Schedule

Shcedule for Conference titled Representation theory, Automorphic forms and Complex geometry II, Celebrating Professor Wilfried Schmid's 80th Birthday, Dec.11-Dec.16, 2023

Monday (December11)		Tuesday (December12)		Wednesday (December13)		Thursday (December14)		Friday (December15)	
Time	**Speaker**	**Time**	**Speaker**	**Time**	**Speaker**	**Time**	**Speaker**	**Time**	**Speaker**
7:30-8:30	*Breakfast (60 minutes)*								
Chair				10:00-11:30	Opening Ceremony of the 10th Anniversary of TSIMF				
9:20	Opening	8:30-9:30	Jorge A. Vargas*			8:30-9:30	Xuhua He	/	/
9:30-10:30	Stephen D. Miller*		Henri Moscovici *			9:30-10:30	Tomoyuki Arakawa	9:30-10:30	Lucas Mason-Brown*
10:00-10:30	*Coffee Break*					10:30-10:50	*Coffee Break*	10:30-11:00	*Coffee Break*
Chair									
11:00-12:00	Dougal Davis	11:00-12:00	Sian Nie			10:50-11:50	Bong Lian	11:00-12:00	Bin Xu
12:00-13:30	*Lunch*			11:30-13:50	Lunch Banquet	12:00-13:30	*Lunch*		
Chair				10th Anniversary Conference		Free Discussion 14:30-18:00 (along Bay Tropical Paradise Forest Park）			
14:40-15:40	Kei Yuen Chan	/	/						
15:40-16:00	*Coffee Break*	15:00-15:30	*Coffee Break*						
Chair									
16:00-17:00	Carlos Simpson*	15:30-16:30	Boris Shapiro						
/	/	16:30-17:30	Joachim Krieger						
17:30	*Dinner*			18:00	*Banquet (10th Anniversary and Prof. Schmid's Birthday Banquet)*	*Dinner*			

Titles and Abstracts

Symplectic singularities and vertex algebras

Tomoyuki Arakawa
Kyoto University/Ningbo University

Symplectic singularities were introduced by Beauville in the beginning of 2000's. Many of such varieties appear in representation theory as well, in particular, their quantizations are often algebras with interesting representation theory. The most famous example is the universal enveloping algebras of semisimple Lie algebras. In this talk, I will explain that the "chiral" quantizations of symplectic singularities also appear in connection with 4 dimensional N=2 supercomformal field theories in physics.

An analogue of Bernstein-Zelevinsky layers for $\mathrm{GL}_n(\mathbb{C})$ and branching laws

Kei Yuen Chan
The University of Hong Kong

Building on works of Arakawa-Suzuki and Ciubotaru-Trapa, we construct an exact functor from the category of $(\mathfrak{g}, K)$-modules of $\mathrm{GL}_n(\mathbb{C})$ to the category of finite-dimensional modules of graded Hecke algebras of type A. We shall explain how to use this functor to obtain an analogue of Bernstein-Zelevinsky layers - a key tool in the representation theory of p-adic general linear groups - for $GL_n(\mathbb{C})$. I shall discuss some work in progress on applications of the functor on branching laws such as the non-tempered Gan-Gross-Prasad problems. This is based on a joint work with Daniel Kayue Wong.

Unitary representations of real groups and localisation theory for Hodge mod- ules

Dougal Davis
University of Melbourne

In a seminal paper from 2011, Kari Vilonen and Wilfried Schmid proposed that the deep theory of mixed Hodge modules can be applied to the old problem of determining the unitary representations of a real reductive Lie group. They conjectured that the unitarity of a representation is completely determined by a canonical filtration, the Hodge filtration, coming from the geometry of the complex flag variety. I will explain a recent paper with Vilonen in which we prove this expectation, along with other remarkable properties of the Hodge filtration. In honour of the occasion, I will focus especially on the great debt our work owes to Schmid's many contributions to both representation theory and Hodge theory.

Towards a Geometric Theory of Characters

Xuhua He
The University of Hong Kong

In the field of representation theory, understanding the behavior of characters has long been a central pursuit. Characters are fundamental objects that encode crucial information about the symmetries inherent in mathematical structures. In this talk, we embark on an exciting journey towards a geometric theory of characters, a captivating framework that reveals hidden connections between algebraic geometry, combinatorics, and the vast landscape of representation theory.
We will begin by exploring the original algebraic definition of characters, focusing on their significance in groups and group algebras. From there, we will delve into Lusztig's theory of character sheaves on $GL_n(\bar{F}_q)$, which serves as a geometric coun- terpart to characters of the finite group $GL_n(F_q)$. This geometric perspective unveils
remarkable connections between algebraic geometry of algebraic groups and their flag variety and the study of characters of finite groups of Lie type. In the end, we will embark on an ongoing project aimed at extending the theory of character sheaves to loop groups.

