Titles and Abstracts

Monojit Bhattacharjee (IIT Bombay)

Title: Unitary Invariants for Commuting tuples of hypercontractions

Abstract: By the model theory of Muller and Vasilescu, a m-hypercontraction is unitarily equivalent to compression of weighted shifts to a co-variant subspace $\mathcal{Q}$ of some vector-valued weighted Bergman space. The co-invariant subspace $\mathcal{Q}$ is called the model space of the m-hypercontraction. On the other hand, by a Beurling-Lax-Halmos type result, $\mathcal{Q}^{\perp} = \Phi H^2_n(\mathcal{E})$ for some partial isometric multiplier Φ from some Drury-Arveson space $H^2_n(\mathcal{E})$ to the weighted Bergman space. But the partial isometric multiplier Φ is not unique and description of these partial isometric multipliers are not known explicitly. In this talk, we will find a general recipe to explicitly construct such partial isometric multipliers which we call as characteristic functions of m-hypercontractions. These characteristic functions also determines the corresponding m-hypercontraction up to unitary equivalence. We will also study them by finding several different factorization results. This is a joint work with B. Krishna Das and Jaydeb Sarkar.

Shibananda Biswas (IISER Kolkata)

Title: On homogeneity and irreducibility of a class of examples arises from quotient modules

Abstract: Let $\Omega \subset \mathbb{C}^m$ be a bounded domain and $\mathcal{Z}$ is equal to $\{(z_1, \ldots, z_m) \in \Omega : z_1 = \cdots = z_d = 0\}$ or an image of this set under certain biholomorphism of Ω. Suppose that $\mathcal{M}_q$ is the quotient Hilbert modules obtained from submodules, consisting of functions in an analytic Hilbert module $\mathcal{M}$ vanishing to order k along $\mathcal{Z}$. We would show that the multiplication operators on $\mathcal{M}_q$ is homogeneous with respect to a subgroup of the automorphism group of Ω. We then show that for a class of weighted Bergman module on $\mathbb{D}^n$, when the co-dimension of $\mathcal{Z}$ is atleast 2, these homogeneous operators are reducible. Moreover, we identify the irreducible components of these reducible operators as generalized Wilkin's operators. This is an ongoing work with Prahllad Deb and Subrata Shyam Roy.

Sameer Chavan (IIT Kanpur)

Title: Weakly concave operators

Abstract: A class of polynomials motivates us to discuss a class of weakly concave operators. This class accommodates concave operators and a non-trivial subclass of $m-$isometries. We discuss Wold-type decomposition and Berger-Shaw-type result for weakly concave operators. Our main tool in these derivations is a spectral dichotomy for left-invertible operators.

Prahllad Deb (IISER Kolkata)

Title: Classification of homogenous operators in $B_3(\mathbb{D}^n)$

Abstract: A bounded linear operator T on a Hilbert space $\mathcal{H}$ is said to be homogeneous with respect to a subgroup G of the automorphism group of some domain $\Omega \subset \mathbb{C}^n$ if the spectrum of T is contained in Ω as well as, for every $g \in G$, $g(T)$ is unitarily equivalent to T. For $\Omega = \mathbb{D}$, all operators in $B_k(\mathbb{D})$, $k \geq 1$, homogeneous with respect to the automorphism group of $\mathbb{D}$ are classified by A. Korányi and G. Misra. So it leads to study tuples of operators in $B_k(\mathbb{D}^n)$, $n \geq 2$, $k \geq 1$, which are homogeneous with respect to some closed subgroup of the automorphism group of $\mathbb{D}^n$. All operators in $B_k(\mathbb{D}^n)$, which are homogeneous with respect to either the group $\mathrm{Aut}(\mathbb{D})^n$, or, $\mathrm{Aut}(\mathbb{D}^n)$, are known for $k = 1, 2$. In this talk, we describe all irreducible tuple of operators (upto unitary equivalence) in $B_3(\mathbb{D}^n)$ which are homogeneous with respect to the subgroup $\mathrm{Aut}(\mathbb{D})^n$ of the automorphism group of $\mathbb{D}^n$. Moreover, for $n = 2$, we show that a subclass of operator tuples in $B_3(\mathbb{D}^n)$ are also homogeneous with respect to the full automorphism group of $\mathbb{D}^n$ while, for $n > 2$, every tuple of operators in $B_3(\mathbb{D}^n)$ fails to be homogeneous with respect to $\mathrm{Aut}(\mathbb{D}^n)$. This is a joint work with Somnath Hazra.

