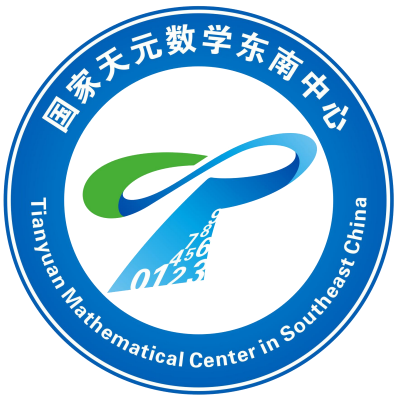
Workshop on Harmonic Analysis and Lie Group Representations



Tianyuan Mathematical Center in Southeast China

School of Mathematical Sciences, Xiamen University

Xiamen, August 04 - 09, 2019

CONTENT

Organizers:

Dihua Jiang (University of Minnesota)

Binyong Sun (Academy of Mathematics and Systems Sciences, Chinese Academy of Sciences)

Genkai Zhang (Chalmers University of Technology)

Yanan Lin (Xiamen University)

Qing Wang (Xiamen University)

Program Coordinator:

Tian Ye (18649928112)

Conference Venue: Laboratory Building 105, Haiyun Campus at Xiamen University

Accommodation: Lujiang Mega (in Chinese: 厦门鹭江•佲家酒店)

(No.382, Longhushan Road, Siming District, Xiamen, 86-592-2199099)

(厦门思明区龙虎山路 382 号，0592-2199099)

Schedule

August 4	All Day	**Check-in**		**Lujiang Mega Hotel**
	16:00-21:00	**Register**		
	18:00-21:30	**Buffet**		
August 5	08:40	**Departure from the Hotel**		
	09:00-09:20	**Chair**	Yanan Lin	
		Opening Ceremony and Group Photo		
	Chair： Shaobin Tan			
	09:20-10:20	Paul Nelson	Applications of the orbit method to the analysis of periods of automorphic forms，I	
	10:20-10:50	**Tea Break**		
	10:50-11:50	Tomasz Przebinda	Resonances of the Laplace-Beltrami operator on a symmetric space of non-compact type and geometry of hyperplane arrangements in a complex sphere	
	12:05, Lunch, Dafengyuan Restaurant（大丰苑）			
	Chair： Binyong Sun			
	15:00-16:00	Simon Marshall	Asymptotics of eigenfunctions on symmetric spaces: analysis and arithmetic , I	
	16:00-16:30	**Tea Break**		
	16:30-17:30	Jing-Song Huang	Generalized Fourier transforms arising from sl(2)-triples and Cartan involutions	
	17:45, Banquet, Dafengyuan Restaurant（大丰苑）			
August 6	**Chair：** Tomasz Przebinda			
	09:00-10:00	Paul Nelson	Applications of the orbit method to the analysis of periods of automorphic forms，II	
	10:00-10:30	**Tea Break**		
	10:30-11:30	Chufeng Nien	Representations of finite Pattern groups and Higman conjecture	
	11:45, Lunch, Dafengyuan Restaurant（大丰苑）			
	Chair： Jing-Song Huang			
	15:00-16:00	Simon Marshall	Asymptotics of eigenfunctions on symmetric spaces: analysis and arithmetic, II	
	16:00-16:30	**Tea Break**		

