Groups over local fields and their representations
(Org: **Paul Mezo** (Carleton University) and/et **Monica Nevins** (University of Ottawa))

NICOLAS ARANCIBIA-ROBERT, Cergy Paris Université
Computing micro-local packets for real G_2

In the early 1990s, Jeffrey Adams, Dan Barbasch, and David Vogan introduced the notion of *micro-packets* in their book *The Langlands Classification and Irreducible Characters for Real Reductive Groups*. Defined using sophisticated sheaf-theoretic techniques, micro-packets generalize the notion of Arthur packets for real groups. In this talk, we report on joint work with L. Barchini and P. Mezo, in which we compute all of these micro-packets for the real group G_2. If time permits, we will explain how to use the Atlas of Lie Groups and Representations software to compute some of these micro-packets.

SERINE BAIRAKJI, University of Ottawa
Brick by Brick: Assembling Supercuspidal Representations of SO(5).

The Adler–Yu construction of supercuspidal representations starts with sequences of twisted Levi subgroups. In this talk, we introduce the concept of twisted Levis and especially elliptic tori, and classify them up to conjugacy in SO(5). Our approach implements methods developed by Lawrence Morris (1991). The next step is to identify so-called generic elements in the Lie algebra of the center of each twisted Levi subgroup, as we will be able to attach families of supercuspidal representations to these. Surprisingly, not every twisted Levi sequence gives rise to generic elements. Building on that, we now have all the right components: the twisted Levis, the generic elements, some points in the building and some cuspidal representations. It's like having every piece of a Lego set neatly laid out, along with the instruction manual—the Adler–Yu construction—that guides us step by step. With everything in place, the construction of supercuspidal representations for SO(5) is no longer a mystery—it's just assembly.

KRISTAPS BALODIS, University of Calgary
Representation-theoretic consequences of the geometry of Vogan varieties.

Building on the work of Zelevisnky and the cases for real and complex groups, Davis Vogan purposed a p-adic Kazhdan-Lusztig hypothesis (p-KLH): The dimensions of stalks of perverse sheaves on varieties V_λ of Langlands parameters having fixed infinitesimal parameter λ, should coincide with multiplicities of irreducible representations of infinitesimal parameter λ in standard representations. Moreover, Vogan defined what we call ABV-packets in terms of the microlocal geometry of V_λ, and purposed that these coincide with Arthur's A-packets.

We will discuss recent work which, under the assumption of the p-KLH, proves a conjecture of Gross-Prasad that an L-packet $\Pi_\phi(G)$ contains a generic representation if and only if $L(s, \phi, \mathrm{Ad})$ is regular at $s = 1$. We also discuss implications for Shahidi's enhanced genericity conjecture, and an analogue for ABV-packets. Time permitting, we may also offer some speculation as to the relationship between Arthur parameters and orbits of smooth closure.

ADÈLE BOURGEOIS, Tutte Institute for Mathematics and Computing / Carleton University
Lifting data from fixed-point subgroups

Let G be a connected reductive group over a local nonarchimedean field of residual characteristic p and set $H = (G^\Gamma)^\circ$, where $\Gamma \subset \mathrm{Aut}(G)$ is a finite group such that $\gcd(p, |\Gamma|) = 1$. The restriction of an Adler-Yu type (J, λ) to its pro-p radical is called a semisimple character in the setting of Bushnell-Kutzko-Stevens types. Given a Γ-stable datum defining a semisimple character of G, one can restrict it to a datum defining a semisimple character of H. In this talk, we will describe some of the key results involved in answering the converse question: that of lifting a datum of H into one of G. This is joint work with Monica Nevins.

MATHILDE GERBELLI-GAUTHIER, University of Toronto
Upper bounds for dimensions of fixed vectors and coefficients in the Harish-Chandra—Howe expansion.