Soumimtra Ghara (IISc Bangalore)

Title: The orbit of a bounded operator under the Möbius group modulo similarity equivalence

Abstract: Let Möb denote the group of biholomorphic automorphisms of the unit disc, and let $(\mathrm{Möb} \cdot T)$ be the orbit of a Hilbert space operator T under the action of Möb. If the quotient $(\mathrm{Möb} \cdot T)/\sim$, where $\sim$ is the similarity between two operators is a singleton, then the operator T is said to be weakly homogeneous. In this talk, we will discuss a criterion to determine if the operator M_z of multiplication by the coordinate function z on a reproducing kernel Hilbert space is weakly homogeneous. We will use this to show that there exists a Möbius bounded weakly homogeneous operator which is not similar to any homogeneous operator, answering a

question of Bagchi and Misra in the negative. Some necessary conditions for the Möbius boundedness of a weighted shift will also be discussed. As a consequence, it will be shown that the Dirichlet shift is not Möbius bounded.

Gargi Ghosh (IISER Kolkata)

Title: An Analytic Chevalley-Shephard-Todd Theorem

Abstract: For any $f \in \mathrm{Hol}(\mathbb{D}^2)$, we can express f as a linear combination of 1 and $z_1 - z_2$ with $\mathfrak{S}_2$-invariant coefficients. An analogous decomposition of $\mathrm{Hol}(\mathbb{D}^n)$ under the natural action of the group $\mathfrak{S}_n$ is observed, $\mathfrak{S}_n$ is the permutation group on n symbols. In this talk, we expand our scope to the action of pseudo-reflection groups on the ring of holomorphic functions and in order to do that we obtain an extension of well-known Chevalley-Shephard-Todd Theorem. We also mention a purely algebraic determinantal formula that may also be of independent interest.

Sushil Gorai (IISER Kolkata)

Title: Some questions on polynomial convexity

Abstract: In this talk we will discuss few problems on polynomial convexity of certain compact subsets of $\mathbb{C}^n$ and some recent observations concerning them. One class of compact sets are disjoint unions of finitely many closed balls in $\mathbb{C}^n$.

Rajeev Gupta (IIT Kanpur)

Title: Operator Space Structures on $\ell^1(n)$

Abstract: We show that the complex normed linear space $\ell^1(n)$, $n > 1$, has no isometric embedding into $k \times k$ complex matrices for any $k \in \mathbb{N}$ and discuss a class of infinite dimensional operator space structures on it.

Somnath Hazra (IISER Kolkata)

Title: A Product Formula For Homogeneous Characteristic Functions

Abstract: A bounded linear operator T on a Hilbert space is said to be homogeneous if $\varphi(T)$ is unitarily equivalent to T for all φ in the group Möb of bi-holomorphic automorphisms of the unit disc. A projective unitary representation σ of Möb is said to be associated with an operator T if $\varphi(T) = \sigma(\varphi)^\star T\sigma(\varphi)$ for all φ in Möb.

We prove that if T is a completely non unitary (cnu) contraction with associated (projective unitary) representation σ, then the characteristic function θ_T of T is of the form

$$\theta_T(z) = \pi_\star(\varphi_z)^*\theta_T(0)\pi(\varphi_z),\ z \in \mathbb{D},$$

where φ_z is the involution in Möb mapping z to 0 and π, π_* are representations of Möb living on the two defect spaces of T defined explicitly in terms of σ.

Conversely, if $\pi_*,\ \pi$ are projective unitary representations of Möb with a common multiplier, and C is a purely contractive intertwiner between $\pi|_{\mathbb{K}}$ and $\pi_*|_{\mathbb{K}}$ such that the function θ defined by $\theta(z) = \pi_*(\varphi_z)^*C\pi(\varphi_z)$ is analytic on $\mathbb{D}$, then θ is the characteristic function of a cnu contractive associator, where $\mathbb{K}$ is the subgroup of Möb consisting of rotations. We obtain a concrete realization of this product formula for a large class of homogeneous cnu contractions.

