PDF-RS Annual Symposium 2023

March 17, 2023

Venue - Auditorium (IInd Floor)
Theoretical Statistics and Mathematics Unit
Indian Statistical Institute, Bangalore

PDF-RS Annual Symposium (2023)
Indian Statistical Institute, Bangalore Centre

Venue: All the lectures will be held in Auditorium (2nd Floor)

All are welcome

Schedule of talks on March 17, 2023 (Friday)

Time	Speaker	Title of the talk
10.00-10.40 am	Sudip Ranjan Bhuia	Characterizations of complex symmetric Toeplitz operators
10.45-11.25 am	Karthick Babu	Discrepancy estimates for some uniformly distributed sequences

Coffee Break: 11.25-11.40 am

11.40-12.20 pm	Ankush Kumar Garg	Reconstruction over Shift-Invariant Spaces using Convoluted Samples: A Probabilistic Approach
12.25-1.05 pm	Souvik Pal	Harish-Chandra modules over full toroidal Lie algebras and higher-dimensional Virasoro algebras

Lunch Break: 1.05-1.40 pm

1.40-2.20 pm	Arup Kumar Maity	Fourier Multipliers Via Twisted Convolution
2.25-3.05 pm	Chaitanya G.K.	On the nonexistence of iterative roots of functions

Tea Break: 3.05-3.20 pm

3.20-4.00 pm	Samarpita Ray	Noncommutative tensor triangulated categories and coherent frames
4.05-4.45 pm	Sarvesh R. Iyer	Harnack Inequalities , Walk dimension and the Geometric Stable Process
4.50-5.30 pm	Bikramjit Kundu	The index of equidimensional flag manifolds

Titles and Abstracts

Characterizations of complex symmetric Toeplitz operators.
Sudip Ranjan Bhuia

Abstract: Complex symmetric operators are characterized by their interactions with certain antilinear operators, namely conjugations (antilinear, isometric, involution). This class of complex symmetric operators is bigger than the normal one. Conjugations and complex symmetric operators will all be briefly discussed in this talk. A bounded linear operator T is said to be complex symmetric if T satisfies $CT^*C = T$ for some conjugation C on a complex separable Hilbert space H. In this talk, I will present complete characterizations of Toeplitz operators that are complex symmetric. This follows as a by-product of characterizations of conjugations on Hilbert spaces. Notably, I will show that every conjugation admits a canonical factorization. Consequently, I will show that a Toeplitz operator is complex symmetric if and only if the Toeplitz operator is S-Toeplitz for some unilateral shift S and the transpose of the Toeplitz operator matrix is equal to the matrix of the Toeplitz operator corresponding to the basis of the unilateral shift S. Also, I will talk about the characterization of complex symmetric Toeplitz operators on the Hardy space over the open unit polydisc. This talk consists of results that answer the well-known open question about the characterizations of complex symmetric Toeplitz operators. I will end this talk by giving the characterizations of conjugations that intertwin M_z and a shift of multiplicity one in a general setting.

Discrepancy estimates for some uniformly distributed sequences.
Karthick Babu C G

Abstract: A sequence $(x_n)_{n\geq 0}$ of real numbers is said to be uniformly distributed modulo one if every subinterval of $[0, 1)$ gets its proper share of the sequence $(\{x_n\})_{n\geq 0}$, where $\{x\}$ denotes the fractional part of x. In other words the sequence $(x_n)_{n\geq 0}$ is uniformly distributed modulo one if

$$\lim_{N\to\infty} \frac{|\{0 \leq n < N : a \leq \{x_n\} < b\}|}{N} = (b - a),$$

for all real numbers a, b satisfying $0 \leq a < b < 1$. For a uniformly distributed sequence, a notion called discrepancy, quantifies the rate of convergence of the counting function to the expected limit. In this talk, we will discuss discrepancy estimates for a few uniformly distributed sequences. This includes a recent joint work with Anirban Mukhopadhyay and G. K. Viswanadham.

Harish-Chandra modules over full toroidal Lie algebras and higher-dimensional Virasoro algebras

Souvik Pal

Abstract: The Virasoro algebra, which can be realized as a central extension of (complex) polynomial vector fields on the unit circle, plays a key role in the representation theory of affine Lie algebras, as it acts on almost every highest weight module for the affine Lie algebra. This remarkable phenomenon eventually led to constructing the affine-Virasoro algebra, which is a semi-direct product of the affine Lie algebra and the Virasoro algebra with a common extension. The representation theory of affine-Virasoro algebra has been studied extensively and is an extremely well-developed classical object.

