Titles and Abstracts

1. Chengming Bai, Chern Institute of Mathematics, Nankai University, China

Title: Some Bialgebra Theories on 3-Lie Algebras

Abstract: In this talk, I will introduce two types of 3-Lie bialgebras whose compatibility conditions between the multiplication and comultiplication are given by local cocycles and double constructions respectively. The former is introduced to extend the connection between Lie bialgebras and the classical Yang-Baxter equation and hence we get a ternary variation of the classical Yang-Baxter equation, called the 3-Lie classical Yang-Baxter equation. The latter is introduced to extend to the 3-Lie algebra context the connection between Lie bialgebras and double constructions of Lie algebras and their related Manin triples give a natural construction of pseudometric 3-Lie algebras with neutral signature. Moreover, the latter can be regarded as a special class of the former. It is a joint work with Li Guo and Yunhe Sheng.

2. Dan Ciubotaru, University of Oxford, England

Title: The Nonabelian Elliptic Fourier Transform for Unipotent Representations of p-adic Groups

Abstract: In this talk, I will consider two nonabelian Fourier transforms related to elliptic unipotent representations of semisimple p-adic groups. The elliptic representation theory concerns the study of characters modulo the parabolically induced ones. The unipotent category of representations was defined by Lusztig and it can be thought of as being the smallest subcategory of smooth representations that is closed under the formation of L-packets and such that it contains the Iwahori representations. The first Fourier transform is defined on the p-adic group side in terms of the pseudocoefficients of these representations, branching to maximal parahoric subgroups, and Lusztig's nonabelian Fourier transform for characters of finite groups of Lie type. The second one is defined "on the dual side" in terms of the Langlands-Kazhdan-Lusztig parameters for unipotent elliptic representations of a split p-adic group. I will present a conjectural relation between them, and exemplify this conjecture in some cases that are known, the most notable case being that of split special orthogonal groups, by the work of Mœglin and Waldspurger. I will also try to explain the relevance of this picture to the verification of the properties of unipotent L-packets and to a geometric interpretation of formal degrees of square integrable representations. The talk is based on joint work with Eric Opdam.

3. Jianxun He, School of Mathematics and Information Sciences, Guangzhou University, China

Title: Wavelet and Radon Transforms on H-type Groups

Abstract: Let $\mathscr{Q}$ be the quaternion Heisenberg group, which is a csse of H-type groups. Now let $\mathbf{P}$ denote the affine automorphism group of $\mathscr{Q}$. We develop the theory of continuous wavelet transform via the unitary representations of $\mathbf{P}$ on $L^2(\mathscr{Q})$. A class of radial wavelets is constructed. Furthermore, we deal with the Radon

transform both by the Euclidean Fourier transform and the group Fourier transform. In addition, we give an inversion formula by using wavelets, which does not require the smoothness of functions if the wavelet is smooth. Also, we obtain an inversion formula of the Radon transform associated with the sub-Laplacian on $\mathscr{Q}$.

4. Joachim Hilgert, Paderborn University, Germany

Title: Resonances and Scattering on Locally Symmetric Spaces

Abstract: By a (quantum) resonance on a Riemannian manifold one traditionaly means a pole of the resolvent kernel for the Laplace-Beltrami operator. The classical counterpart of the Laplace-Beltrami operator is the geodesic ow, which gives rise to (classical) Pollicott-Ruelle resonances. In special cases one knows that there is a close relation not only between quantum and classical resonances, but also between quantum resonances and scattering poles. In this talk we describe recent results obtained with G. Guillarmou and T. Weich, respectively S. Hansen and A. Parthasarathy, in this direction for certain locally symmetric spaces of rank one. The methods applied, in view of results obtained with A. Pasquale and T. Przebinda, respectively S. Hansen and M. Schröder on resonances and Patterson-Sullivan distributions in higher rank, suggest that extensions to higher rank are possible. A sketch of a possible approach will be given.

