

**Second Texas-Oklahoma Representations and  
Automorphic Forms Conference (TORA II)**

Department of Mathematics  
Oklahoma State University  
Stillwater, Oklahoma

**SCHEDULE**

**FRIDAY, APRIL 6, 2012**

---

- 03:00 PM - 04:00 PM    Registration  
03:30 PM - 04:00 PM    Refreshments
- 04:00 PM - 05:00 PM    Allen Knutson, Cornell University  
*Decomposition of irreducible representations under subgroups*
- 05:15 PM - 06:00 PM    Roger Zierau, Oklahoma State University  
*Computing Associated Cycles*

**SATURDAY, APRIL 7, 2012**

---

- 08:30 AM - 09:15 AM    Olav Richter, University of North Texas  
*Kohnen's limit process for real-analytic Siegel modular forms*
- 09:30 AM - 10:15 AM    Martin Raum, MPIM-Bonn  
*Heisenberg harmonic weak Maass-Jacobi forms*
- 10:15 AM - 10:45 AM    Refreshments
- 10:45 AM - 11:05 AM    Jeannette Larsen, University of North Texas  
*Subquotients of Pseudodifferential Operator Modules over  $\mathbb{R}$*
- 11:05 AM - 11:25 AM    Naomi Tanabe, Oklahoma State University  
*Congruence for L-functions of Hilbert modular forms*
- 11:25 AM - 11:45 AM    Yeansu Kim, Purdue University  
*Langlands-Shahidi L-function for  $GSpin$  groups and the generic Arthur L-packet conjecture*
- 12:00 PM - 01:00 PM    Laura Peskin, California Institute of Technology  
*The mod  $p$  Iwahori Hecke algebra of the metaplectic cover of  $SL_2(\mathbb{Q}_p)$*
- 01:00 PM - 02:30 PM    Lunch
- 02:30 PM - 03:00 PM    Baiying Liu, University of Minnesota  
*On Fourier coefficients of automorphic forms on  $GL(n)$*
- 03:00 PM - 03:30 PM    Kwangho Choi, Purdue University  
*L-packet Invariance of Plancherel Measures*
- 03:30 PM - 04:00 PM    Refreshments
- 04:00 PM - 04:30 PM    Kimball Martin, University of Oklahoma  
*Periods and functorial transfer*
- 04:30 PM - 05:00 PM    Ameya Pitale, University of Oklahoma  
*Quantum Unique Ergodicity for powerful levels*
- 05:15 PM - 06:00 PM    Amit Ghosh, Oklahoma State University  
*Zeros of Hecke cusp forms*
- 06:30 PM - 09:30 PM    Conference Banquet in Murray Hall Parlor

**SUNDAY, APRIL 8, 2012**

---

- 08:30 AM - 09:15 AM Dan Ciubotaru, University of Utah  
*Unitary equivalences for reductive  $p$ -adic groups*
- 09:30 AM - 10:15 AM Charles Conley, University of North Texas  
*Differential operators on contact manifolds*
- 10:15 AM - 10:45 AM Refreshments
- 10:45 AM - 11:15 AM Christopher Marks, University of Alberta  
*The unbounded denominator conjecture for vector-valued modular forms*
- 11:15 AM - 11:45 AM Luis Lomelí, University of Oklahoma  
*On automorphic  $L$ -functions in positive characteristic II: applications to representation theory of  $p$ -adic reductive groups*
- 12:00 PM - 01:00 PM Jiu-Kang Yu, Purdue University  
*Epipelagic representations*
- 01:00 PM Lunch & Departure

Abstracts start on next page.

## ABSTRACTS

SPEAKER: Kwangho Choiy, Purdue University

TITLE:  $L$ -packet Invariance of Plancherel Measures

ABSTRACT: I shall discuss the behavior of the Plancherel measure on  $L$ -packets. One expects that the Plancherel measure is invariant on  $L$ -packets. First, I will introduce known results which support the expectation. Then, I will verify it for the depth-zero supercuspidal  $L$ -packets constructed by DeBacker-Reeder. This work implies that the reducibility of the induced representations, the Knapp-Stein  $R$ -group, and the commuting algebra are also invariant on the  $L$ -packets.