Lie group actions and dispersive PDE

Joachim Krieger
EPFL

I will survey some recent developments in the theory of dispersive PDE, particularly relating to existence of large global solutions as well as singularity for- mation, and the role that Lie group actions have played therein. Work by myself together with my co-authors S. Miao, W. Schlag, D. Tataru in particular will be touched upon.

Fractional Complete Intersections

Bong Lian
Brandeis University, BIMSA, SIMIS

We will consider a class of (typically) singular Calabi-Yau varieties given by cyclic branched covers of a fixed semi-Fano manifold. The first prototype example goes back to Euler, Gauss and Legendre, who considered 2-fold covers of $\mathbb{P}^1$ branched over 4 points. Two-fold covers of $\mathbb{P}^2$ branched over 6 lines have been studied more recently by many authors, including Matsumoto, Sasaki, Yoshida and others, mainly from the viewpoint of their moduli spaces and their comparisons. I will outline a higher dimensional generalization from the viewpoint of mirror symmetry, and discuss the Riemann-Hilbert problem for periods of these singular varieties. The new insight here is the idea of 'abelian gauge fixing' and 'fractional complete intersections' that leads to a new interpretation of those classical results. The idea further points to a construction of large class of Calabi-Yau mirror pairs. The lecture is based on joint work with S. Hosono, T.-J. Lee, M. Romo, L. Santilli, H. Takagi, S.-T. Yau.

Unipotent representations are unitary

Lucas Mason-Brown
University of Oxford

Let $\Pi(G)$ denote the set of irreducible unitary representations of a semisim- ple Lie group G. A fundamental problem in representation theory is to describe the structure of this set. In previous joint work with Losev and Matvieievskyi, we have defined a class of representations called *rigid unipotent*, which are conjectured to form the building blocks of $\Pi(G)$. Unfortunately, it is not at all clear from their construction that these representations are unitary. In this talk, I will sketch a proof of unitarity. The proof I will present is an application of the program, initiated by Schmid and Vilonen, for studying unitary representations via mixed Hodge modules. This is joint work in progress with Dougal Davis.

Wilfried Schmid's vision of automorphic distributions

Stephen D. Miller
Rutgers University

in the late-1990s Wilfried Schmid showed how boundary value distribu- tions of automorphic forms could be used to prove new results in analytic number theory. His ideas, in particular to apply representation-theoretic tools such as Mackey theory, gave rise to new sources of information about sums of coefficients of automor- phic forms, most notably the Voronoi summation formula for $SL(3, Z)$. They also simplify many other aspects of the theory of automorphic forms. I'll describe joint work with Schmid which, in light of the recent Ph.D. thesis of Doyon Kim, now gives an algebraic-geometric proof of the existence and uniqueness of Whittaker functions for $SL(n, R)$.

Prolate wave operators, Sonin spaces and the zeros of Zeta

Henri Moscovici
Ohio State University

I will talk about two recent developments relating the classical prolate spheroidal operator to the zeros of the Riemann zeta. One of them, which is joint work with A. Connes, uncovers a previously unexplored negative spectrum of a specific selfadjoint extension of the prolate wave operator, concentrated in the associated Sonin space, which has a similar ultraviolet behavior as the zeros of zeta. The other, which is joint work with A. Connes and C. Consani, provides a formalism which allows to extend the prolate wave operator and the Sonin space from the archimedean place to the adelic level of Connes' semilocal trace formula. The latter involves the metaplectic representation of $Mp(2, R)$.

Steinberg's cross-sections and loop Deligne-Lusztig varieties

Sian Nie
Chinese Academy of Science

Loop Deligne-Lusztig varieties (LDLVs for short) were first introduced by Lusztig, whose cohomology are expected to realize interesting reprentations of p-adic groups. For general linear groups, by studing LDLVs of Coxeter type, Boyarchenko, Weinstein, Chan and Ivanov obtained a purely local and geometric realization for a large class of local Langlands and Jaquet-Langlands correspondences. In this talk, we will discuss a generalization of their results to other reductive groups. This is a joint work with Ivanov and Tan. A key ingredient is a loop group version of Steinberg's cross-sections.

On the Waring problem for polynomial rings

Boris Shapiro
Stockholm University

I will show that a generic complex-valued form of degree kd in $n+1$ variables can be represented as a sum of at most k^n k-th powers of forms of degree d. Several related conjectures will be formulated.