5. Jing-Song Huang, The Hong Kong University of Science and Technology

Title: Borel-de Siebenthal Systems and Generalization of Holomorphic Representations

Abstract: Holomoprhic representations are lowest weight representations for simple Lie groups of Hermitian symmetric type and play important roles in harmonic analysis. Inspired by the work of Orsted and Wolf on Borel-de Siebenthal discrete series, we define and study Borel-de Siebenthal representations (also called quasi-holomorphic representations) associated with Borel-de Siebenthal root systems for simple Lie groups of non-Hermitian symmetric type. This is a joint work with Yongzhi Luan and Binyong Sun.

6. Anthony To-Ming Lau, University of Alberta, Canada

Title: Characterization of Fourier algebra in a Class of Banach Algebra

Abstract: In this talk, I shall describe some recent joint work with Hung Le Pham on characterizations of the Fourier and Fourier Stieltjes algebras of a locally compact group in the class of F-algebras, a Banach algebra A which is the predual of a von Neumann algebra M and the identity in M is a multiplicative linear functional on A.

7. Lei Li, School of Mathematical Sciences, Nankai University, China

Title: Separably Injective Banach Space and C*-algebra

Abstract: In this talk, I will give s short introduction of separably injective Banach space. And then give a characterization of separably injective C*-algebras. This is a joint work with Professor Cho-Ho Chu.

8. Bingchen Lin, College of Mathematics, Sichuan University, China

Title: Archimedean Zeta Integrals on $U(n,1)$

Abstract: For a dual pair of unitary groups with equal size, zeta integrals arising from Rallis inner product formula give the central values of certain automorphic L-functions. In this paper we explicitly calculate archimedean zeta integrals of this type for $U(n,1)$, assuming that the corresponding archimedean component of the automorphic representation is a holomorphic discrete series.

9. Jan Möllers, University of Erlangen, Germany

Title: Knapp-Stein Type Intertwining Operators for Symmetric Pairs II. Vector Kernels and the Translation Principle

Abstract: In the previous talk we constructed intertwining operators between spherical principal series representations of a reductive group G and a reductive subgroup H, intertwining for the subgroup. In this second part we ex- plain how these operators give rise to intertwining operators between vector- valued principal series by tensoring with finite-dimensional representations of G. Using this translation principle we construct meromorphic families of intertwining operators which are explicitly given in terms of their integral kernels. These operators resemble the classical KnappStein intertwining operators. Applying our construction to the case of spinor-valued principal series rep- resentations of $(G,H) = (Pin(n+1,1), Pin(n,1))$ we obtain a meromorphic family of intertwining operators which, together with all possible residues, span the space of intertwining operators for all parameters. This lecture is based on joint work with Bent Ørsted and Yoshiki Oshima.

10. Karl-Hermann Neeb, Friedrich-Alexander-University Erlangen-Nuremberg, Germany

Title: Smoothing Operators and Semibounded Unitary Representations

Abstract: In the representation theory of locally compact groups the one-to-one passage between unitary group representations and representations of the corresponding group C^*-algebra obtained from $L^1(G)$ makes the rich toolbox of C^*-algebraic techniques available in the group context. For infinite dimensional groups there is no Haar measure and therefore no L^1-algebra that can be used to obtain a universal C^*-algebra. However, under certain semiboundedness requirements on spectra, one can use analytic continuations to obtain C^*-algebras whose representation theory cover the so-called semibounded unitary representations of Lie groups.

The key underlying idea is the concept of a smoothing operator, i.e., an operator whose range consists of smooth vectors. Natural operators with this property then generate C^*-algebras behaving in many respects like $C^*(G)$.

11. Chi-Keung Ng, Nankai University, Tianjin, China

Title: Properties of Locally Compact Groups from Reduced Crossed Products

Abstract: We will present several results concerning characterizations of amenability and property T of locally compact groups in terms of their reduced group C^*-algebras or reduced crossed products of their actions on some locally compact spaces.

