

Titles and Abstracts

Frontiers of Mathematics Lecture

Speaker: Eric Opdam (University of Amsterdam)

Title: Hecke algebras, residues and spectral decomposition

Abstract: Affine and graded affine Hecke algebras are ubiquitous in representation theory, integrable models, special functions and automorphic forms. We will discuss some elegant aspects of their representation theory and spectral theory, and consider some remarkable applications of these results in the subjects mentioned above.

Conference Talks

Speaker: U.K. Anandavardhanan (Indian Institute of Technology, Bombay)

Title: The correlation coefficient in representation theory

Abstract: Given a group G and two Gelfand subgroups H and K of G , associated to an irreducible representation π of G , there is a notion of H and K being correlated with respect to π in G . This notion was defined by Benedict Gross in 1991. We discuss this theme and give some details in some specific examples (which are part of joint works with Arindam Jana and Basudev Pattanayak).

Speaker: Hiraku Atobe (Kyoto University)

Title: Local newforms for unramified unitary groups

Abstract: Theory of local newforms is a bridge between modular forms and automorphic representations. In this talk, I will explain the theory of local newforms for irreducible tempered generic representations of unramified unitary groups over a non-archimedean local field of characteristic 0. This is partially a joint work with Masao Oi in Kyoto University and Seidai Yasuda in Hokkaido University.

Speaker: Anne-Marie Aubert (CNRS, Sorbonne Université)

Title: Typical representations for p -adic groups

Abstract: The category of smooth representations of a p -adic group G decomposes into subcategories, called Bernstein blocks, which are indexed by equivalence classes of supercuspidal representations of Levi subgroups.

For such a class \mathfrak{s} , a representation τ of an open compact subgroup K of G is called \mathfrak{s} -typical if the only representations of G in the restrictions of which τ occurs belong to the block indexed by \mathfrak{s} . Typical representations have very interesting number-theoretic applications, e.g. to the inertial local Langlands correspondence.

I will provide an overview of what we know about \mathfrak{s} -typical representations. In particular, I will outline a joint project with Luis Gutiérrez Frez in which we obtain a characterization of the \mathfrak{s} -typical representations of K , whenever \mathfrak{s} is attached to a proper Levi subgroup of G and K is a maximal hyperspecial parahoric subgroup.

Speaker: Dan Ciubotaru (University of Oxford)

Title: Bounds for the Langlands parameter of a smooth irreducible representation

Abstract: In joint work with Ju-Lee Kim, we propose a bound for the nilpotent part of the Langlands parameter of a smooth irreducible representation of the reductive p -adic group in terms of the geometric wavefront set of the representation, an invariant that appears naturally in the local character expansion of Howe and Harish-Chandra. In the talk, I will concentrate in particular on the case of depth-zero representations where the bound is closely related to the Kawanaka wavefront set of the representations of finite reductive groups.

Speaker: Lian Duan (Shanghai Tech University)

Title: On the irreducibility of low-dimensional geometric Galois representations

Abstract: In this talk, we discuss the irreducibility of compatible systems of certain five-dimensional geometric Galois representations. Using the modu-

larity results of classical cases, we prove that such a compatible system of representations is either irreducible for almost all p , or decompose uniformly as p varies. Our irreducibility result will deduce an algorithm for checking the irreducibility of corresponding Galois representations. Moreover, by applying a result of Cadoret and Tamagawa on the image of monodromy representation, we can spread out the irreducibility among the family of representations induced by the transcendental part of a family of elliptic surfaces. If time allows, I will talk about a concrete example as an application of our main result. This is a joint work with Xiyuan Wang and Ariel Weiss.

Speaker: Hui Gao (Southern University of Science and Technology)

Title: Hodge-Tate prismatic crystals and Sen theory

Abstract: We discuss Hodge-Tate crystals on the absolute prismatic site of O_K , where K is a p -adic field. These are vector bundles defined over the Hodge-Tate structure sheaf. We first classify them by O_K -modules equipped with small endomorphisms. We then classify rational Hodge-Tate crystals by nearly Hodge-Tate C_p -representations. This is joint work with Yu Min and Yupeng Wang.

Speaker: Oğuz Gezmis (Heidelberg University)

Title: Nearly holomorphic Drinfeld modular forms and their special values at CM points

Abstract: In 1970s, Shimura initiated the study of a non-holomorphic operator, the Maass-Shimura operator, which led him to define the notion of nearly holomorphic modular forms. He later discovered their role on constructing class fields as well as the connection with periods of CM elliptic curves. In this talk, our goal is to introduce their positive characteristic counterpart, nearly holomorphic Drinfeld modular forms. Moreover, we introduce Maass-Shimura operators in our setting and investigate the relation between the periods of CM Drinfeld modules and the values at CM points of arithmetic Drinfeld modular forms under the image of such operators. If time permits, we also explain the link between our objects and Drinfeld

quasi-modular forms introduced by Bosser and Pellarin. This is a joint work with Yen-Tsung Chen.

Speaker: Zilong He (Dongguan University of Technology)

Title: n -ADC integral quadratic lattices

Abstract: In 2012, Clark introduced ADC quadratic forms and studied their classification in the ring of integers with Jagy in 2014. Motivated by their work, we extend the ADC property to the representation of quadratic lattices by quadratic lattices, which we define as n -ADC-ness. In this talk, we will review the n -universality and n -regularity of quadratic lattices and explore their relationships with n -ADC properties. Then we will present equivalent conditions for n -ADC lattices over local fields and partial results in the global setting. Besides, we will briefly discuss how to determine the local structure of n -ADC lattices.