In this talk, we shall consider a natural higher-dimensional analogue of the affine-Virasoro algebra, popularly known as the full toroidal Lie algebra in the literature and henceforth classify the irreducible Harish-Chandra modules over this Lie algebra. As a by-product, we also obtain the classification of all possible irreducible Harish-Chandra modules over the higher-dimensional Virasoro algebra, thereby proving Eswara Rao's conjecture (conjectued in 2004). These directly generalize the well-known result of O. Mathieu for the classical Virasoro algebra and also the recent work of Billig-Futorny for the higher rank Witt algebra.

Noncommutative tensor triangulated categories and coherent frames

Samarpita Ray

Abstract: In this talk, I will discuss a point-free approach for constructing the Nakano-Vashaw-Yakimov-Balmer spectrum of a noncommutative tensor triangulated category under some mild assumptions. In particular, I will provide a conceptual way of classifying radical thick tensor ideals of a noncommutative tensor triangulated category using frame theoretic methods, recovering the universal support data in the process. This is a recent joint work with Vivek Mohan Mallick.

Fourier Multipliers Via Twisted Convolution

Arup Maity

Abstract: We will talk about $L^p \to L^q$ boundedness of Fourier multipliers on R^{2n}, which arise as twisted convolution of functions from Lebesgue spaces, as well as Lorentz spaces.

The index of equidimensional flag manifolds

Bikramjit Kundu

Abstract: Let G be a compact Lie group. If X is a G-space, then denote by X_{hG}, the homotopy orbit space EG_GX which is also known as Borel construction. The equivariant cohomology $H^*_G(X)$ of X is defined as $H^*(EG_GX)$ with a suitable coefficient system. Considering the fibration $XX_{hG}BG$ the Fadell-Husseini index $Index_G(X)$ of a G-space X is defined as $Ker(p^*)$ where $p^* : BGX_{hG}$. This talk deals with the Fadell-Husseini index computations for flag manifolds of equal dimensional p orthogonal subspaces on which C_p acts by the cyclic permutation . The computations involved wreath power construction of vector bundles and computations of characteristic classes of it in terms of characteristic classes of the original bundle. The result bears geometric consequences about measures of orthogonal shadows of convex subsets. This is an odd primary analogue of a calculation of Baralic et. al. (Index of Grassmann manifolds and orthogonal shadows) for the Grassmannian and is joint work with Samik Basu.

Reconstruction over Shift-Invariant Spaces using Convoluted Samples: A Probabilistic Approach

Ankush Kumar Garg

Abstract: One of the most dynamically evolving research areas, with both practical and theoretical interests, is that of sampling and reconstruction. In 1949, the celebrated Shannon sampling theorem was proved which turned out to be a milestone in this field of study and set the foundation for information theory. Over these years, the theory of sampling has been intensively studied. As the deterministic approach for irregular sampling of functions involving several variables seems to be hard, a probabilistic one, namely the random sampling is considered. We analyze the random average sampling problems for certain suitable classes of shift-invariant subspaces of mixed Lebesgue spaces. We show that the sampling inequalities as well as the reconstruction formulae hold with very high probability if the number of samples is taken to be sufficiently large.

Harnack Inequalities , Walk dimension and the Geometric Stable Process

Sarvesh R. Iyer

Abstract: Harnack inequalities are an important tool in the regularity theory of Partial Differential Equations(PDE) that have profound implications even in a purely probabilistic setting. While the Parabolic Harnack inequality is well-characterized, comparable equivalences for the Elliptic Harnack inequality have

proved elusive thus far. The geometric stable family of processes are subordinated Brownian motions whose density of small jumps is very large, making them analytically difficult to deal with. Using the notion of conformal walk dimension, we show that the geometric stable processes are examples of a large discrepancy between the Elliptic and Parabolic Harnack inequality. This talk is based on joint work with Prof. Siva Athreya and Prof. Mathav Murugan.

On the nonexistence of iterative roots of functions

Chaitanya G K

Abstract: An *iterative root of order* $n \geq 2$ of a self-map f on a nonempty set X is a self-map g on X such that $g^n = f$. We discuss a new result on the nonexistence of iterative roots of self-maps on arbitrary sets and use it to prove that every nonempty open set of the space $\mathcal{C}([0,1]^m)$ of all continuous self-maps on the unit cube $[0,1]^m$ in $\mathbb{R}^m$ contains a map that does not have even discontinuous iterative roots of order $n \geq 2$. This, in particular, proves that continuous self-maps on $[0,1]^m$ with no continuous iterative roots at all are dense in $\mathcal{C}([0,1]^m)$. The talk is based on joint works with B. V. Rajarama Bhat.

Thanks Notes

We would like to thank Prof. Jaydeb Sarkar and all Postdoc and Ph.D. scholars who have made this event possible. Without your support, this symposium would not be possible. Further, we would like to extend a warm welcome to all of our guests and attendees. We look forward to seeing you all at the symposium and learning about the exciting research that you are conducting.