A nonabelian Hodge viewpoint on Hecke eigensheaves in the geo- metric Langlands program

Carlos Simpson
CNRS, Université Côte d'Azur

The Donagi-Pantev program aims to give a description, in terms of par- abolic logarithmic Higgs bundles, of the Hecke eigensheaves that come out of the geometric Langlands program. We recall that a representation Λ of the fundamental group of a Riemann surface X, serving as the "eigenvalue", leads to a Hecke eigensheaf on the moduli stack *Bun* of bundles on X. This perverse sheaf involves a representa- tion of the fundamental group of a Zariski open subset of *Bun*, the complement of the "wobbly locus". It is a natural question to look for a geometric understanding of this representation. Following the "electro-magnetic duality" of Kapustin and Witten, and based on their analysis of the classical limit of geometric Langlands, Donagi and Pantev initiated a conjectural program of analyzing this question using the nonabelian Hodge correspondence. One of the main features is that the spectral variety of the parabolic Higgs bundle over *Bun* is identified with the fiber of the Hitchin fibration corresponding to Λ, under the birational equivalence $T^*Bun \sim M_{Higgs}$. Donagi and Pantev treated the case of the projective line minus 5 points. In our current work, we treat the case of rank 2 local systems on a curve of genus 2, using the classical Narasimhan-Ramanan description of *Bun*.
This is joint work with Ron Donagi and Tony Pantev

A duality in branching laws for Discrete Series

Jorge A., Vargas
CIEM-FAMAF, Universidad Nacional de Córdoba

Let $(G, H := (G^{\sigma})_0)$ be a reductive symmetric pair, and let (π, V) denote a H-admissible square integrable representation for G. We fix a maximal compact subgroup $K := G^{\theta}$ of G so that $L := H \cap K$ is a maximal compact subgroup of H. Let $H_0 = (G^{\sigma\theta})_0$ denote the dual subgroup to H. The aim of the exposition is to present the duality formula
$\mathrm{Hom}_H(Y, V_{l_H}) \equiv \mathrm{Hom}_L(Z, \mathbb{H}^2(H_0, \tau))$
Here, (ρ, Y) is a Discrete Series for H. $(\sigma, Z), Z \subset Y$ is the lowest L-type of (ρ, Y). Let $(\tau, W), W \subset V$ denote the lowest K-type of (π, V). We write $\mathrm{res}_L(\tau) = \oplus_i (\sigma_i, Z_i)$ as sum of L-irreducibles. We can show for each σ_i there exists a Discrete Series $H^2(H_0, \sigma_i)$ for H_0 of lowest L-type (σ_i, Z_i). We define $\mathbb{H}^2(H_0, \tau) := \oplus_i H^2(H_0, \sigma_i)$.
The duality formula, in case $H/L \hookrightarrow G/K$ is a holomorphic imbedding has been shown by Kobayashi-Pevzner-Nakahama. We will sketch a new proof of their result as well as the main ingredients and steps for the general case. The proof of the duality formula is based on work of Atiyah-Schmid, W. Schmid, Hecht-Schmid, T. Kobayshi, Duflo-Heckmann-Vergne. This is joint work with Bent Ørsted in Aarhus, Denmark.

Unipotent A-packets for real symplectic and even orthogonal groups

Bin Xu
YMSC, Tsinghua University

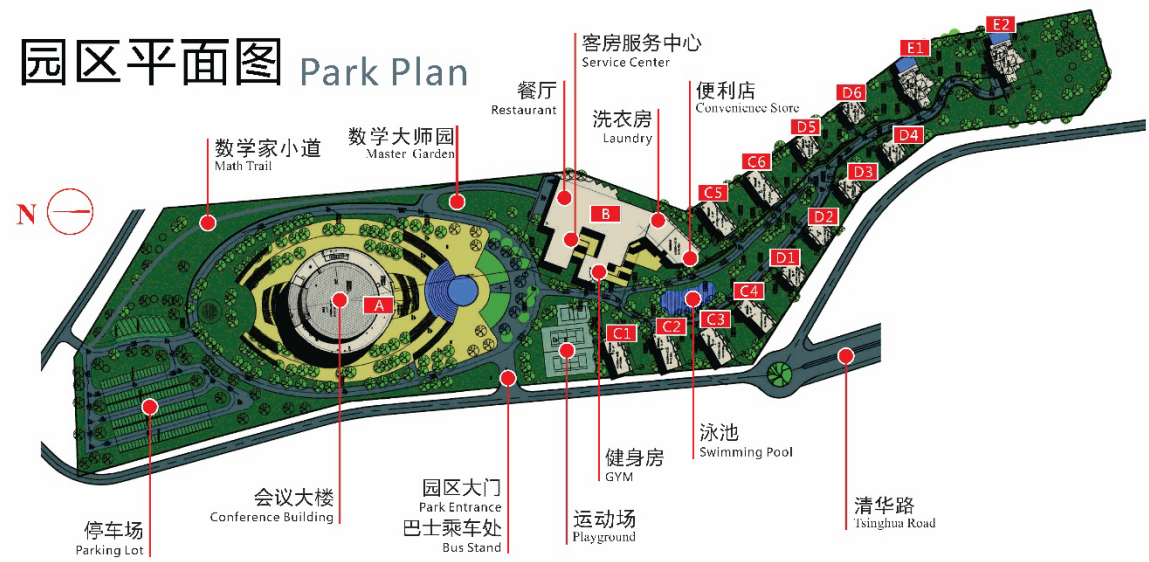
The special unipotent representations of real classical groups have been classified recently by Barbasch-Ma-Sun-Zhu in a series of works. In this talk we wil explain how to obtain the A-packets of these representations in the case of symplectic and even orthogonal groups. This is a joint work with Taiwang Deng, Chang Huang and Binyong Sun.

