

## TITLES AND ABSTRACTS

### AUTOMORPHIC FORMS AND NUMBER THEORY, GOA, 2010

- U. Anandavardhanan

**Title: A local global question in automorphic forms**

Abstract: The notion of a distinguished representation is much studied both locally and globally. If a global representation is distinguished then each local constituent is distinguished. In this talk we will discuss the converse question in certain basic examples.

- Fabrizio Andreatta

**Title:  $p$ -adic modular forms via  $p$ -adic Hodge-Tate theory**

Abstract: (joint work with A. Iovita and Glenn Stevens) I will explain how to use  $p$ -adic Hodge-Tate theory to define families of overconvergent  $p$ -adic modular forms. For elliptic modular forms one obtains Coleman's definition. I will also present work in progress concerning a  $p$ -adic analogue of the Eichler-Shimura isomorphism for such families.

- Ioan Badulescu

**Title: Speh representations of linear groups**

Abstract: Speh representations of linear groups over local division algebras have strong properties: they are the basic brick in the construction of all unitary representations, they are local components of global automorphic representations and they have nice decomposition on the standard basis (Tadic) lately interpreted in terms of determinants by Chenevier and Renard. I will recall these properties and the different methods which led to their proof.

- Joël Bellaïche

- Gebhard Böckle

**Title: Lifting mod  $p$  Galois representations under non-smooth local conditions**

Abstract: Under smooth local deformation conditions, Ramakrishna gave an ingenious inductive method based on auxiliary primes allowing Steinberg type deformations to lift mod  $p$  Galois representations to  $p$ -adic Galois representations. Khare-Larsen-Ramakrishna have recently extended the method by a new technique of choosing auxiliary primes. Using this, we improve Ramakrishna's original method to include some non-smooth local deformation conditions. This allows one to use auxiliary primes with supercuspidal lifts to construct even  $p$ -adic Galois representations with large image

which are potentially unramified away from  $p$ . In particular the image of the lifting takes coefficients in a ramified extensions of Witt vectors. Another application is the lifting of mod  $p^n$  representation provided at all critical places they admit local lifts which are only generically smooth.

- Henri Darmon

**Title:  $p$ -adic weak harmonic Maass forms**

Abstract: Weak harmonic Maass forms are (non-holomorphic) modular forms which have attracted recent interest because of their connections with Ramanujan's theory of mock theta functions, the surjectivity properties of Borcherd's singular theta-lifts, and analogues of the Gross-Kohnen-Zagier theorem involving derivatives of twisted  $L$ -series. I will formulate the basic definitions of weak harmonic Maass forms in geometric terms, leading to a  $p$ -adic analogue of these objects. This is joint work with Luca Candelori.

- Mladen Dimitrov

**Title: Automorphic symbols,  $p$ -adic  $L$ -functions and control theorems for Hilbert modular varieties**

- Haruzo Hida

**Title: Hecke fields and  $L$ -invariants**

Abstract: Fix an infinite  $p$ -adic analytic family of Hecke eigenforms  $f_P$  of weights  $k_P > 1$ . Then I prove that  $\mathbb{Q}(a(p, f_P)|P)$  is a finite extension of the cyclotomic field of all  $p$ -power roots of unity if and only if the family has complex multiplication. As a corollary of this, the  $L$ -invariant of the adjoint square  $L$ -function is constant on the family if and only if the family has complex multiplication.

- Wee Teck Gan

**Title: Automorphic forms and representations on the metaplectic group**

- Guy Henniart

**Title: A Satake isomorphism for mod  $p$  representations of reductive groups over local fields**

Abstract: (Joint work with Vigneras). Using congruences of modular forms has had tremendous impact in Number Theory. A natural general framework is the study of congruences between automorphic forms or representations. The local counterpart of that is the study of representations of local reductive groups on vector spaces over finite fields. Here  $F$  is a local field with finite residue field of characteristic  $p$ ,  $G$  is a connected reductive group over  $F$  and  $B$  is a minimal parabolic subgroup of  $G$  with Levi decomposition  $B = LU$ . Let  $K$  be a special parahoric subgroup of  $G$ , in good position with respect to  $(L, U)$ . For any absolutely irreducible smooth representation of  $K$  on a vector space  $V$  over a field  $C$  of characteristic  $p$ , we describe the intertwining algebra  $H(G, K, V)$  of  $V$  in  $G$ . More precisely, we define a natural algebra homomorphism from  $H(G, K, V)$  to a similar algebra for  $L$ , we show it is injective and determine its image.

We thus generalise work of Herzig. Contrary to the cases of Herzig, and the classical case, due to Satake, where  $V$  is trivial and  $C$  is a field of complex numbers, we show that the intertwining algebra  $H(G, K, V)$  need not be commutative.

- Atsushi Ichino

**Title: Formal degrees and local theta correspondence**

The formal degree conjecture relates a certain representation-theoretic invariant to an arithmetic invariant. We test its functoriality property in the case of local theta correspondence. If time permits, we also discuss a relation with the Siegel-Weil formula. This is joint work with Wee Teck Gan.

- Hung Yean Loke

**Title: Automorphic representations of the non-linear two fold covers of tori**

Abstract: Let  $G$  be a non-linear double cover of a simply-connected Chevalley group. Let  $T$  be a split torus of  $G$ . In this talk, I will describe an irreducible genuine automorphic representation of  $T(\mathbb{A})$  where  $\mathbb{A}$  is the adèle ring of the rational numbers. This representation is closely related to the pseudo-spherical  $K$ -types of  $G(\mathbb{R})$ . I use this representation to construct a residue representation of the Eisenstein series of  $G(\mathbb{A})$ . This is a joint work with Gordan Savin.