12. Kyo Nishiyama, Aoyama Gakuin University, Japan

Title: Intertwiners Between Degenerate Principal Series Arising From a Double Flag Variety

Abstract: We introduce integral kernel operators which intertwine degenerate principal series of $Sp_{2n}(R)$ and $GL_n(R)$. For the kernel of the operator, we use relative invariants associated to a double flag variety of type CI. The integrals have natural complex parameters, and we determine the region of parameters in which it actually converges to define intertwiners of Hilbert space representations. As an application, we will discuss the occurrence of finite dimensional representations in degenerate principal series. The talk is based on joint work with Bent {Orsted.

13. Eric Opdam, University of Amsterdam, Holland

Title: On the Unramified Spherical Automorphic Spectrum Kernels

Abstract: Let G be a split connected reductive group defined over a global field F, with maximal split torus T, and let $\mathbf{K} = \prod_v K_v \subset G(\mathbb{A})$ be a maximal compact subgroup such that $K_v = G(O_v)$ at every nonarchimedian place v. Let χ be an everywhere unramified automorphic character of T. In this talk I will explain how the spectral decomposition of $L^2(G(F)\backslash G(\mathbb{A}))^{\mathbf{K}}_{[T,\chi]}$ reduces to the known spectral decomposition of the (anti)spherical subalgebra of a certain (graded) affine Hecke algebra.

The proof uses besides standard analytic properties of the Dedekind L-function, known properties of so-called residue distributions, which were introduced to study the Plancherel decomposition of (graded) affine Hecke algebras, and a result by M. Reeder on the support of the weight spaces of the anti-spherical discrete series representations of affine Hecke algebras. Both these ingredients are of a purely local nature.

This talk is based on joint work with M. De Martino (Oxford) and V. Heiermann (AMU Marseille).

14. Yoshiki Oshima, The University of Tokyo, Kavli IPMU, Japan

Title: The Orbit Method and Characters of Representations for Real Reductive Groups Kernels

Abstract: The orbit method relates coadjoint orbits and unitary representations of Lie groups. Although such correspondence does not work perfectly for reductive groups, it still provides a general principle for the study of unitary representations. In this talk we study distribution characters of singular representations of real reductive groups from the viewpoint of orbit philosophy.

15. Bent Ørsted, Aarhus University, Denmark

Title: Knapp-Stein Type Intertwining Operators for Symmetric Pairs I. Scalar Kernels

Abstract: For a symmetric pair (G, H) of reductive Lie groups we construct a family of intertwining operators between spherical principal series representations of G and H that are induced from parabolic subgroups satisfying certain compatibility conditions. These operators are symmetry breaking in the sense of T. Kobayashi, and they are closely related to Knapp-Stein operators. This lecture is based on joint work with Jan Möllers and Yoshiki Oshima.

16. Pavle Pandžić, University of Zagreb, Croatia

Title: Dirac Cohomology of Unitary Highest Weight Modules

Abstract: Nilpotent Lie algebra cohomology is one of the main tools in representation theory of real reductive groups. In 1988 Enright computed the $\mathfrak{p}^+$ cohomology for unitary highest weight modules. We recover his result using Dirac cohomology, which can be computed in a much more direct way, and which was shown to be equal to $\mathfrak{p}^+$ cohomology by Huang-P.-Renard. This is joint work in progress with Kyo Nishiyama.

17. Birgit Speh, Cornell University, USA

Title: Triple tensor products of representations of PGL(2,$\mathbb{R}$)

Abstract: Suppose V_1, V_2 are irreducible finite dimensional representations of a connected simple complex Lie group G. The tensor product $V_1 \otimes V_2$ is a direct sum of irreducible representations of G and the multiplicity of V_3 in the tensor product V_1, V_2 is equal to

$$\dim \mathrm{Hom}_G(V_1 \otimes V_2, V_3).$$

It is also equal to the dimension of the space of trilinear G-invariant linear functionals on

$$V_1 \otimes V_2 \otimes V_3^*,$$

where V^* is the contra gredient representation of V. It is well known that for $G = SL(2, \mathbb{R})$ the dimension is at most 1.

