

# Workshop on “Automorphic Forms, Geometry and Representation Theory”

Time: 9:30-12:00am, 2:00-4:30pm, June 4–June 8 (free afternoon on June 6)

Venue: Sir Run Run Shaw Science Building 212

Speaker: Yuanqing Cai

Institute: The Weizmann Institute of Science

Title: Doubling constructions for tensor product L-functions and applications

Abstract: I will discuss new integrals representing tensor product L-functions of classical groups with general linear groups. These integrals generalize the doubling integrals of Piatetski-Shapiro and Rallis and are applicable to all automorphic representations. The integrals also work for covering groups under certain hypotheses. This is joint with Friedberg, Ginzburg, and Kaplan. If time permits, I will discuss joint work with Friedberg and Kaplan on applications towards functoriality for split classical groups.

Speaker: Jingsong Chai

Institute: Sun Yat-Sen University

Title: On local converse problems over p-adic fields

Abstract: In this talk, we will review recent progress on local converse problems, on determination of irreducible generic representations of general linear group over p-adic fields by local twisted gamma factors.

Speaker: Pierre-Henri Chaudouard

Institute: University Paris 7-Denis-Diderot

Title: The Jacquet-Rallis trace formula

Abstract: The Jacquet-Rallis trace formula is a variant of the Arthur-Selberg trace formula. It was suggested by Jacquet and Rallis as a tool to prove global Gan-Gross-Prasad conjectures for unitary groups. We will present the formula, its current state, its applications and the problem of its fine spectral expansion. (based on a work-in-progress with Michal Zydor)

Speaker: Shuyang Cheng

Institute: University of Michigan

Title: Fourier transforms on the Steinberg–Hitchin base

Abstract: Fourier transforms have been a useful tool in the study of automorphic forms since Tate’s thesis, and recently in the proposed framework of Braverman–Kazhdan, Lafforgue and Ngo, a non-linear Fourier transform on reductive groups have been conjectured to exist, satisfy various properties, and are related to general automorphic L-functions. In a different direction, in the work of Frenkel–Langlands–Ngo and subsequently Altug on beyond endoscopy, the Fourier transform has also been applied not to the group, but rather to the base of the Steinberg–Hitchin fibration, in other words the space of characteristic polynomials in the case of  $GL(n)$ . In this talk I will compare the two approaches and summarize some recent progress.

Speaker: Dan Ciubotaru

Institute: University of Oxford

Title: Types and unitary representations of reductive p-adic groups

Abstract: We prove that for every Bushnell–Kutzko type that satisfies a certain rigidity assumption, the equivalence of categories between the corresponding Bernstein component and the category of modules for the Hecke algebra of the type induces a bijection between irreducible unitary representations in the two categories. Moreover, we show that every irreducible smooth  $G$ -representation contains a rigid type. This is a generalization of the unitarity criterion of Barbasch and Moy for representations with Iwahori fixed vectors.

Speaker: Wee Teck Gan

Institute: National University of Singapore

Title: The Shimura-Waldspurger correspondence for  $Mp(2n)$

Abstract: We discuss a classification of the automorphic discrete spectrum of the metaplectic group  $Mp(2n)$  in the style of Arthur, which extends the results of Waldspurger for the case of  $Mp(2)$ . This is joint work with Atsushi Ichino.

Speaker: Fan Gao

Institute: Purdue University

Title: Several concrete problems for genuine representations of covering groups.

Abstract: The significance of the Langlands program for linear algebraic groups and its deep connection with number theory, arithmetic of variety etc are well-known. On the other hand, for finite-degree central coverings of a linear reductive group, the analogous framework has not been fully established despite many important works on special families of coverings, e.g., the classical metaplectic double cover of the symplectic group. In this expository talk, we will discuss several concrete questions pertaining to a Langlands-Shahidi theory (yet to be developed) for genuine representations of covering groups.

Speaker: Kyu-Hwan Lee

Institute: University of Connecticut

Title: Whittaker functions and Demazure characters

Abstract: In this talk, we consider how to express an Iwahori-Whittaker function through Demazure characters. Under some interesting combinatorial conditions, we obtain an explicit formula and thereby a generalization of the Casselman-Shalika formula. Under the same conditions, we compute the transition matrix between two natural bases for the space of Iwahori fixed vectors of an induced representation of a  $p$ -adic group. This is a joint work with Cristian Lenart and Dongwen Liu.

Speaker: Wen-Wei Li

Institute: Chinese Academy of Sciences

Title: Langlands parameterization and contragredient representations

Abstract: I will discuss a conjectural description of the local  $L$ -parameter of contragredient representations. It is formulated by Adams-Vogan and D. Prasad independently and involves the Chevalley involution on the dual side. I will then move to the case of positive characteristic, and sketch a local-global argument to tackle this problem in terms of the parameters constructed by Genestier and Lafforgue.

