

Whittaker Functions: Number Theory, Geometry, and Physics

October 13–18, 2013

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.

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 (if desired)
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
9:00–10:00 Daniel Bump (Stanford) *Whittaker functions and quantum groups*
10:00–10:15 Coffee Break, TCPL
10:15–11:00 Sol Friedberg (Boston College) *Metaplectic Whittaker functions*
11:00–11:30 Dan Orr (Virginia Tech), *Specializations of nonsymmetric Macdonald polynomials at infinity*
11:30–13:30 Lunch
13:30–13:50 Anna Puskás (Columbia), *Sums of metaplectic Demazure-Lusztig Operators and crystals*
14:00–14:45 Dan Ciubotaru (Utah), *Classification of generic unitary irreducible representations*
14:45–15:00 Coffee Break, TCPL
15:00–16:00 Nicolas Templier (Princeton), *Singularities and large values of Whittaker functions*
16:00–17:30 Afternoon Work Sessions
17:30–19:30 Dinner

Tuesday

7:00–9:00	Breakfast
9:00–10:00	Reda Chhaibi (Universität Zürich), <i>Archimedean Whittaker functions and geometric crystals</i>
10:00–10:15	Coffee Break
10:15–11:00	Manish Patnaik (Alberta), <i>Eisenstein series on loop groups</i>
11:05–11:25	Holley Friedlander (Williams), <i>On the formulas of Tokuyama and Gindikin-Karpelevich for G_2</i>
11:30–12:30	Lunch
12:30–13:30	Guided Tour of The Banff Centre; meet in the 2nd floor lounge, Corbett Hall
13:30	Group Photo; meet in foyer of TCPL (photograph outdoors; jacket might be required)
13:45–14:30	Kyu-Hwan Lee (UConn) <i>Eisenstein series on rank 2 hyperbolic Kac-Moody groups</i>
14:30–14:45	Coffee Break, TCPL
14:45–15:30	Axel Kleinschmidt (Max-Planck-Institut für Gravitationsphysik), <i>Whittaker vectors and constant terms for Kac-Moody groups</i>
15:45–16:30	Shuichiro Takeda (Missouri), <i>Metaplectic tensor product</i>
16:30–17:30	Afternoon Work Sessions
17:30–19:30	Dinner

Wednesday

7:00–9:00	Breakfast
9:00–9:45	Cristian Lenart (State University of New York at Albany and Max-Planck-Institut für Mathematik) <i>Specialized Macdonald polynomials, quantum K-theory, and Kirillov-Reshetikhin crystals</i>
9:50–10:10	Elizabeth Beazley (Haverford), <i>The alcove path model and matrix coefficients</i>
10:15–10:30	Coffee Break, TCPL
10:30–11:15	Anne Schilling (UC Davis), <i>Weak crystal operators</i>
11:20–11:40	Ben Salisbury (Central Michigan) <i>Combinatorics of the Casselman-Shalika formula in type A</i>
11:45–13:30	Lunch Free Afternoon
17:30–19:30	Dinner

Thursday

7:00–9:00	Breakfast
9:00–10:00	Yumiko Hironaka (Waseda) <i>Spherical function on certain p-adic homogeneous spaces</i>
10:00–10:15	Coffee Break, TCPL
10:15–11:00	Ian Whitehead (Columbia) <i>Constructing affine Weyl group multiple Dirichlet series</i>
11:15–12:00	P. Edward Herman (Chicago), <i>On Patterson's conjecture: sums of quartic exponential sums</i>
12:00–13:30	Lunch
13:45–14:30	Andre Reznikov (Bar-Ilan), <i>Adelic action on periods of automorphic functions and special values of L-functions</i>
14:30–15:00	Coffee Break, TCPL
15:00–15:45	Maki Nakasuji (Sophia), <i>Casselman's basis and Schubert calculus – from computational evidence</i>
16:00–17:30	Afternoon Work Session
17:30–19:30	Dinner

Friday

7:00–9:00	Breakfast
9:00–10:00	Morning Work Session I
10:00–10:30	Coffee Break, TCPL
10:30–11:30	Morning Work Session II
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 Friday, though participants are still required to checkout of guest rooms by 12 noon. **

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ABSTRACTS

(in alphabetic order by speaker surname)

Speaker: **Elizabeth Beazley** (Haverford)

Title: *The alcove path model and matrix coefficients*

Abstract: In the representation theory of reductive groups over a nonarchimedean local field, spherical and Whittaker functions can be expressed via Tokuyama's formula as sums over Gelfand-Tsetlin patterns, or equivalently as integrals over crystals. The crystals appearing in such matrix coefficients can also be realized as (generalized) Mirkovic-Vilonen cycles, which are naturally indexed by the positively folded alcove walks originally defined by Gaussent-Littelmann and generalized by Parkinson-Ram-Schwer. In this talk, we discuss joint work with Ben Brubaker in which we compute matrix coefficients for spherical functions using the combinatorics of alcove walks. Preliminary data shows that we bijectively recover Tokuyama's formula.

