

# Representation Theory Workshop 2019

**Date:** Wed 21- Thurs 22 Aug 2019

**Time & Venue:**

Wed 21 Aug, 9:30am – 5:40pm @ S17-04-04

Thurs 22 Aug, 9:30am – 12:00pm @ S17-04-06

**Organisers:**

Gan Wee Teck (NUS)

Zhang Lei (NUS)

**SPEAKERS**

*Huanchen Bao (NUS)*

*Valentin Buciumas (UQ)*

*Yao Cheng (Sinica)*

*Chaoping Dong (SNU)*

*Kazuki Morimoto (Kobe)*

*Xiaolei Wan (NUS)*



Department of Mathematics  
Faculty of Science

# Programme

## Wed 21 Aug (@ S17-04-04)

- 09:30am – 10:30am     **Dirac cohomology and unitary representations**  
*Dong Chaoping*  
*Shanghai Normal University*
- 10:30am – 10:50am     Break
- 10:50am – 11:50am     **Relative character identities and theta correspondence**  
*Wan Xiaolei*  
*National University of Singapore*
- 11:50am – 2:00pm     Lunch
- 3:00pm – 3:30pm     Coffee Break @ Mathematics Department Lounge
- 3:30pm – 4:30pm     **On Gan-Gross-Prasad conjecture for  $(U(2n), U(1))$**   
*Kazuki Morimoto*  
*Kobe University*
- 4:30pm – 4:40pm     Break
- 4:40pm – 5:40pm     **Gamma factors for Asai Representations of  $GL(2)$**   
*Yao Cheng*  
*Institute of Mathematics Academia Sinica*

## Thurs 22 Aug (@ S17-04-06)

- 9:30am – 10:30am     **A bridge between p-adic and quantum group representations via Whittaker coinvariants**  
*Valentin Buciumas*  
*The University of Queensland*
- 10:30am – 10:50am     Break
- 10:50am – 11:50am     **The amplituhedron**  
*Bao Huanchen*  
*National University of Singapore*
- 6:00pm     Dinner (for workshop speakers and invited guests only)

# Abstract

## **Dirac cohomology and unitary representations**

***Dong Chaoping, Shanghai Normal University***

Dirac cohomology was a notion introduced by David Vogan in three MIT Lie group seminars in 1997. After the verification of the Vogan conjecture by Huang and Pandzic in 2002, it became a new invariant of Lie group representations. It also has natural connections with unitary representations. This talk aims to report our works on Dirac cohomology over these years. In particular, we will mention some recent progress (joint with Dan Barbasch and Daniel Wong) and its potential link with number theory.

## **Relative character identities and theta correspondence**

***Wan Xiaolei, National University of Singapore***

The main conclusion of this talk is that the theory of transfer developed by Sakellaridis can be very efficiently developed using the theta correspondence. In this talk, we focus on  $(N, \psi) \backslash SL_2$  and  $O_{n-1} \backslash O_n$ . And we give a conceptual definition of the transfer, then show the relative character identities under the transfer. We then express the transfer in geometric terms, which agrees with the formula given by Sakellaridis. Finally, We establish a decomposition of global period as product of local functionals.

## **On Gan-Gross-Prasad conjecture for $(U(2n), U(1))$**

***Kazuki Morimoto, Kobe University***

Gan, Gross and Prasad proposed a conjecture on a relationship between non-vanishing of certain period of automorphic forms and non-vanishing of central values of certain tensor product L-functions. In this talk, we show this conjecture in the case of  $(U(2n), U(1))$ . If time permits, we explain our result on refined Gan-Gross-Prasad conjecture.

## **Gamma factors for Asai Representations of $GL(2)$**

**Yao Cheng, *Institute of Mathematics Academia Sinica***

Let  $F$  be a local field of characteristic zero and let  $E$  be a semi-simple  $F$ -algebra of rank 2. Let  $\pi$  (resp.  $\tau$ ) be an irreducible smooth representation of  $GL_2(E)$  (resp.  $GL_n(F)$  with  $n = 1, 2$ ). Assume that  $\pi$  and  $\tau$  (if  $n = 2$ ) are generic. Denote by  $As(\pi)$  the Asai transfer of  $\pi$  to an irreducible admissible representation of  $GL_4(F)$ . Fix a non-trivial additive character of  $F$ . One can define the L-factors and the  $\varepsilon$ -factors for  $As(\pi) \otimes \tau$  from the Galois theoretic side (via the Weil-Deligne group) as well as from the analytic side (via certain local zeta integrals). It's natural and important to ask whether these two definitions agree. We show that the L-factors are the same. The  $\varepsilon$ -factors, on the other hand, might be different. We instead give an explicit relation between the  $\varepsilon$ -factors. This is a joint work with Shih-Yu Chen and Isao Ishikawa.

## **A bridge between p-adic and quantum group representations via Whittaker coinvariants**

**Valentin Buciumas, *The University of Queensland***

Unramified principal series representations of p-adic  $GL(r)$  and its metaplectic covers are important in the theory of automorphic forms. I will present a method of endowing the Whittaker coinvariants of such a representation with the structure of a quantum affine  $gl_n$  module (where  $n$  is the degree of the metaplectic cover). If time permits I will explain a version of this result for the symplectic group  $Sp(2r)$  (which involves coideal subalgebras) and a conjecture relating representations of p-adic and quantum groups via a Schur-Weyl duality.

## **The amplituhedron**

**Bao Huan Chen, *National University of Singapore***

An amplituhedron (defined in terms of totally nonnegative Grassmannians) is a geometric structure introduced in 2013 by two physicists Nima Arkani-Hamed and Jaroslav Trnka. It enables simplified calculation of particle interactions in some quantum field theories. In this talk, I will give an introduction of the subject (from a mathematical point of view). This is based on work in progress with Xuhua He.