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## Automorphic forms and representations

### Formes automorphes et représentations

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**WONG TIAN AN**, University of Michigan-Dearborn

*Towards a notion of mesoscopy*

The theory of endoscopy concerns the transfer of distributions between a reductive group  $G$  and  $G'$ , an endoscopic group of  $G$ . At the heart of Langlands' original study on Beyond Endoscopy is the notion of stable transfer between groups  $G$  and  $G'$ , where  $G'$  is no longer required to be an endoscopic group. Arthur referred to these as 'beyond endoscopic groups,' and which we call mesoscopic groups. In this talk I will introduce these ideas, the role they play in functoriality, and open problems that arise in their study.

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**SERINE BAIRAKJI**, University of Ottawa

*Lost in Levis: The Case of the Missing Middle*

The Adler-Yu construction of supercuspidal representations posits, among other things, an exhaustive list of sequences of "twisted Levi subgroups". In this talk we define these and give an explicit construction of their conjugacy classes in the group  $SO(5)$ , focusing particularly on elliptic tori, adapting methods by Lawrence Morris (1991); this parallels work by Ju-Lee Kim and JK Yu for  $Sp(4)$ . Surprisingly, not all elliptic tori allow intermediate twisted Levis in the sequence. Even stranger, some other elliptic tori not only allow, but actually require, an intermediate Levi. These issues are governed by the regularity and genericity of elements of the torus. Our results allow a completely explicit construction of all supercuspidal representations of  $SO(5)$ .

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**KRISTAPS BALODIS**, University of Calgary

*The Status and Consequences of the  $p$ -adic Kazhdan-Lusztig Hypothesis*

In recent history, the Langlands program has undergone a process of "geometrization" in a variety of different ways. In this talk, we will focus on a version which relates a category  $\text{Rep}_\lambda(G)$  of smooth representations the  $F$ -points  $G(F)$  of a reductive group, to (a full sub-category of) the category  $\text{Per}(V_\lambda)$  of perverse sheaves on a kind of moduli space of Langlands parameters. In particular, we will articulate both the status, and recent consequences of the  $p$ -adic Kazhdan-Lusztig hypothesis.

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**YANZE CHEN**, University of Alberta

*Eisenstein series on metaplectic covers and multiple Dirichlet series*

We computed the first Whittaker coefficient of a Borel Eisenstein series on a metaplectic cover of a semisimple simply-connected group under a mild assumption of the root system, which results in a Weyl group multiple Dirichlet series. This confirms a conjecture of Brubaker-Bump-Friedberg.

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**FATMA CICEK**, University of Northern British Columbia

*Moments of Rankin-Selberg Convolution  $L$ -functions Near the Central Point*

We will talk about our recent results on the first and second twisted moments of some Rankin-Selberg convolution  $L$ -functions of primitive forms of prime power level. This is joint work with Alia Hamieh.

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**JOSE CRUZ**, University of Calgary

*On the Fourier transform and Vogan's perspective on the Local Langlands Correspondence*

Deligne's Fourier transform is an endofunctor defined on the derived category of  $\ell$ -adic sheaves on vector bundles. It maps sheaves with small support to sheaves with large support, and its first appearance was in the proof of the Weil conjectures. Nowadays it has proved to be a fundamental tool in geometric representation theory and in the Local Langlands correspondence. In this talk, I am going to introduce the Fourier transform via Grothendieck's function-sheaf dictionary, and I am going to apply it on some small examples that appear in Vogan's perspective of the local Langlands correspondence, just as Cunningham et al. did in their work.

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**MIAO (PAM) GU**, University of Michigan  
*On Triple Product  $L$ -functions*

The Poisson summation conjecture of Braverman-Kazhdan, Lafforgue, Ngô and Sakellaridis is an ambitious proposal to prove analytic properties of quite general Langlands  $L$ -functions using vast generalizations of the Poisson summation formula. In this talk, we present the construction of a generalized Whittaker induction such that the associated  $L$ -function is the product of the triple product  $L$ -function and  $L$ -functions whose analytic properties are understood. We then formulate an extension of the Poisson summation conjecture and prove that it implies the expected analytic properties of triple product  $L$ -functions. Finally, we use the fiber bundle method to reduce this extended Poisson summation conjecture to a case of the Poisson summation conjecture in which spectral methods can be employed together with certain local compatibility statements. This is joint work with Jayce Getz, Chun-Hsien Hsu, and Spencer Leslie.

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**ALEX HAZELTINE**, University of Michigan  
*The local theta correspondence and functoriality*

Langlands conjectured that the local theta correspondence is an instance of Langlands functoriality, e.g., it should preserve  $L$ -packets. Unfortunately, this was false. As a remedy, Adams conjectured that instead of  $L$ -packets, the local theta correspondence should preserve Arthur packets. Mœglin showed that this was "mostly" true; however, Mœglin also gave examples where the Adams conjecture was false. In this talk, we discuss a conjecture which would remedy the failure of the Adams conjecture along with some supporting evidence.