- Colette Moeglin

**Title: Langlands  $L$ -functions and cuspidal automorphic representations of classical groups**

Abstract Now that we can take for granted the Langlands' classification for (some) classical groups thanks to Arthur's results, it is possible to define the full Rankin-Selberg like Langlands'  $L$ -functions,  $L(s, \rho \times \pi)$ . Here  $\rho$  is a cuspidal representation of some general linear group and  $\pi$  a square integrable automorphic representation of a classical group. In this talk I will compare this function to the same kind of function obtained by lifting  $\pi$  to the suitable general linear group. And I will relate the pole of the quotient  $L(s, \rho \times \pi)/L(s+1, \rho \times \pi)$  to the pole of some Eisenstein series assuming that  $Re(s) > 0$  and  $\pi$  is cuspidal.

- Goran Muic

**Title: Modular Curves and Bases for the Spaces of Cuspidal Modular Forms**

Abstract: Let  $\Gamma \subset SL_2(\mathbb{R})$  be one of the groups  $\Gamma_0(N)$ ,  $\Gamma_1(N)$ , and  $\Gamma(N)$ , or more generally a Fuchsian group of the first kind acting on the upper half-plane  $X$ . Let  $\mathfrak{R}_\Gamma$  the corresponding Riemann surface. Let  $S_m(\Gamma)$  be the space of cuspidal modular forms of weight  $m \geq 0$ . For each  $\xi \in X$  and  $m \geq 3$ , we construct cuspidal modular forms  $\Delta_{k,m,\xi} \in S_m(\Gamma)$  ( $k \geq 0$ ) which represent the linear functionals  $f \mapsto \frac{d^k f}{dz^k} \Big|_{z=\xi}$  in terms of the Petersson inner product:  $\langle f, \Delta_{k,m,\xi} \rangle = \frac{d^k f}{dz^k} \Big|_{z=\xi}$ . This gives the interpretation of the family of modular forms  $\Delta_{k,m,\xi}$  ( $k \geq 0$ ) which is analogous to the one for classical Poincaré series where the Petersson inner products of classical Poincaré series with a

modular form  $f$  determine the Fourier coefficients of  $f$  at a cusp. Also, with the aid of the geometry of the Riemann surface  $\mathfrak{R}_\Gamma$ , for each non-elliptic point  $\xi \in X$  and integer  $m \geq 3$ , we construct the basis of  $S_m(\Gamma)$  out of the modular forms  $\Delta_{k,m,\xi}$  ( $k \geq 0$ ).

- Omer Offen

**Title: Unitary periods**

Abstract: (joint with B. Feigon & E. Lapid) Consider an automorphic form on  $GL(n)$  over a quadratic extension. Its period integral over a unitary group is called a unitary period. Applying the relative trace formula of Jacquet and a process of stabilization we study the unitary periods and their local analogues. In particular, we characterize distinction by any unitary group.

- George Pappas

**Title:  $\varphi$ -modules and coefficient spaces for Galois representations**

Abstract: We consider stacks of modules with Frobenius endomorphisms that can be considered as parameter spaces for the coefficients of  $p$ -adic Galois representations of a  $p$ -adic field. These are global variants of the spaces introduced by Kisin in his study of deformations of Galois representations and can be viewed as giving analogues of Rapoport-Zink spaces. In particular, there is a construction of a period map in this case. This is joint work with M. Rapoport.

- A. Raghuram

**Title: Eisenstein cohomology and special values of Rankin-Selberg L-functions**

Abstract: I will begin my talk with a classical example based on Shimura's theorem on the critical values of  $L$ -functions attached to modular forms. I will then introduce the notion of Eisenstein cohomology and show how one can use it to prove algebraicity theorems for ratios of critical values of  $L$ -functions. Finally, I will report on my joint work with Guenter Harder: by studying rank-one Eisenstein cohomology for the group  $GL(N)$ , where  $N$  is an odd positive integer that is at least 3, we are able to prove algebraicity theorems for ratios of critical values of Rankin-Selberg L-functions for  $GL(a) \times GL(b)$ , with  $a + b = N$ . This generalizes previous work of Harder in the case of  $GL(2) \times GL(1)$  which boils down to the classical example mentioned above, and complements my own work on the central critical values of L-functions for  $GL(n) \times GL(n-1)$ .

- Gordan Savin

**Title: Some results on representations of metaplectic groups**

Abstract: (Joint with Gan). By means of Hecke algebras we describe Bernstein components for the metaplectic group that contain the even and the odd Weil representation. We describe the theta correspondence for irreducible representations in these components. Some recent results of Gan-Ichino and the role of epsilon factors in the theta correspondence will also be discussed.

- David Savitt

**Title: Generalizations of Serre's Conjecture**

Abstract: We will discuss recent progress on formulating and proving generalizations of the weight part of Serre's conjecture on the modularity of mod  $p$  Galois representations. This includes joint work with F. Herzig and T. Gee.

- Chen-bo Zhu

**Title: Archimedean multiplicity one theorems**

Abstract: I will discuss some recent multiplicity one results in the Archimedean cases. For linear models they include the spherical models of Bernstein and Rallis, and their extensions to special orthogonal groups. For mixed models they are the Bessel models and Ginzburg-Rallis models. The former represents joint work with Binyong Sun, and the latter with Binyong Sun and Dihua Jiang.