Speaker: Jiajun Ma (Xiamen University)

Title: Theta correspondence over finite fields and its geometrization

Abstract: Under the theta correspondence, the principle series correspond to each other. With Congling Qiu and Jialiang Zou, we explicitly computed this correspondence by analyzing the relevant Hecke algebra bimodules and applying a Tits deformation argument. This provides another proof of Aubert-Michel-Rouquier's conjecture, which was first proved by Shu-Yen Pan. In this talk, we will discuss an approach to geometrize the picture. Consequently, we obtained a new description of the theta correspondence in terms of the Springer theory. This is an ongoing joint work with Congling Qiu, Jialiang Zou, and Zhiwei Yun.

Speaker: Yoshiki Oshima (The University of Tokyo)

Title: Discrete branching laws of derived functor modules

Abstract: We consider the restriction of unitary representations of real reductive groups to their subgroups. In particular, we study the restriction of Zuckerman's derived functor modules for symmetric pairs assuming that it is discretely decomposable in the sense of Kobayashi. In this talk, we would

like to discuss how to obtain explicit branching formulas and observe some relationship with the projection of coadjoint orbits.

Speaker: Eitan Sayag (Ben-Gurion University of the Negev)

Title: Strong Density of Spherical characters

Abstract: Spherical characters are distributions on Homogeneous spaces that play an important role in the relative trace formula. Natural density problems regarding these distributions lead to some open problems. In a joint work with A. Aizenbud (Weizmann) and J. Bernstein (Tel-Aviv), we introduce some algebraic methods to tackle some of these density problems.

Speaker: Daniel Wong (The Chinese University of Hong Kong, Shenzhen)

Title: On the Lefschetz principle for $GL(n, \mathbb{C})$ and $GL(m, \mathbb{Q}_p)$

Abstract: The Harish-Chandra Lefschetz principle says that there are close relationships between the representation theories for real groups and p -adic groups. In this talk, we give one account of such similarities by constructing an exact functor from the category of Harish-Chandra modules of $GL(n, \mathbb{C})$ to the category of finite-dimensional modules of graded Hecke algebra \mathbb{H}_m of Type A.

We will show that the functor preserves parabolically induced modules, standard modules, irreducible modules, unitary modules and Dirac series. It also links a Bernstein-Zelevinsky type functor in \mathbb{H}_m -module side to tensor decomposition problems on the $GL(n, \mathbb{C})$ -module side.

This is a joint work with Kei Yuen Chan.

Speaker: Chenyan Wu (University of Melbourne)

Title: Theta correspondence and simple factors of global Arthur parameters

Abstract: Let π be a cuspidal automorphic representation of a classical group or a metaplectic group. We show an exact relation between two invariants associated to π , one being the lowest occurrence index of π with respect to theta lifts and the other the location of the maximal positive

pole of an Eisenstein series attached to π . As an application, we use this relation to show that certain global Arthur packets cannot contain cuspidal automorphic representations.

Speaker: Jun Yu (Peking University)

Title: Cartan-Helgason theorem for quaternionic symmetric pairs

Abstract: we present a joint work with Clemens Weiske and Genkai Zhang (Sweden). It shows a branching law for compact symmetric pairs of quaternionic type.

Speaker: Lei Zhang (National University of Singapore)

Title: Strongly Tempered BZSV Quadruples

Abstract: This talk will discuss the Relative Langlands Duality Conjecture. We will explain the notation of BZSV quadruples and their duality, then discuss strongly tempered BZSV quadruples. Furthermore, we will explain how the conjectures of BZSV give a conceptual explanation of many existing Rankin-Selberg integrals and period integrals. This project is joint with Zhengyu Mao and Chen Wan at Rutgers University in Newark.

Student Talks

Speaker: Mohammed Saad Qadri (Indian Institute of Technology, Bombay)

Title: Ext branching laws for the general linear group

Abstract: Let F be a non-archimedean local field. Let π_1 and π_2 be irreducible Arthur type representations of $\mathrm{GL}_n(F)$ and $\mathrm{GL}_{n-1}(F)$ respectively. We study Ext branching laws when π_1 and π_2 are products of discrete series representations and their Aubert-Zelevinsky duals. We obtain an Ext analogue of the local non-tempered Gan-Gross-Prasad conjecture in this case.

Speaker: Watcharakiet Wongcharoenbhorn (Chulalongkorn University)

Title: Square-full values of quadratic polynomials

Abstract: A *square-full* number is a positive integer for which all its prime divisors divide itself at least twice. The counting function of square-full integers of the form $f(n)$ for $n \leq N$ is denoted by $S_f^\blacksquare(N)$. We have known that for a relatively prime pair $(a, b) \in \mathbb{N} \times \mathbb{N} \cup \{0\}$ with a linear polynomial $f(x) = ax + b$, its counting function is $\asymp_{a,b} N^{\frac{1}{2}}$. Fix $\varepsilon > 0$, for an admissible quadratic polynomial $f(x)$, we prove that

$$S_f^\blacksquare(N) \ll_{\varepsilon, f} N^{\varpi + \varepsilon}$$

for some absolute constant $\varpi < 1/2$. Under the assumption on the *abc* conjecture, we expect the upper bound to be $O_{\varepsilon, f}(N^\varepsilon)$.

Speaker: Akash Yadav (Indian Institute of Technology, Bombay)

Title: Archimedean Distinguished Representations and Exceptional Poles

Abstract: Let F be an archimedean local field and let E be $F \times F$ (resp. a quadratic extension of F). We prove that an irreducible generic (resp. nearly tempered) representation of $\mathrm{GL}_n(E)$ is $\mathrm{GL}_n(F)$ distinguished if and only if its Rankin-Selberg (resp. Asai) L -function has an exceptional pole of level zero at 0. Further, we deduce a necessary condition for the ramification of such representations using the theory of weak test vectors developed by Humphries and Jo.