---

SPEAKER: Dan Ciubotaru, University of Utah

TITLE: Unitary equivalences for reductive  $p$ -adic groups

ABSTRACT: In joint work with Dan Barbasch, we establish a transfer of unitarity for a Bernstein component of the category of smooth representations of a reductive  $p$ -adic group to the associated Hecke algebra, in the framework of the theory of types, whenever the Hecke algebra is an affine Hecke algebra with geometric parameters, in the sense of Lusztig (possibly extended by a group of automorphisms of the root datum). This is a generalization of the Barbasch and Moy transfer of unitarity for representations with Iwahori fixed vectors. As a consequence, we establish relations between the unitary duals of different groups, in the spirit of endoscopy.

---

SPEAKER: Charles Conley, University of North Texas

TITLE: Differential operators on contact manifolds

ABSTRACT: Locally, the space of differential operators on a contact manifold possesses a unique “projective quantization”: a unique decomposition into subspaces irreducible under the contact projective Lie algebra. In joint work with Valentin Ovsienko, we use this quantization to prove the existence of certain global properties of contact manifolds.

---

SPEAKER: Amit Ghosh, Oklahoma State University

TITLE: Zeros of Hecke cusp forms

ABSTRACT: I will report on some recent work concerning the distribution of zeros of Hecke cusp forms. We consider zeros in the fundamental domain. It is known that quantum unique ergodicity implies that the zeros of such forms are uniformly distributed as the energy of the form increases. For holomorphic forms, we show that there are many zeros on the boundary. For the non-holomorphic case, the nodal set is studied and we obtain some new results on the number of nodal domains. In the process, we prove some sharp restriction theorems. This is joint work Andre Reznikov and Peter Sarnak.

---

SPEAKER: Yeansu Kim, Purdue University

TITLE: Langlands-Shahidi  $L$ -function for  $GSpin$  groups and the generic Arthur  $L$ -packet conjecture

ABSTRACT: I will explain about the equality of the  $L$ -function for  $GSpin$  groups from Langlands-Shahidi method and the Artin  $L$ -function. The first main tool of the proof, the functoriality for  $GSpin$  groups, was constructed by Asgari and Shahidi and the second main tool is the classification of the irreducible strongly positive discrete series representations of  $GSpin$  groups over  $p$ -adic field. In general, if the irreducible generic representation  $\pi$  of quasi-split connected reductive algebraic group  $G(F)$ , where  $F$  is non-archimedean local field, is not a supercuspidal representation, then we cannot find the globally generic cuspidal representation whose local component is  $\pi$ . For example, we cannot use the local-global argument for some irreducible generic non-supercuspidal discrete series representations of  $GSpin$  groups. Because we cannot use this method in general, we construct the classification of irreducible strongly positive discrete series representations of  $GSpin$  groups over  $p$ -adic field. The main tool used to prove this classification result is the Tadić’s

structure formula for Jacquet modules of the induced representation with respect to the maximal parabolic subgroups. This classification result is parallel to those for the metaplectic group by Ivan Matić.

One of the applications of the equality of L-functions is the generic Arthur L-packet conjecture. If L-packet attached to the Langlands parameter which corresponds to Arthur parameter has a generic member, it is tempered.

---

SPEAKER: Allen Knutson, Cornell University

TITLE: Decomposition of irreducible representations under subgroups

ABSTRACT: A basic problem in representation theory asks, given an irreducible representation  $V$  of a Lie group  $G$ , and a subgroup  $K$ , which irreps of  $H$  occur in  $V$  and with what multiplicity? One well-understood special case is that  $G = K \times K$ , in which the irreps of  $G$  are tensor products.