Dinesh Kumar Keshari (NISER Odisha)

Title: Unitary and similarity invariants of a subclass of the Cowen-Douglas class of operators.

Abstract: The explicit description of irreducible homogeneous operators in the CowenDouglas class and the localization of Hilbert modules naturally leads to the definition of a smaller class possessing a flag structure. In the talk, we will discuss similarity and unitary invariants of these operators. This a joint work with Kui Ji, Chunlan Jiang and Gadadhar Misra.

Surjit Kumar (IISc Bangalore)

Title: Reproducing kernel structure and unitary equivalence of operator-valued multishifts

Abstract: In this talk, we introduce and discuss a few basic properties for instance, circularity, analyticity and wandering subspace property of operator-valued multishifts. Further, we discuss the reproducing kernel structure and the unitary equivalence of operator-valued multishifts with

invertible operator weights. This is a joint work with Rajeev Gupta and Shailesh Trivedi.

Sasmita Patnaik (IIT Kanpur)

Title: Single commutators of compact operators and matrix sparsification

Abstract: A commutator is an operator of the form $AB-BA$ where A and B are bounded operators on a Hilbert space. After the Brown-Pearcy characterization of single commutators of bounded operators, Pearcy-Topping posed the question: Which compact operators are single commutators of compact operators? which still remains open. The progress made in this direction and its connection with the sparsification of matrices will be discussed in this talk.

Paramita Pramanik (IISc Bangalore)

Title: Berger-Shaw theorem for commuting tuple of operators

Abstract: Berger-Shaw theorem for a single operator states that a hyponormal operator possessing a finite rational cyclicity has a trace-class self commutator. For $n-$tuple of commuting strong hyponarmal operators R.G.Douglas and K.Yan gave a version of Berger-Shaw theorem. In this talk we first show that Douglas-Yan's theorem holds for $n-$tuple of weak hyponormal operators also.Then we introduce the notion of determinant operator associated to block operators and show that it is related to the general commutator of a commuting tuple. Finally, we conjecture a new version of Berger-Shaw theorem in multivariable set up and provide a large class of examples supporting our conjecture.

Samya Kumar Ray (IIT Kanpur)

Title: Multivariate Matsaev's conjecture

Abstract: In this talk, we discuss multivariate von Neumann's inequality in commutative and non-commutative L^p-spaces. This is known to be the Matsaev's conjecture. We show that the multivariate von Neumann inequality is true for any commuting tuple of isometries on L^p-spaces for $1 < p < \infty$. However, we show that, a in the well studied case of $p = 2$, it fails eventually for some commuting tuple of contractions for each $1 < p < \infty$. We then consider the von Neumann inequality on non-commutative L^p-spaces. By establishing a joint dilation theorem, we show that any commuting tuple of completely positive Schur multipliers associated with real valued matrices satisfy multivariate non-commutative Matsaev's conjecture. We also establish a joint dilation theorem for commuting tuple of unital completely

positive Fourier multipliers associated to real valued functions acting on the group von Neumann algebra $VN(G)$ of a discrete group G. If time permits we go back to single variable case and discuss some new results and application.

Subrata Shyam Roy (IISER Kolkata)

Title: Finite group action and reducibility of operators

Abstract: We look at actions of finite groups on reproducing kernel Hilbert spaces of holomorphic functions and consider the question of reducibility of naturally occurring operators on these Hilbert spaces.

Shailesh Trivedi (IIT Kanpur)

Title: von Neumann's inequality for commuting operator-valued multishifts

Abstract: Recently, Hartz proved that every commuting contractive classical multishift with non-zero weights satisfies the matrix-version of von Neumann's inequality. We show that this result does not extend to the class of commuting operator-valued multishifts with invertible operator weights. In fact, we show that if A and B are commuting contractive d-tuples of operators such that B satisfies the matrix-version of von Neumann's inequality and $(1, \ldots, 1)$ is in the algebraic spectrum of B, then the tensor product $A \otimes B$ satisfies the von Neumann's inequality if and only if A satisfies the von Neumann's inequality. This result facilitates us to construct the counterexamples with desired properties.

(This is a joint work with Rajeev Gupta and Surjit Kumar)