Speaker: **Daniel Bump** (Stanford)

Title: *Whittaker Functions and Quantum Groups*

Abstract: We will discuss a relationship between nonarchimedean Whittaker functions and quantum groups. The talk will begin with some exposition of older work by Brubaker, Bump, Friedberg, Chinta and Gunnells on the representation of Whittaker functions by solvable lattice models, followed by a discussion of the how the Yang-Baxter equation was used by Drinfeld and by Faddeev, Reshetikhin and Takhtajan to construct (dual) quasitriangular Hopf algebras, or quantum groups. Variants of this construction by Cotta-Ramusino, Lambe and Rinaldi and by Buciumas are applicable to the case in question.

Speaker: **Reda Chhaibi** (Universität Zürich)

Title: *Archimedean Whittaker functions and geometric crystals*

Abstract:

Speaker: **Dan Ciubotaru** (Utah)

Title: *Classification of generic unitary irreducible representations*

Abstract: Joint work Barbasch on a classification of all generic (Whittaker) unitary irreducible representations with Iwahori fixed vectors for a quasi-split simple p-adic group.

Speaker: **Solomon Friedberg** (Boston College)

Title: *Metaplectic Whittaker functions*

Abstract: I discuss relations between the Whittaker coefficients of metaplectic Eisenstein series and crystal graphs. For types B and C this is recent joint work with Lei Zhang.

Speaker: **Holley Friedlander** (Williams)

Title: *On the formulas of Tokuyama and Gindikin-Karpelevich for G_2*

Abstract: In 1988 Tokuyama proved a deformation of the Weyl character formula for GL_n using Gelfand-Tsetlin patterns. In this talk, we present a conjecture giving an analogous formula for the root system G_2 via BZL patterns. As evidence for our conjecture, we show that our formula exhibits the Gindikin-Karpelevich integral as a sum over the crystal $B(\infty)$, in the spirit of Bump-Nakasuji and McNamara.

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

Title: *On Patterson's Conjecture: Sums of Quartic Exponential Sums*

Abstract:

Speaker: **Yumiko Hironaka** (Waseda)

Title: *Spherical functions on certain p -adic homogeneous spaces*

Abstract: First I want to introduce a typical spherical function on certain p -adic homogeneous space (e. g. weak spherical homogeneous satisfying some technical conditions), and give its expression formula by using data for spherical functions of groups and functional equations). Then I want to discuss some specific spaces and give explicit formulas by using specialized Macdonald polynomials associated to root system. For the space of unramified hermitian matrices or unitary hermitian matrices, we may give parametrization of all the spherical functions and Plancherel formula on the Schwartz space.

Speaker: **Axel Kleinschmidt** (Max-Planck-Institut für Gravitationsphysik)

Title: *Whittaker vectors and constant terms for Kac-Moody groups*

Abstract:

Speaker: **Kyu-Hwan Lee** (University of Connecticut)

Title: *Eisenstein series on rank 2 hyperbolic Kac-Moody groups*

Abstract: We define Eisenstein series on rank 2 hyperbolic Kac-Moody groups over \mathbb{R} , induced from quasi-characters. We prove convergence of the constant term and hence the almost everywhere convergence of the Eisenstein series. We define and calculate the degenerate Fourier coefficients. We also consider Eisenstein series induced from cusp forms and show that these are entire functions. This is a joint work with Lisa Carbone and Dongwen Liu.