If  $V$  is finite-dimensional, it is easy to give a formula for these multiplicities as an alternating sum. However, such formulae are nearly useless for determining which multiplicities are positive and which are zero. (Also, since they can't be negative, they are unsatisfying.)

In the special case that  $K$  is the fixed-point set of an involution – or equivalently (!), the maximal compact subgroup of a real Lie group  $G$  – I'll state a conjecture for these multiplicities, and in which special cases I can prove it. One infinite family is the pairs  $G = GL(2n)$ ,  $K = Sp(n)$ . In almost all cases this conjecture is the first such manifestly positive formula.

---

SPEAKER: Jeannette Larsen, University of North Texas

TITLE: Subquotients of Pseudodifferential Operator Modules over  $\mathbb{R}$ .

ABSTRACT: Lecomte and Ovsienko classified the subquotients of the  $\text{Vec}\mathbb{R}$ -modules of pseudodifferential operators on tensor density modules. We classify the subquotients of pseudodifferential modules of mixed weight. In particular, the equivalence classes of subquotients of length five are determined by two invariants.

---

SPEAKER: Baiying Liu, University of Minnesota

TITLE: On Fourier coefficients of automorphic forms on  $GL(n)$

ABSTRACT: It is a well-known theorem, due to J. Shalika and I. Piatetski-Shapiro, independently, that any non-zero cuspidal automorphic form on  $GL_n(\mathbb{A})$  is generic, i.e. has a non-zero Whittaker-Fourier coefficient. Its proof follows from the Fourier expansion of the cuspidal automorphic form in terms of its Whittaker-Fourier coefficients. In this talk, we extend this Fourier expansion to the whole discrete spectrum of the space of all square-integrable automorphic forms of  $GL_n(\mathbb{A})$  and determine the Fourier coefficients of irreducible non-cuspidal (residual) automorphic representations of  $GL_n(\mathbb{A})$  in terms of unipotent orbits. This is a joint work with Prof. Dihua Jiang.

---

SPEAKER: Luis Lomelí, University of Oklahoma

TITLE: On automorphic L-functions in positive characteristic II: applications to representation theory of p-adic reductive groups

ABSTRACT: Based upon previous work, we conclude our study of the Langlands-Shahidi method in the case of a Siegel Levi subgroup of a quasi-split classical group over a global function field. This includes the case of a quasi-split special orthogonal group. The Langlands-Shahidi local coefficient, defined via intertwining operators and the uniqueness property of Whittaker models, leads us towards a refinement for Harish-Chandra's  $\mu$ -functions of the Plancherel formula for reductive p-adic groups. These can be expressed in terms of local L-functions and root numbers, which we define in positive characteristic. Also, it is possible to normalize intertwining operators in such a way that they become unitary. This question was posed by Langlands and was answered in characteristic zero by Shahidi; the normalized intertwining operators satisfy several additional properties that were predicted by Arthur. Furthermore, we obtain a criterion to determine reducibility points of an induced representation in terms of L-functions.

---

SPEAKER: Christopher Marks, University of Alberta

TITLE: The unbounded denominator conjecture for vector-valued modular forms

ABSTRACT: It has been understood since the fundamental work of Atkin and Swinnerton-Dyer in the 1970s that modular forms for noncongruence subgroups should have “unbounded denominators”, and in fact the condition of having bounded denominators is conjecturally equivalent to being a congruence modular form. I will explain how the theory of vector-valued modular forms provides an effective method of probing this conjecture, and present some recent evidence I have accumulated in the three-dimensional setting.

---

SPEAKER: Kimball Martin, University of Oklahoma

TITLE: Periods and functorial transfer

ABSTRACT: Periods and functorial transfer Abstract: Period integrals of automorphic forms are related to special values of L-functions, Fourier coefficients of modular forms and Langlands functoriality. We will discuss some aspects of how periods “behave under functorial transfer.”