	16:30-17:30	Dan Barbasch	Unitary representations and Dirac cohomology
	17:45, Dinner, Dafengyuan Restaurant（大丰苑）		
August 7	**Chair：** Dan Barbasch		
	09:00-10:00	Paul Nelson	Applications of the orbit method to the analysis of periods of automorphic forms，III
	10:00-10:30	**Tea Break**	
	10:30-11:30	Simon Marshall	Asymptotics of eigenfunctions on symmetric spaces: analysis and arithmetic, III
	11:45, Lunch, Dafengyuan Restaurant（大丰苑）		
	Afternoon	**Free Discussion**	
	18:00-21:30, Dinner, Lujiang Mega Hotel		
August 8	**Chair：** Paul Nelson		
	09:00-10:00	Zhi Qi	Bessel functions and Beyond Endoscopy
	10:00-10:30	**Tea Break**	
	10:30-11:30	Dongwen Liu	Split Bessel models and test vectors for spinor L-functions of GSp(4,R)
	11:45, Lunch, Dafengyuan Restaurant（大丰苑）		
	Chair： Simon Marshall		
	15:00-16:00	Hang Wang	A K-theoretic Selberg trace formula
	16:00-16:30	**Tea Break**	
	16:30-17:30	Bingchen Lin	Non-vanishing of archimedean local integrals of Friedberg-Jacquet (complex case)
	17:45, Dinner, Dafengyuan Restaurant（大丰苑）		
August 9	**Chair：** Genkai Zhang		
	09:00-10:00	Han Wu	Trace formula via Rankin-Selberg method
	10:00-10:30	**Tea Break**	
	10:30-11:30	Shilin Yu	Deformation quantization of coadjoint orbits
	11:45, Lunch, Dafengyuan Restaurant（大丰苑）		
	Afternoon	**Free Discussion**	

Titles and Abstracts

Unitary representations and Dirac cohomology

Dan Barbasch (Cornell University)

Abstract: The classification of the unitary dual of a real reductive group is a central problem in the representation theory of such groups. The Dirac operator plays an important role in singling out an important subset of the unitary dual. For example, via the index theorem, work of Atiyah and Schmid classify the discrete series which are essential for the Plancherel formula. Unitary representations with nontrivial (g,K)-cohomology play an important role in the theory of automorphic forms. Dirac cohomology (introduced by Vogan) is another invariant which can be viewed as a generalization of (g,K)-cohomology. In this talk I will discuss results about the unitary representations with nontrivial Dirac cohomology.
This is joint work with Chao-Ping-Dong and Daniel Wong.

Generalized Fourier transforms arising from sl(2)-triples and Cartan involutions

Jing-Song Huang (Hong Kong University of Science and Technology)

Abstract: The Fourier transform on the n-dimensional Euclidean space can be identified with an element of the metaplectic group through the oscillator representation. We obtained several families of operators having important properties similar to the Fourier transform via dual pair correspondence. This led us to consider generalized Fourier transforms in more general setting of unitary representations of semisimple Lie groups. These generalized Fourier transforms arise from sl(2)-triples associated with nilpotent coadjoint orbits and Cartan involutions.

Non-vanishing of archimedean local integrals of Friedberg-Jacquet (complex case)

Bingchen Lin (Sichuan University)

Abstract: In a recent work joint with Dihua Jiang and Fangyang Tian, we explicitly constructed a cohomological vector v and established the non-vanishing property of the archimedean local Friedberg-Jacquet integral for GL(2n,R) when evaluating at v. In this talk, we will study the same problem for complex case and give similar results to the real case. The strategy is similar, but there are still some unforeseen difficulties to conquer in our situation. This is a joint work with Fangyang Tian.

Split Bessel models and test vectors for spinor L-functions of GSp(4,R)

Dongwen Liu (Zhejiang University)

Abstract: We consider two families of generic representations of GSp(4,R). We determine the existence of their split Bessel models and find explicit test vectors to evaluate Piatetski-Shapiro’s zeta integrals. We also outline some arithmetic applications. This is a joint work in progress with Bingchen Lin.