Speaker: **Cristian Lenart** (State University of New York at Albany and Max-Planck-Institut für Mathematik)

Title: *Specialized Macdonald polynomials, quantum K -theory, and Kirillov-Reshetikhin crystals*

Abstract: Braverman and Finkelberg related the specialized symmetric Macdonald polynomials $P_\lambda(x; q, t = 0)$ to the quantum K -theory $QK(G/B)$ of flag varieties (more precisely, to the K -theoretic J -functions) via their q -Whittaker functions. In this talk, I discuss the combinatorics underlying this connection and its ramifications. On the one hand, by the Ram-Yip formula, $P_\lambda(x; q, 0)$ is expressed in terms of the so-called quantum alcove model, which I developed with A. Lubovsky. On the other hand, with A. Postnikov, we conjectured that the Chevalley multiplication formula in $QK(G/B)$ is expressed in terms of the same model; some evidence will be discussed. Furthermore, with S. Naito, D. Sagaki, A. Schilling, and M. Shimozono, we proved that the quantum alcove model is also a uniform model, in all untwisted affine types, for tensor products of one-column Kirillov-Reshetikhin crystals.

Speaker: **Dan Orr** (Virginia Tech)

Title: *Specializations of nonsymmetric Macdonald polynomials at infinity*

Abstract: We present alcove path formulas for specializations of nonsymmetric Macdonald polynomials at $q = \infty$ and at $t = \infty$. At $q = \infty$, these polynomials were shown recently by Brubaker, Bump, and Licata to coincide with certain p -adic Iwahori-Whittaker functions, while at $t = \infty$ they are conjecturally related to the PBW filtration of level-one affine Demazure modules. This talk is based on joint work with M. Shimozono.

Speaker: **Manish Patnaik** (Alberta)

Title: *Eisenstein series on loop groups*

Abstract:

Speaker: **Anna Puskás** (Columbia)

Title: *Sums of metaplectic Demazure-Lusztig Operators and crystals*

Abstract:

Speaker: **Andre Reznikov** (Bar-Ilan)

Title: *Adelic action on periods of automorphic functions and special values of L -functions*

Abstract: We are interested in invariant functionals defined on automorphic representations via period integrals. We consider the action of an adelic subgroup on such an invariant functional. We show that in certain cases this action gives rise to another period integral, and this corresponds to a known relation of an automorphic period to a special value of an appropriate L -function (that is classical formulas of Hecke-Jacquet-Langlands and of Waldspurger among others). However, even in some of the simplest cases, we find that the relation to L -functions is more puzzling. Namely, the construction leads to a non-standard Euler product which nevertheless could be regularized by an appropriate L -function. This is joint work with J. Bernstein.

Speaker: **Ben Salisbury** (Central Michigan University)

Title: *Combinatorics of the Casselman-Shalika formula in type A*

Abstract: The Casselman-Shalika formula evaluates the spherical Whittaker function in terms of a Weyl character. In recent years, Brubaker-Bump-Friedberg, Bump-Nakasuji, and others have interpreted this formula as a sum over a crystal graph, to which each vertex is attached a polynomial determined by data embedded in the graph. In this talk, we will discuss how the tableaux realization of the crystal encodes this same data in a local way; i.e., without the graph structure.

Speaker: **Anne Schilling** (UC Davis)

Title: *Weak crystal operators*

Abstract: Weak crystal operators are crystal operators on the weak order of the affine symmetric group and relate to the combinatorics of cores and k -Schur functions. k -Schur functions play an important role in Macdonald theory. In particular, we can give new combinatorial formulas for Gromov-Witten invariants and fusion coefficients by determining the highest weight elements under the new crystal operators (in the limit $k \rightarrow \infty$ one obtains the usual crystal structure). This is joint work with Jennifer Morse.

Speaker: **Shuichiro Takeda** (Missouri)

Title: *Metaplectic tensor product*

Abstract: The notion of the metaplectic tensor product of irreducible admissible representations of the covering group \widetilde{GL}_r of Kazhdan-Patterson over the local field has been developed by P. Mezo. In this talk, we will give the analogous contraction of automorphic representations of the covering group over the adèles. This metaplectic tensor product of automorphic representations is compatible with the local metaplectic tensor product of Mezo and satisfies various expected properties.

Speaker: **Nicolas Templier** (Princeton)

Title: *Singularities and large values of Whittaker functions*

Abstract:

Speaker: **Ian Whitehead** (Columbia)

Title: *Constructing affine Weyl group multiple Dirichlet series*

Abstract: I will describe the construction of a multiple Dirichlet series whose group of functional equations is the infinite affine Weyl group \tilde{A}_3 , and which is uniquely determined by certain axioms. This is part of a project of constructing function field multiple Dirichlet series for all affine Weyl groups. The presentation will include some background on Weyl group multiple Dirichlet series and the Eisenstein conjecture, as well as a number-theoretic application.