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**CHI-HENG LO**, Purdue University  
*On local Arthur packets and unitary dual of classical groups*

Recently, Tadić classified the unitary dual for representations of corank at most 3 of classical groups over  $p$ -adic fields. Based on the classification, he conjectured that a representation of critical type is unitary if and only if it is of Arthur type, and that any isolated representation in the unitary dual is of critical type. These conjectures indicate that representations of Arthur type form an important subset inside the whole unitary dual.

Jointly with A. Hazeltine, D. Jiang, B. Liu and Q. Zhang, we proposed a refinement of Tadić's conjecture: A representation of good parity is unitary if and only if it is of Arthur type. Moreover, we gave a conjectural description of the whole unitary dual for classical groups. In this talk, I will introduce these two conjectures, discuss their applications, and present our main result that they hold for representations of corank at most 3 of symplectic and split special odd orthogonal groups.

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**RACHEL OLLIVIER**, University of British Columbia  
*Rigid dualizing complexes for affine Hecke algebras.*

Grothendieck's duality theory relies on the notion of a dualizing complex. In the non-commutative setting such dualizing complexes were studied in the 90s beginning with work by Yekutieli. Since these complexes are not unique (for example, one can tensor them with any invertible object) Van der Bergh subsequently introduced the notion of a rigid dualizing complex. Generic (and nil) affine Hecke algebras appear naturally in the mod  $p$  Langlands program.

We will discuss rigid dualizing complexes in the context of generic affine Hecke algebras and see what sort of consequences one can draw.

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**MANISH M. PATNAIK**, University of Alberta

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**LIOR SILBERMAN**, The University of British Columbia  
*Arithmetic Quantum Unique Ergodicity on Hyperbolic spaces*

I will report on progress toward the Arithmetic Quantum Unique Ergodicity (AQUE) Conjecture for locally symmetric spaces, that is on the equidistribution problem for Hecke–Maass forms, specifically in the case of hyperbolic 3-space and 4-space, in joint work with Z. Shem-Tov.

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**JAMES STEELE**, University of Calgary  
*Between equivariant and constructible Yoneda algebras in the  $p$ -adic local Langlands correspondence*

For a  $p$ -adic group  $G$ , extensions between perverse sheaves on an associated moduli space of Langlands parameters have been used in a variety of ways to model local portions of  $\mathbf{Rep}(G)$ . Famously, Lusztig was able to realise particular graded affine Hecke algebras describing subcategories of  $\mathbf{Rep}(G)$  as the Yoneda algebra generated by certain  $\widehat{G}$ -equivariant perverse sheaves on the moduli space, where extensions are taken in the  $\widehat{G}$ -equivariant derived category. If one instead takes extensions in the usual constructible, derived category, this alternative approach, due to Chriss and Ginzburg and others, produces a localization of the same affine Hecke algebra at a point on the Bernstein centre for  $G$ .

In this talk, we describe cases where these two Yoneda algebras are, in fact, Koszul dual to one-another, producing a Koszul duality in-kind between the graded affine Hecke algebra and the localized affine Hecke algebra.

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**JACOB STOCKTON**, UBC  
*A derived Hecke algebra*

Let  $F$  be a  $p$ -adic field and  $G$  the  $F$ -rational points of a connected reductive group over  $F$ . We discuss the derived Hecke algebra  $\mathrm{Ext}_G^*(\mathrm{ind}_U^G 1, \mathrm{ind}_U^G 1)$ , where  $U$  is a compact open subgroup and  $1$  its trivial representation, which has appeared recently in the context of the mod- $p$  local Langlands program. This talk is based in part on joint work with Karol Koziol and Rachel Ollivier.

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**ILA VARMA**, University of Toronto  
*Geometry of numbers in the cusp*

In joint work with Arul Shankar, Artane Siad, and Ashwin Swaminathan, we develop a new method for counting integral orbits having bounded invariants and satisfying congruence conditions that lie inside the cusps of fundamental domains for coregular representations — i.e., representations of semisimple groups for which the ring of invariants is a polynomial ring. During this talk, we will illustrate this method in the case of counting 3-torsion elements in class groups of quadratic orders, and time permitting, we will discuss the new applications of these methods, including to counting 2-torsion ideal classes of monogenized degree- $n$  orders.

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**DANIELLE WANG**, UC Berkeley  
*Twisted GGP conjecture in the unramified case*

We present the relative trace formula approach to the global twisted Gan-Gross-Prasad conjecture. In particular, we explain how the relevant fundamental lemma can be reduced to the Jacquet-Rallis fundamental lemma, which allows us to prove the conjecture in the unramified case under some additional local conditions.