Asymptotics of eigenfunctions on symmetric spaces: analysis and arithmetic I, II, III

Simon Marshall (University of Wisconsin–Madison)

Abstract: I will explore the asymptotic behavior of eigenfunctions on symmetric spaces of nonpositive curvature, using tools from analysis and automorphic forms. I will first discuss the conjectural chaotic behavior of these eigenfunctions, including the conjecture of Hejhal-Rackner and the rigorous formulation of Berry's conjecture by Abert-Bergeron-Le Masson. Motivated by these conjectures, I will describe upper bounds for the L^p norms of such eigenfunctions and their restrictions to submanifolds. I will also explain how tools from the theory of automorphic forms can be used to improve these upper bounds, and to show the existence of unexpected concentration phenomena.
Part of my lectures is based on joint work with Farrell Brumley (Paris 13).

Applications of the orbit method to the analysis of periods of automorphic forms I, II, III

Paul Nelson（ETH Zurich）

Abstract: I will discuss joint work with Akshay Venkatesh in which we apply the orbit method, developed in the spirit of microlocal analysis, to study mean values of L-functions attached to period integrals of automorphic forms on Gan--Gross--Prasad pairs.

Representations of finite Pattern groups and Higman conjecture

Chufeng Nien (Hunan Normal University)

Abstract: The talk is about representations of finite pattern groups and Higman conjecture. We give examples of finite pattern groups for which coadjoint orbits parameterizes irreducible representations nicely and check in that cases Higman conjecture holds.

Resonances of the Laplace-Beltrami operator on a symmetric space of non-compact type and geometry of hyperplane arrangements in a complex sphere

Tomasz Przebinda (University of Oklahoma)

Abstract: The resonances, mentioned in the title are poles of a meromorphic extension of the resolvent of the Laplacian, when its domain is restricted from the Hilbert space of the square integrable functions on the symmetric space to the space of compactly supported smooth functions. The corresponding residues yield irreducible admissible spherical representations of the group of the isometries of the symmetric space.

The Helgason Fourier transform provides an expression for the resolvent in terms of an integral over the unit sphere in a real Euclidean space of dimension equal to the rank of the symmetric space. The problem of finding the desired meromorphic extension leads to the problem of deforming that sphere within its complexification while avoiding the hyperplanes defined by the singularities of the Harish-Chandra c-function. (In the classical analysis this is equivalent to the standard procedure of a deforming the contour of integration on the complex plane avoiding a finite number of points.)

The theory of resonances on a symmetric space of non-compact type is far from completion. Even the existence of the resonances is not known in general. We shall explain the underlying geometry in the case when the rank of the symmetric space is 3.

The talk is based on ongoing works with Joachim Hilgert (Universität Paderborn, Germany) and Angela Pasquale (Université de Lorraine ? Metz, France).

Bessel functions and Beyond Endoscopy

Zhi Qi (Zhejiang University)

Abstract: In this talk, I will first introduce the thesis of Akshay Venkatesh on Beyond Endoscopy for Sym^2 L-functions on GL_2 over $\mathbb{Q}$ or a totally real field. The idea follows a suggestion of Peter Sarnak on using the Kuznetsov relative trace formula instead of the Arthur-Selberg trace formula for the Beyond Endoscopy problem. I will then discuss how to generalize Venkatesh's work from totally real to arbitrary number fields. The main supplement is an integral formula for the Fourier transform of Bessel functions over $\mathbb{C}$

A K-theoretic Selberg trace formula

Hang Wang (East China Normal University)

Abstract: The close relationship between index theory and representation theory is a classical theme. In particular, the trace formula has been studied through the lens of index theory by several researchers already. In joint work with Bram Mesland and Haluk Sengun, we take this connection further and obtain a formulation of the trace formula in K-theoretic terms. The central object here is the K-theory groups of the C^*-algebras associated to a semisimple Lie group and its lattice. This work is part of a program which explores the potential role that operator K-theory could play in the theory of automorphic forms.

Trace formula via Rankin-Selberg method

Han Wu (EPFL)

Abstract: In the 80s, Zagier and Jacquet-Zagier initiated an alternative approach to the Selberg trace formula for GL2 via the Rankin-Selberg method. Their derivation was incomplete due to a puzzle. We solve the puzzle and complete their proof. The main tool is an extension of the theory of regularized integrals invented by Zagier, which we developed while solving some subconvexity problems.