Speaker: Jie Lin

Institute: Institut des Hautes Etudes Scientifiques

Title:  $L$ -functions and periods of automorphic motives

Abstract: A conjecture of Deligne predicts a relation between motivic  $L$ -functions and geometric periods. In this talk, we will explain an approach towards this conjecture for automorphic motives. This is a joint work with Harald Grobner and Michael Harris.

Speaker: Feng Su

Institute: Chinese Academy of Sciences

Title: Lattice points counting and bounds on periods of Maass forms

Abstract: We provide a “soft” proof for non-trivial bounds on spherical, hyperbolic and unipotent Fourier coefficients of a fixed Maass form for a general co-finite lattice  $\Gamma$  in  $\mathrm{PGL}_2(\mathbb{R})$ . We use the amplification method based on the Airy type phenomenon for corresponding matrix coefficients and an effective Selberg type pointwise asymptotic for the lattice points counting in various homogeneous spaces for  $\mathrm{PGL}_2(\mathbb{R})$ . This requires only  $L^2$ -theory. We also show how to use the uniform bound for the  $L^4$ -norm of  $\mathcal{K}$ -types in a fixed automorphic representation of  $\mathrm{PGL}_2(\mathbb{R})$  in order to slightly improve these bounds. This is joint work with A. Reznikov.

Speaker: Shuichiro Takeda

Institute: University of Missouri

Title: Subrepresentation theorems for  $p$ -adic symmetric spaces

Abstract: In this talk, I will talk about a couple of subrepresentation theorems for  $p$ -adic symmetric spaces, which can be considered as a generalization of well-known subrepresentations for admissible representations. The idea is to generalize the theory developed by Kato and Takano.

Speaker: Chen Wan

Institute: Institute for Advanced Study, Princeton

Title: A Local Trace Formula for the Generalized Shalika model

Abstract: I will discuss the local multiplicity problem for the generalized Shalika model. By proving a local trace formula for the model, we are able to prove a multiplicity formula for discrete series, which implies that the multiplicity of the generalized Shalika model is a constant over every discrete local Vogan L-packet. We also prove a relation between the multiplicity and the local exterior square L-function. This is a joint work with Rapheal Beuzart-Plessis.

Speaker: Bin Xu

Institute: Sichuan University

Title: The twisted descent method and its application to a reciprocal problem of Gan-Gross-Prasad conjectures

Abstract: We will talk about a reciprocal problem of the Gan-Gross-Prasad conjectures, and explain an approach using the twisted descent method. In particular, we will give both local and global examples for the case of special orthogonal groups and symplectic groups.

Speaker: Chong Zhang

Institute: Nanjing University

Title: Distinguished regular supercuspidal representations

Abstract: Regular supercuspidal representations are recently introduced by Kaletha, which are a subclass of tame supercuspidal representations. This new construction has many applications in the representation theory of  $p$ -adic reductive groups. I will discuss the distinction problem for these representations, and also its relation with the local theta correspondence.

Speaker: Lei Zhang

Institute: National University of Singapore

Title: Guess Sum and Converse Theorem

Abstract: In this talk, we will investigate  $n \times 1$  Local Converse Problem on twisted gamma factors over finite and  $p$ -adic fields. After transforming the  $GL(1)$ -twisted gamma factors over  $\mathbb{F}_q$  into Gauss sums, the Local Converse Problem is reduced to a natural question on Gauss sums. By appealing to Gross-Koblitz formula, we are able to establish  $n \times 1$  Local Converse Theorem for  $n \leq 5$ . Moreover, Zhiwei Yun applies the results on

Kloosterman sheaves to establish  $n \times 1$  Local Converse Theorem when  $q$  is sufficiently larger than  $n$ . We propose a conjecture for general  $n$ . This is a joint work with Chufeng Nien.

Speaker: Chengbo Zhu

Institute: National University of Singapore

Title: Orbit method and unipotent representations

Abstract: In this talk, I will describe basic ideas of the orbit method as well as a recent development on the problem of unipotent representations, which is to associate unitary representations to nilpotent coadjoint orbits and which is the hardest part of the orbit method. We solve this problem for real classical groups, by profitably combining analytic ideas of Howe on theta lifting and algebro-geometric ideas of Vogan on associate varieties. This is joint work with J.-J. Ma and B. Sun.

Speaker: Yihang Zhu

Institute: Columbia University

Title: Recent progress in the arithmetic intersection on Rapoport-Zink spaces

Abstract: We will describe joint work with Chao Li on the computation of some arithmetic intersection numbers on Rapoport-Zink spaces, motivated from the Arithmetic Fundamental Lemma.