Welcome to TSIMF

The facilities of TSIMF are built on a 23-acre land surrounded by pristine environment at Phoenix Hill of Phoenix Township. The total square footage of all the facilities is over 29,000 square meter that includes state-of-the-art conference facilities (over 10,000 square meter) to hold many international workshops simultaneously, two reading rooms of library, a guest house (over 10,000 square meter) and the associated catering facilities, a large swimming pool, gym and sports court and other recreational facilities.

Management Center of Tsinghua Sanya International Forum is responsible for the construction, operation, management and service of TSIMF. The mission of TSIMF is to become a base for scientific innovations, and for nurturing of innovative human resource; through the interaction between leading mathematicians and core research groups in pure mathematics, applied mathematics, statistics, theoretical physics, applied physics, theoretical biology and other relating disciplines, TSIMF will provide a platform for exploring new directions, developing new methods, nurturing mathematical talents, and working to raise the level of mathematical research in China.

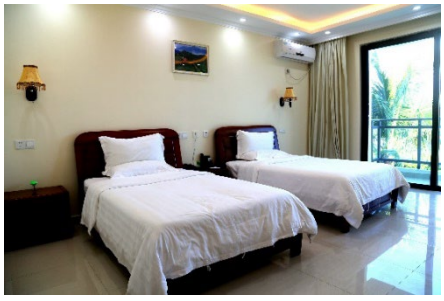
About Facilities



Registration

Conference booklets, room keys and name badges for all participants will be distributed at the front desk. Please take good care of your name badge. It is also your meal card and entrance ticket for all events.

Guest Room



All the rooms are equipped with: free Wi-Fi (no password), TV, air conditioning and other utilities.

Family rooms are also equipped with kitchen and refrigerator.

Library

Opening Hours: 09:00am-22:00pm

TSIMF library is available during the conference and can be accessed by using your room card. There is no need to sign out books but we ask that you kindly return any borrowed books to the book cart in library before your departure.

In order to give readers a better understanding of the contributions made by the Fields Medalists, the library of Tsinghua Sanya International Mathematics Forum (TSIMF) instituted the Special Collection of Fields Medalists as permanent collection of the library to serve the mathematical researchers and readers.
So far, there are 234 books from 47 authors in the Special Collection of Fields Medalists of TSIMF library. They are on display in room A220. The participants are welcome to visit.

Restaurant

All the meals are provided in the restaurant (Building B1) according to the time schedule.

Breakfast	07:30-08:30
Lunch	12:00-13:30
Dinner	17:30-19:00

Laundry

Opening Hours: 24 hours

The self-service laundry room is located in the Building 1 (B1).

Gym

The gym is located in the Building 1 (B1), opposite to the reception hall. The gym provides various fitness equipment, as well as pool tables, tennis tables etc.

Playground

Playground is located on the east of the central gate. There you can play basketball, tennis and badminton. Meanwhile, you can borrow table tennis, basketball, tennis balls and badminton at the reception desk.

Swimming Pool

Please note that there are no lifeguards. We will not be responsible for any accidents or injuries. In case of any injury or any other emergency, please call the reception hall at +86-898-38882828.

Outside Shuttle Service

We have shuttle bus to take participants to the airport for your departure service. Also, we would provide transportation at the Haihong Square （海虹广场） of Howard Johnson for the participants who will stay outside TSIMF. If you have any questions about transportation arrangement, please feel free to contact Ms. Li Ye (叶莉)at (0086)139-7679-8300.

Free Shuttle Bus Service at TSIMF

We provide free shuttle bus for participants and you are always welcome to take our shuttle bus, all you need to do is wave your hands to stop the bus.

Destinations: Conference Building, Reception Room, Restaurant, Swimming Pool, Hotel etc.

Contact Information of Administration Staff

Location of Conference Affairs Office: *Room 104, Building A*
Tel: 0086-898-38263896

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