Let F be a p-adic field and let K_ℓ be the sequence of principal congruence subgroups of $GL_N(F)$. I will present work in progress on bounding the dimensions of spaces K_ℓ-fixed vectors in an irreducible representation π as ℓ grows. The asymptotic rate of growth has long been known to depend on the Gelfand-Kirillov dimension of π, equal to half the dimension of its wavefront set. I will explain how we uniformly bound the constants appearing in this asymptotic expansion, and how to deduce uniform upper bounds for the coefficients in the Harish-Chandra—Howe expansion of the character of π near the identity. This is joint work with Rahul Dalal and Simon Marshall.

JULIA GORDON, University of British Columbia
Explicit improvement on Harish-Chandra's integrability exponent

It is a well-known result of Harish-Chandra that most invariant distributions on real and p-adic reductive groups (e.g., Fourier transforms of orbital integrals, and characters of representations) are represented by locally integrable functions on the group, and the singularities of these functions are 'smoothed' by the zeroes of the Weyl discriminant. In the recent joint work with Itay Glazer and Yotam Hendel, we analyze the singularities of the inverse of the Weyl discriminant, and from that, obtain an explicit improvement on the integrability exponent of the Fourier transforms of nilpotent orbital integrals, and consequently, of characters. I will discuss this improvement and some surprising applications, e.g., to word maps.

ALEX HAZELTINE, University of Michigan
Functoriality and the local theta correspondence

The Adams conjecture predicts that the local theta correspondence preserves local Arthur packets. However its reliance on local Arthur packets limits its usefulness to representations which lie in a local Arthur packet. In this talk, we remove this restriction by considering the analogue of the Adams conjecture for ABV-packets.

ZANDER KARAGANIS, University of Toronto
Branching rules for $\mathrm{SL}(2, F)$ for F a 2-adic field

Giving branching rules consists of describing the decomposition of the restriction of an irreducible representation π of a group G to a subgroup K. Here, let $G = \mathrm{SL}_2(F)$ and let K be a maximal compact open subgroup. If F is p-adic with p odd, these rules are known and uniform. In this talk, we present the astounding arithmetic complexity that arises in the open case of F a 2-adic field, even for π a depth zero irreducible supercuspidal representation. This is joint work with Dr. Monica Nevins.

GIL MOSS, University of Maine
The universal Plancherel measure

The idea of developing the theory of intertwining operators in a general and purely algebraic way was suggested by Bernstein in unpublished notes in 1992, and further developed by Waldspurger (2003) and Dat (2005). One result of this is more general and precise versions of well-known properties of the Harish-Chandra j-function and Plancherel measure. In this talk we will discuss a further extension of this theory resulting in a "universal" Plancherel measure defined over the Bernstein variety, which interpolates the classical Plancherel measure at each supercuspidal support. The results are not only for complex coefficients, but also hold in the context of "families," where the coefficients are rings. We will outline how it can be used to characterize a putative local Langlands correspondence in families.

ISABELLA NEGRINI, University of Toronto
Rigid Cocycles and the p-adic Kudla Program

Rigid cocycles, introduced by Darmon and Vonk in 2017, offer a promising framework to extend complex multiplication theory to real quadratic fields, suggesting a theory of "real multiplication." They exhibit striking parallels with modular forms and are central to the emerging p-adic Kudla program. While the classical Kudla program studies the theta correspondence between automorphic forms on different groups, the p-adic version appears to replace automorphic forms with rigid cocycles. Although a theory for a p-adic theta correspondence has yet to be developed, recent results suggest its existence. In this talk, I present some of these p-adic results, draw comparisons to the classical setting, and discuss the evidence for an underlying p-adic theta correspondence.