---

SPEAKER: Laura Peskin, California Institute of Technology

TITLE: The mod  $p$  Iwahori Hecke algebra of the metaplectic cover of  $SL_2(\mathbb{Q}_p)$

ABSTRACT: The local Shimura correspondence relates representations of  $PGL_2$  to those of the metaplectic cover of  $SL_2$ , where both groups are  $p$ -adic and the representations are on  $\mathbb{C}$ -vector spaces. Many pieces of the usual construction break down, due to non-semisimplicity, when the representations are instead taken over a field of positive characteristic. The mod  $p$  case is especially problematic. I will discuss an alternate approach, which involves a comparison of certain Iwahori Hecke algebras of both groups.

---

SPEAKER: Ameya Pitale, University of Oklahoma

TITLE: Quantum Unique Ergodicity for powerful levels

ABSTRACT: In this talk I will describe some relations between equidistribution problems of mass of holomorphic modular forms and the subconvexity problems for related L-functions. I will show how, via a “local subconvexity bound” for Rankin-Selberg integrals, we are able to obtain the QUE conjecture concerning equidistribution of mass of classical holomorphic newforms of level  $q$  and weight  $k$  as  $qk$  goes to infinity. When  $q$  is far away from being squarefree (for example when  $q = p^n$ ) we get a power saving in the rate of the equidistribution. This is joint work with Paul Nelson and Abhishek Saha.

---

SPEAKER: Martin Raum, MPIM-Bonn

TITLE: Heisenberg harmonic weak Maass-Jacobi forms

ABSTRACT: The space of harmonic weak Maass-Jacobi forms has originally been defined by Bringmann and Richter. We consider a subspace, which we call the subspace of Heisenberg harmonic Maass-Jacobi forms. This space, as opposed to the space of all Maass-Jacobi forms, allows for a detailed analysis. We will decompose the space with respect to an analog of the xi-operator for harmonic weak Maass forms. We will put emphasis on a theta-like decomposition that comes up in the theory.

---

SPEAKER: Olav Richter, University of North Texas

TITLE: Kohnen’s limit process for real-analytic Siegel modular forms

ABSTRACT: Kohnen introduced a limit process for Siegel modular forms that produces Jacobi forms and he asked if there is a space of real-analytic Siegel modular forms such that skew-holomorphic Jacobi forms arise via this limit process. In this talk, I will report on recent joint work with Kathrin Bringmann and Martin Raum. We initiate the study of harmonic skew-Maass-Jacobi forms and harmonic Siegel-Maass forms. We improve a result of Maass on the Fourier coefficients of harmonic Siegel-Maass forms, which allows us to establish a connection to harmonic skew-Maass-Jacobi forms and in particular, to answer Kohnen’s question in the affirmative.

---

SPEAKER: Naomi Tanabe, Oklahoma State University

TITLE: Congruence for  $L$ -functions of Hilbert modular forms

ABSTRACT: Vatsal proved that if two elliptic cusp forms are congruent modulo  $l$ , for a prime  $l$ , then the congruence also holds for critical  $L$ -values. As a joint work with A. Raghuram, our aim is to generalize Vatsal's result to Hilbert modular forms.

---

SPEAKER: Jiu-Kang Yu, Purdue University

TITLE: Epipelagic representations

ABSTRACT: In this joint work with Gross and Reeder, we generalized Gross-Reeder's construction of simple supercuspidal representations. The simple supercuspidals are characterized by their depth being  $1/h$ , the smallest possible positive depth. The generalized supercuspidal representations similarly share a feature of small positive depth.

---

SPEAKER: Roger Zierau, Oklahoma State University

TITLE: Computing Associated Cycles

ABSTRACT: The associated cycle of a Harish-Chandra module is a fundamental invariant. It contains information about the size of a Harish-Chandra module as well as information about its global character. This lecture will discuss some methods for computing associated cycles for several families of irreducible Harish-Chandra modules.

---