstein series associated to hyperbolic fixed points, or equivalently a primitive hyperbolic element of Fuchsian groups of the first kind. It was first introduced by S. S. Kudla and J. J. Millson in 1979 as the analogue of the ordinary Eisenstein series associated to a parabolic fixed point. In this talk, we introduce the hyperbolic Eisenstein series on n-dimensional hyperbolic spaces and its fundamental properties. We prove the convergence, the differential equation associated to the Laplace-Beltrami operator and the analytic continuation with the location of the possible poles and residues. We also establish the precise spectral expansion of it.

11:00 – 12:00 **Keiichi Gunji (Chiba Institute of Technology)**
Title: On the computation of ramified Siegel series.
Abstract: The Fourier coefficients of the Siegel-Eisenstein series with levels and characters are important objects, but not yet completely solved. By Takemori, the explicit formula is given in general degree and primitive character, except for the case of quadratic characters. In this talk, we explain the computations and the results for degree 3 case, including the case of quadratic characters.

13:30 – 14:30 **Hiroaki Narita (Kumamoto University)**
Title: Explicit constructions of non-tempered cusp forms on orthogonal groups of low split ranks.
Abstract: The aim of this talk is to report a recent research on explicit constructions of cusp forms on orthogonal groups of split rank one or two by some lifts from cusp forms on the complex upper half plane. We also discuss cuspidal representations generated by them in terms of the explicit determination of their local components. As for the representation theoretic treatment, the point is to use Sugano's non-archimedean local theory of "Jacobi form formulation" of Oda-Rallis-Schiffman lifting to orthogonal groups of rank two. Sugano's local theory turns out to be useful also for the case of rank one (in fact, for a more general orthogonal group). Such argument leads to non-temperedness of the non-archimedean local components and the explicit determination of the standard L-functions. It should be remarked that the cusp forms taken up in this talk are counterexamples to the Ramanujan conjecture and those in rank one case are real analytic but non-holomorphic. This talk includes a recent joint work with Yingkun Li and Ameya

Pitale for the case of the rank one.

14:45 – 15:45 **Cris Poor (Fordham University)**
Title: Computing with paramodular forms.
Abstract: We survey recent results on the Paramodular Conjecture of Brumer and Kramer. In particular, we review examples where the modularity of an abelian surface has either been proven, or where a candidate paramodular newform has been constructed. The computational methods are joint work with David S. Yuen.

16:00 – 17:00 **Tomoyoshi Ibukiyama (Osaka University)**
Title: Siegel modular forms of middle parahoric subgroups and Ihara lift.
Abstract: Around in 1963, Ihara gave a theory of lifts from elliptic modular forms to automorphic forms of compact symplectic group of complex rank two. This can be regarded as a compact version of Saito-Kurokawa lift and Yoshida lift, which were found much later. In this talk, we give a precise conjectural global correspondence (of Langlands type) between Siegel modular forms and automorphic forms on compact symplectic group, for discrete subgroups which are parahoric subgroups locally, which are not maximal, and not minimal. This is based on exact dimension formulas of automorphic forms and a lot of numerical examples. As a byproduct, we propose a conjecture on precise images of the Ihara lift.

19 Fri
9:45 – 10:45 **Siegfried Böcherer (University of Mannheim)**
Title: Arithmetic properties of vector-valued Siegel modular forms
Abstract: Using equivariant holomorphic differential operators (as studied in detail by Ibukiyama) one can construct vector-valued modular forms of degree n from scalar-valued modular forms of degree n. If the scalar weight is large, all modular forms arise in such a way (for quite general groups Γ) from Siegel Eisenstein series. This allows one to get generators of spaces of modular forms with algebraic Fourier coefficients and bounded denominators for the vector-valued case. A main motivation comes from an application of this procedure to vector-valued p-adic modular forms.

11:00 – 12:00 **Bernhard Heim (German University of Technology (Oman))**
Title: Powers of the Dedekind Eta Function and Hurwitz Polynomials.
Abstract: In this talk, we study the vanishing properties of Fourier coefficients of powers of the Dedekind eta function. We give a certain type of classification of this property. Further we extend the results of Atkin, Cohen, and Newman for odd powers and a list Serre presented in 1985. The topic is intimately related with Hurwitz polynomials. We also indicate possible generalization of the Lehmer conjecture. This talk contains joint work with Florian Luca, Atsushi Murase, Markus Neuhauser, Florian Rupp and Alexander Weisse.