

14w5001: The Future of Trace Formulas

June 1-6, 2014

MEALS

*Breakfast (Buffet): 7:00-9:30 am, Sally Borden Building, Monday-Friday

*Lunch (Buffet): 11:30 am-1:30 pm, Sally Borden Building, Monday-Friday

*Dinner (Buffet): 5:30-7:30 pm, Sally Borden Building, Sunday-Thursday

Coffee Breaks: As per daily schedule, in the foyer of the TransCanada Pipeline Pavilion (TCPL)

***Please remember to scan your meal card at the host/hostess station in the dining room for each meal.**

MEETING ROOMS

All lectures will be held in the lecture theater in the TransCanada Pipelines Pavilion (TCPL). An LCD projector, a laptop, a document camera, and blackboards are available for presentations.

The schedule consists of 90-minute "presentation" talks and 60-minute "current research" talks.

SCHEDULE

Sunday

- 16:00 Check-in begins (Front Desk - Professional Development Centre - open 24 hours)
17:30-19:30 Buffet Dinner, Sally Borden Building
20:00 Informal gathering in 2nd floor lounge, Corbett Hall
Beverages and a small assortment of snacks are available on a cash honor system.

Monday

- 7:00-8:45 Breakfast
8:45-9:00 Introduction and Welcome by BIRS Station Manager, TCPL
9:00-10:30 **James Arthur**, On the stable trace formula.
10:30-11:00 Coffee Break
11:00-12:00 **Pierre-Henri Chaudouard**, On the unipotent contributions of the trace formula for $GL(n)$.
12:00 Group Photo; meet in foyer of TCPL.
12:00-13:30 Lunch
13:30-15:00 **P. Edward Herman**, Overview of Beyond Endoscopy.
15:00-15:30 Coffee Break
15:30-16:30 **Wei Zhang**, Arithmetic fundamental lemma and transfer.

Tuesday

- 7:00-9:00 Breakfast
9:00-10:30 **Ngô Bao Châu**, Automorphic L -functions and monoids.
10:30-11:00 Coffee Break
11:00-12:00 **Jean-Loup Waldspurger**, Stabilization of the twisted trace formula.
12:00-13:30 Lunch
13:00-14:00 Guided Tour of The Banff Centre; meet in the 2nd floor lounge, Corbett Hall
14:00-15:00 **Colette Moeglin**, Stabilization of the twisted trace formula.
15:00-15:30 Coffee Break
15:30-16:30 **Wen-Wei Li**, Godement-Jacquet theory revisited.
17:30-19:30 Dinner

Wednesday

7:00-9:00	Breakfast
9:00-10:30	Omer Offen , The relative trace formula and periods of automorphic forms.
10:30-11:00	Coffee Break
11:00-12:30	Tasho Kaletha , Rigidification of inner forms and the structure of L -packets.
12:30-13:30	Lunch
	Free afternoon
17:30-19:30	Dinner

Thursday

7:00-9:00	Breakfast
9:00-10:00	Ali Altug , Analytic Number Theory and The Trace Formula.
10:00-10:30	Coffee Break
10:30-11:30	Shunsuke Yamana , Periods of residual automorphic forms.
11:30-13:30	Lunch
13:30-14:30	Shuyang Cheng , Trace formula for Lie algebras and Poisson summation formula for the Harish-Chandra transform.
14:30-15:00	Coffee Break
15:00-16:00	Clifton Cunningham , Progress toward the geometrization of admissible distributions on p -adic groups.
17:30-19:30	Dinner

Friday

9:00-10:00	Informal discussion or unscheduled talk
10:00-10:30	Coffee Break
10:30-11:30	Informal discussion or unscheduled talk
11:30-13:30	Lunch
Checkout by 12 noon.	