Deformation quantization of coadjoint orbits

Shilin Yu（Xiamen University）

Abstract: The coadjoint orbit method/philosophy suggests that irreducible unitary representations of a Lie group can be constructed as quantization of coadjoint orbits of the group. In this talk, I will propose a geometric way to understand orbit method using deformation quantization, in the case of noncompact real reductive Lie groups. This approach combines recent results on quantization of symplectic singularities and Lagrangian subvarieties. This is joint work with Conan Leung.

Participants List

No.	Name	Affiliation
1	Dan Barbasch	Cornell University
2	Jing-Song Huang	Hong Kong University of Science and Technology
3	Bingchen Lin	Sichuan University
4	Dongwen Liu	Zhejiang University
5	Simon Marshall	University of Wisconsin–Madison
6	Paul Nelson	ETH Zurich
7	Chufeng Nien	Hunan Normal University
8	Tomasz Przebinda	University of Oklahoma
9	Zhi Qi	Zhejiang University
10	Hang Wang	East China Normal University
11	Han Wu	EPFL
12	Shilin Yu	Xiamen University
13	Shengmei An	University of Minnesota
14	Yixin Bao	Harbin Institute of Technology, Shenzhen
15	Jinsong Chai	Sun Yat-sen University
16	KeiYuen Chan	Fudan University
17	Man Chen	South China University of Technology
18	Yangyang Chen	Harbin Institute of Technology, Shenzhen
19	JianFeng Dong	Shanghai University
20	Xingya Fan	Xinjiang University
21	Hongyu Jia	Huaqiao University
22	Dihua Jiang	University of Minnesota
23	Dongxing Li	Guangdong University of Finance
24	Haisheng Li	Rutgers University
25	Ning Li	National University of Singapore
26	Xiaocheng Li	University of Wisconsin–Madison
27	Ali Liao	Sichuan University
28	Hengfei Lu	Weizmann Institute of Science

29	Yongzhi Luan	The Hong Kong University of Science and Technology
30	Caihua Luo	Chalmers University of Tech. and Gothenburg Univ.
31	Jiajun Ma	Shanghai Jiao Tong University
32	Xinchen Miao	University of Minnesota
33	Qinghua Pi	Shandong University, Weihai
34	Tianfang Qi	South China University of Technology
35	Simon Robby	Universite de Lorraine
36	Feng Su	Xi’ an Jiaotong-liverpool University
37	Binyong Sun	Chinese Academy of Sciences
38	Fangyan Tian	National University of Singapore
39	Miao Wang	South China University of Technology
40	Chunhui Wang	Wuhan University
41	Daniel Wong	The Chinese University of Hong Kong, Shenzhen
42	Chenyan Wu	The University of Melbourne
43	Wei Xiao	Shenzhen University
44	Huajian Xue	Shantou University
45	Genkai Zhang	Chalmers and Gothenburg University
46	Lei Zhang	National University of Singapore
47	Hongfeng Zhang	Beijing International Center for Mathematical Research
48	Yupei Zhang	The Hong Kong University of Science and Technology
49	Junren Zheng	University of Science and Technology of China
50	Fulin Chen	Xiamen University
51	Jianmin Chen	Xiamen University
52	Ni Du	Xiamen University
53	Yongkun Hong	Xiamen University
54	Yanan Lin	Xiamen University
55	Xiaoling Liao	Xiamen University
56	Lei Luo	Xiamen University
57	Shaobin Tan	Xiamen University
58	Bin Wang	Xiamen University
59	Qing Wang	Xiamen University
60	Nina Yu	Xiamen University

Transportation

Routemap of Hotel, Restaurant and Conference Venue

Map of Haiyun Campus at Xiamen University

Note: You are allowed to enter or exit Xiamen University with your name tag during the conference.

Notebook