We consider 3 principal series representations $I(\lambda_1), I(\lambda_2)$ and $I(\lambda_3)$ of $G = PGL(2, \mathbb{R})$ and show that the dimension of the space of continuous invariant trilinear linear functionals on the projective triple tensor product or equivalently the dimension of the space of symmetry breaking operators

$$\mathrm{Hom}_G(I(\lambda_1) \otimes I(\lambda_2), I(-\lambda_3))$$

is at most most 3. This estimate is sharp. This is joint work with R. Gomez.

18. Peter Trapa, Department of Mathematics, University of Utah, USA

Title: Categorification via Blocks of Harish-Chandra Modules in Type A

Abstract: We give a categorical action of the universal enveloping algebra of $sl(2)$ (and related algebras) using categories of Harish-Chandra modules for real forms of $GL(n, \mathbb{C})$, extending basic results of Bernstein, Frenkel, Khovanov, and others. This is joint work with Vinoth Nandakumar.

19. Lyudmila Turowska, Chalmers University of Technology and University of Gothenburg, Sweden

Title: Beurling-Fourier Algebras on Lie Groups and Their Spectrum

Abstract: I shall discuss Beurling-Fourier (or "weighted" Fourier) algebras $A(G, W)$ on various Lie groups G focusing on their spectral analysis. If G is a compact group and the weight W is a so-called central weight given by a function $W : \widehat{G} \to \mathbb{R}^+$ on the dual $\widehat{G}$ of G, then the spectrum of $A(G, W)$ is a subset of the complexification of G which was shown in [J.Ludwig, N.Spronk and L.Turowska, J. Func. Anal. (2012)]. This was possible thanks to the abstract Lie theory developed by McKennon and Cartwright/McMullen. Unfortunately for non-compact groups the model of abstract Lie theory is not compatible with our model of Beurling-Fourier algebra and the situation forces us to build our own connection between spectrum of $A(G, W)$ and the complexification of G. In this talk I will discuss different examples of weights, possibly non-central ones, and spectrum of the corresponding Beurling-Fourier algebras emphasizing their connection with the complexification of the underlying groups. This is a joint work with Mahya Ghandehari, Hun Hee Lee, Jean Ludwig and Nico Spronk.

20. Harald Upmeier, Department of Mathematics, University of Marburg, Germany

Title: Intertwining Operators and Reproducing Kernels for Homogeneous Vector Bundles on Hermitian Symmetric Spaces

Abstract: It is well-known that hermitian symmetric spaces, of non-compact or compact type, can be realized in Jordan algebraic terms, as the 'spectral' unit ball $D = G/K$ of a hermitian Jordan triple Z and its conformal compactification $M = U/K$ containing Z as a Zariski open subset. Here K is the compact group of all linear automorphisms preserving the Jordan triple product. In this talk we combine both geometries by considering holomorphic hermitian vector bundles $\mathcal{E}$ over D whose fibres $\mathcal{E}_z, z \in D$, are irreducible representation spaces of U which have a multiplicity-free decomposition when restricted to $K \subset U$. In this setting, our main results (joint with G. Misra, Bangalore) are the following

- The explicit decomposition of the holomorphic sections $\mathcal{H} = \Gamma(D, \mathcal{E})$ into irreducible subspaces under G, using intertwining operators constructed from the Jordan theoretic 'quasi-inverse' map
- A classification of G-invariant (matrix valued) reproducing kernel functions, depending on the (non-unique) choice of hermitian inner product on $\mathcal{E}$
- A proof that the C^*-algebra generated by all holomorphic multiplication operators (Toeplitz operators) acts irreducibly on $\mathcal{H}$, although the covariance group G is not irreducible.
- Some progress concerning the boundedness of such (Cowen-Douglas) operators, based on a detailed computation of the (vector-valued) Wallach set.

From a different perspective (decomposition of tensor product representations), similar questions have been studied by G. Zhang and L. Peng.