** 5-day workshop participants are welcome to use BIRS facilities (BIRS Coffee Lounge, TCPL and Reading Room) until 3 pm on Friday, although participants are still required to checkout of the guest rooms by 12 noon. **

14w5001: The Future of Trace Formulas
June 1-6, 2014

ABSTRACTS

Speaker: **James Arthur** (University of Toronto)

Title: *On the stable trace formula.*

Abstract: We shall discuss the stable trace formula, and its applications to the theory of endoscopy. If time permits, we will also discuss its possible role in Langlands' proposed theory of Beyond Endoscopy.

Speaker: **Pierre-Henri Chaudouard** (IMJ-PRG Université Paris 7-Denis Diderot)

Title: *On the unipotent contributions of the trace formula for $GL(n)$.*

Abstract: The elliptic and weighted orbital integrals are the regular semi-simple terms of the geometric part of the trace formula. The other geometric contributions are not so explicit. For many reasons, it would be useful to have a more explicit form of the trace formula. In this talk, we will introduce global weighted unipotent orbital integrals attached to certain unipotent orbits. We will also discuss the contributions of "regular by blocks" orbits. If time permits, we will give some conjectures and applications.

Speaker: **P. Edward Herman** (University of Chicago)

Title: *Overview of Beyond Endoscopy.*

Abstract: TBA

Speaker: **Wei Zhang** (Columbia University)

Title: *Arithmetic fundamental lemma and transfer.*

Abstract: In the first half of the talk I will explain the motivation of the problem which leads to an arithmetic fundamental lemma. In the second half I will report a joint work with Rapoport and Smithling, on an arithmetic transfer problem for a Rapoport-Zink space with exotic good reduction, associated to a special parahoric level structure of a tamely ramified unitary group.

Speaker: **Ngô Bao Châu** (University of Chicago)

Title: *Automorphic L-functions and monoids*

Abstract: There is a natural class of equivariant embedding of reductive group attached to irreducible representations of its dual group. The geometry of the space of formal arcs on this monoid seems to be closely related to the local factor of the corresponding automorphic L-function. We will also discuss the global moduli space built upon this monoid.

Speaker: **Jean-Loup Waldspurger** (Institut de Mathématiques de Jussieu)

Title: *Stabilization of the twisted trace formula.*

Abstract: Consider a twisted space \tilde{G} over a number field. Fix a stable conjugacy class in the set of semi-simple elements of $\tilde{G}(F)$. The principal part of the geometric side of the twisted trace formula is a sum of orbital integrals relative to elements $\gamma \in \tilde{G}(F)$. We consider the partial sum relative to the γ whose semi-simple parts belong to the fixed stable conjugacy class. It is a distribution. For almost all stable conjugacy class, we can stabilize it by induction. Arthur calls this method "global descent". I will explain it in our twisted situation.

Speaker: **Colette Moeglin** (Institut de Mathématiques de Jussieu)

Title: *Stabilization of the twisted trace formula*

Abstract: I will recall the general structure of the stabilization of the spectral side of the twisted trace formula; this is very similar to Arthur's proof of the untwisted case. And I will try to keep time to give an

idea of the proof of the stabilization of the local twisted weighted orbital integrals, which is a key point to finish the proof.

Speaker: **Wen-Wei Li** (Chinese Academy of Sciences)

Title: *Godement-Jacquet theory revisited*

Abstract: Thanks to the works of Godement, Jacquet et al., the analytic properties of the standard L-functions are relatively well-understood. How about the other L-functions? Braverman and Kazhdan gave audacious conjectures in this direction, whose importance has been reiterated in the recent works of L. Lafforgue and Sakellaridis. I will try to sketch some aspects and partial results of this program.

Speaker: **Omer Offen** (Technion)

Title: *The relative trace formula and periods of automorphic forms*

Abstract: I will explain the formalism of the relative trace formula (RTF) and the way it was successfully applied to study period integrals of automorphic forms. We will discuss Jacquet's approach to the results of Waldspurger on toric periods for $GL(2)$ and more recent applications of the RTF.