MISHTY RAY, Carleton University
Some results on geometric analogues to local A-packets

Vogan's perspective on the local Langlands correspondence attaches to each enhanced L-parameter a perverse sheaf on the Vogan variety for a fixed infinitesimal parameter. Following his work with Adams and Barbasch on real groups, Vogan suggested a geometric analogue to local A-packets. Cunningham et al reformulated this proposal by using the vanishing cycles functor on equivariant perverse sheaves on the Vogan variety. The proposed geometric analogues are called ABV-packets and the conjecture that ABV-packets generalize local A-packets is called Vogan's conjecture. The key strategy of the proof for classical groups is to relate endoscopic transfer maps with restriction of perverse sheaves. Not used in the proof, but of independent interest, is the result that parabolic induction is dual to geometric restriction of perverse sheaves. I will report on the status of Vogan's conjecture and make precise the aforementioned related result. These results are in collaboration with some or all members of the group consisting of Clifton Cunningham, Alex Hazeltine, Chi-Heng Lo, Baiying Liu, and Bin Xu.

HADI SALMASIAN, University of Ottawa
Polynomiality of faithful dimension of finite p-groups parametrized by finite truncated valuation rings

The faithful dimension of a finite group G is the smallest dimension of a faithful representation of G. It is a notion closely related to the concept of essential dimension of G, introduced by Buhler and Reichstein. In this talk we present polynomiality results for the faithful dimension of finite p-groups associated (through the Lazard correspondence) to Lie algebras of the form $\mathfrak{g} \otimes_{\mathbb{Z}} R$, where $\mathfrak{g}$ is a nilpotent Lie ring and R is a finite truncated valuation ring (e.g., a quotient of the form $\mathcal{O}/\mathfrak{p}^n$ where $\mathcal{O}$ is the ring of integers of a p-adic field). We also discuss some connections with model theory and a question about the number of solutions of equations over such rings. This is based on joint work with M. Bardestani and K. Karai.

AMIN SOOFIANI, University of British Columbia
Hensel's lemma for the norm principle for groups of type D_n

Let G be a linear algebraic group defined over a field K. The Norm Principle for G, examines how the base change of G to finite separable field extensions of K behaves with respect to the norm map of the field extensions. It remains an open question whether the norm principle holds for all linear algebraic groups. In this talk, we will discuss the norm principle for groups of type D_n, in particular over complete discretely valued fields. Understanding this case is an important step toward studying the norm principle over function fields of curves over global and local fields.

LOREN SPICE, Texas Christian University
Fixed points under quasisemisimple and locally quasisemisimple actions

The notion of quasisemisimplicity is a generalization of semisimplicity, due to Steinberg, that allows us to describe nicely behaved outer automorphisms. The geometric behaviour of fixed-point groups under a single quasisemisimple automorphism was first investigated by Steinberg. In joint work with Adler and Lansky, we investigated generalisations in several directions: first, dealing with the rational theory (over a non-algebraically closed base field); second, dealing with the jointly quasisemisimple actions; and, third, dealing with the more general class of locally quasisemisimple actions. In this talk, we will try to give the flavour of this third generalisation, including how it turns out to involve surprisingly deep results in the theory of abstract finite groups.

The work being described has as its motivation lifting results by Adler and Lansky for finite groups of Lie types, and hence of depth-zero Moy–Prasad types, but the talk will focus almost exclusively on the structure theory.

EKTA TIWARI, University of Ottawa
Branching Rules for Principal Series Representations

The restriction of a principal representation of unramified p-adic U(1,1) to a maximal compact subgroup decomposes as a multiplicity-free direct sum of irreducible representations, and we show moreover that when restricted to a small enough neighbourhood, such a representation decomposes as a direct sum of irreducible representations constructed from nilpotent elements of the Lie algebra. This mirrors the supercuspidal case, which I completed in earlier work. In this talk, we will explore how to study such branching rules: from understanding the decomposition at the level of maximal compact subgroups to uncovering finer structure at smaller scales. Along the way, we will present an explicit description of the decomposition and highlight tools and ideas that make this analysis possible.

TIAN AN WONG, University of Michigan
Stable transfer and its applications

The stable transfer of distributions on reductive groups was identified by Langlands as a fundamental property required for the study of functoriality beyond endoscopic settings. In this talk, we will discuss recent progress on developing both an abstract and an explicit construction of this transfer for stable orbital integrals over local fields, conditional on the local Langlands correspondence. Time permitting, we will explain how this should be applied to the trace formula.