21. Kai Wang, School of Mathematical Sciences, Fudan University, China

Title: Dixmier Trace of Quotient Module on Bounded Symmetric Domain

Abstract: In this talk, we mainly concern the essential normality of Toeplitz operators on bounded symmetric domains. We define a Hilbert quotient module corresponding to partitions of length 1 and prove that it belongs to the Macaev class $\mathcal{L}^{n,\infty}$. We next obtain an explicit formula for the Dixmier trace of Toeplitz commutators in terms of the underlying boundary geometry. This is a joint work with Prof. Harald Upmeier.

22. Ya-Shu Wang, National Chung Hsing University, Taiwan

Title: Orthogonally Multiplicative Maps on Figá-Talamanca-Herz Algebras

Abstract: A linear operator $\Phi : E \to F$ between function spaces or Banach algebras is orthogonally multiplicative if

$$fg = gf = 0 \quad \text{implies} \quad \Phi(f)\Phi(g) = 0 \ \text{ for all } f, g \in E.$$

In this talk, we will present the structure of an orthogonally multiplicative map from a Figá-Talamanca-Herz algebra $A_p(G_1)$ into $A_p(G_2)$. A representation for a polynomial on Figá-Talamanca-Herz algebra is also given.

23. Joseph Wolf, University of California at Berkeley, USA

Title: Parabolic Subgroups and Stepwise Square Integrability

Abstract: I'll sketch the idea of stepwise square integrability for nilpotent Lie groups and indicate its consequences for analysis on parabolic subgroups of real reductive Lie groups.

24. Jinsen Xiao, School of Sciences, Guangdong University of Petrochemical Technology, China

Title: Mikhlin Multiplier and Hardy Inequalities on the Heisenberg Group

Abstract: The Mikhlin multiplier theorem in the Hardy spaces on the Heisenberg group is studied. The proof mainly depends on some estimates deduced by the horizontal Taylor formula with integral remainder, coupled with the properties of the special Hermite functions. Using these estimates, the Hardy inequalities on the Heisenberg group are also established.

25. Wei Xiao, Shenzhen University, China

Title: Differential-Operator Representations of Weyl Group and Singular Vectors

Abstract: Given a suitable ordering of the positive root system associated with a semisimple Lie algebra, there exists a natural correspondence between Verma modules and related polynomial algebras. With this, the Lie algebra action on a Verma module can be interpreted as a differential operator action on polynomials, and thus on the corresponding truncated formal power series. We prove that the space of truncated formal power series is a differential-operator representation of the Weyl group W. We also introduce a system of partial differential equations to investigate singular vectors in the Verma module. It is shown that the solution space of the system in the space

of truncated formal power series is the span of $\{w(1)|w \in W\}$. Those $w(1)$ that are polynomials correspond to singular vectors in the Verma module. This elementary approach by partial differential equations also gives a new proof of the well-known BGGVerma Theorem.

26. Liang Yang, Sichuan University, China

Title: On the Normality of Nilpotent Varieties in $u(p, q)$

Abstract: Let $\mathcal{O}$ be a nilpotent $K_{\mathbb{C}}$-orbit in $u(p, q)$. We prove that the closure of $\mathcal{O}$ is normal.

27. Genkai Zhang, Math. Sci., Chalmers University of Tech. and Gothenburg University, Sweden

Title: H-type Homogeneous Spaces and Heat Kernels

Abstract: Let $L \subset K$ be subgroups of a semisimple Lie group G such that G/K and K/L are symmetric spaces. We consider the totally geodesic fibration $K/L \hookrightarrow M = G/L \to B = G/K$ of M. The orthogonal complement of the tangent space of K/L defines a distribution which satisfies the Hörmander's condition. The fiberation is called H-type if the dual of the torsion of the sub-Riemannian connection satisfies the J^2-condition. We classify all H-type totally geodesic fibration $K/L \hookrightarrow G/L \to B = G/K$. We find an integral formula for the subelliptic heat kernel in term of Segal-Bargmann transform.