Speaker: **Tasho Kaletha** (Princeton University)

Title: *Rigidification of inner forms and the structure of L-packets.*

Abstract: The basic version of the local Langlands conjecture predicts a correspondence between Langlands parameters and packets of representations of a given reductive group G defined over a local field F . The more refined version enhances the space of parameters by including representations of certain finite groups and then predicts a correspondence between enhanced parameters and individual representations of G . This refinement is needed in many application, one example being the multiplicity formula for discrete automorphic representations. While the basic version is easy to state for any G , a precise statement of the refined version was not known for general reductive groups over p -adic fields (including classical groups like special linear, symplectic, and special orthogonal groups over division algebras).

In this talk, we will begin with an introduction to the problem of refining the basic version of the local Langlands correspondence and discuss its applications. We will then give an overview of the different approaches to the problem and their evolution, including Vogans concept of pure inner forms, Kottwitzs theory of isocrystals with additional structure, the relationship between these and and the stabilization of the spectral side of the trace formula, and the limitations of these methods. We will then conclude with the description of a new approach, which is in some sense a natural development of the earlier approaches, but which overcomes their limitations. It relies on the construction of a canonical gerb over the Galois group of any local field of characteristic zero. Over the real numbers, this approach recovers (rather surprisingly) the notion of "strong real forms" from the book of Adams-Barbasch-Vogan. Over the p -adic numbers, it allows one to describe the internal structure of L -packets on arbitrary reductive groups. Finally, we will discuss work in progress that ties these local results with questions about automorphic representations and their multiplicity in the discrete spectrum of a reductive group over a global field.

Speaker: **Ali Altug** (Columbia University)

Title: *Analytic Number Theory and The Trace Formula.*

Abstract: I will discuss a recent project aiming to incorporate (some of the) machinery of analytic number theory into the trace formula (for now $GL(2)$ only), which is aimed at obtaining a formula that is suitable for studying analytic properties (sizes, distributions, averages, etc.) of Hecke eigenvalues. I will also talk about some applications, mainly to Langlands "Beyond Endoscopy" which this research is primarily aimed at.

Speaker: **Shunsuke Yamana** (Kyushu University)

Title: *Periods of residual automorphic forms.*

Abstract: I will discuss periods of automorphic forms by giving as many examples as possible. Though we do not use trace formula, the technique, developed to compute periods of noncuspidal automorphic

forms, uses mixed truncation, a relative variant of Arthur's truncation, discovered by Jacquet, Lapid, Rogawski.

Speaker: **Shuyang Cheng** (University of Chicago)

Title: *Trace formula for Lie algebras and Poisson summation formula for the Harish-Chandra transform.*

Abstract: The Harish-Chandra transform is a linear transformation on the space of orbital integrals on a reductive Lie algebra \mathfrak{g} , defined by the action of the usual Fourier transform on \mathfrak{g} . In the case of general linear groups this could be thought of as an integral transform defined on the space of characteristic polynomials. It satisfies a number of interesting properties analogous to the Fourier transform, of particular interest is a version of the Poisson summation formula, which is derived from the Lie algebra version of the global trace formula.

Speaker: **Clifton Cunningham** (University of Calgary)

Title: *Progress toward the geometrization of admissible distributions on p -adic groups.*

Abstract: In this talk I will describe recent work with David Roe giving a complete description of quasi-characters of p -adic tori in terms of local systems on group schemes over finite fields and, using results from Takashi Suzuki, explain the relation to the class field theory of Serre and Hazewinkel. I will also report on ongoing work with Roe and Suzuki on an adaptation of the theory of character sheaves to p -adic fields and resulting constructions of supercuspidal representations of p -adic groups.

ORGANIZERS:

Wee Teck Gan (National University of Singapore)

Chung Pang Mok (McMaster University)

Yiannis Sakellaridis (Rutgers University - Newark)

Shuichiro Takeda (University of Missouri)