# NATIONAL CONFERENCE ON OPERATOR THEORY AND FUNCTION SPACES
# Shiv Nadar IoE Delhi NCR, March 27-29, 2024
# Abstracts
## Invited talks

1. **Kalyan Bidhan Sinha (JNCASR)**

   TITLE: Relative Folner sequences, Szego-pair and Asymptotic Spectral distribution of Unbounded self-adjoint operators .

   Abstract : Arveson in the 90's investigated the "accumulation sets " of eigenvalues of "appropriately truncated " bounded self-adjoint operators , at its essential spectrum. However, probably a bit earlier , Connes (and later Folner) had started looking at "amenable traces " on $C^*$-algebras in his studies on discrete groups and associated $C^*$- algebras. These two sets of ideas come together through the question of Szego-type limit theorems. For unbounded self-adjoint operators, one needs to extend the concept of Folner sequence, again leading to weighted limit theorems and they find applications in Weyl-algebra .

2. **Ajay Kumar (University of Delhi)**

   TITLE: Operator spaces and their tensor products

   Abstract: The theory of operator spaces grew out of the analysis of completely positive and completely bounded mappings. These maps were first studied on $C^*$-algebras, and later on suitable subspaces of $C^*$-algebras. On tensor product of operator spaces we can define several norms. The resulting tensor product has several nice structures in case of n x n matrices, $C^*$-algebras , TRO and $C^*$-ternary rings. We shall try to review recent results on tensor products of these structures arising out of Haagerup, Schur, Operator space projective norms.

3. **Kallol Paul (Jadavpur University)**

   TITLE: On some applications of Birkhoff-James orthogonality

   Abstract: One of the most important notion of orthogonality studied in Banach space is the Birkhoff-James orthogonality, which is motivated by the inbuilt notion of orthogonality in a Hilbert space that comes from the inner product. In this

talk we focus on the role of Birkhoff-James orthogonality in the study of some important problems that includes best approximation theory, best coapproximation theory and Fermat-Torricelli problem.

4. **Tanvi Jain (ISI Delhi)**

   TITLE: An introduction to symplectic eigenvalues

   Abstract: For every $2n \times 2n$ real positive definite matrix $A$ there exists a symplectic matrix $M$ such that $A = M^T \mathrm{diag}(D, D)M$, where $D$ is an $n \times n$ positive diagonal matrix. The diagonal entries of $D$ are called the symplectic eigenvalues of $A$. We will begin with a brief overview of these quantities, then quickly look at their significance in quantum information theory and discuss some recent results.

5. **Sasmita Patnaik (IIT Kanpur)**

   TITLE: A matrix-theoretic perspective on commutators of compact operators

   Abstract: Over half-a-century old Pearcy-Topping compact commutator problem remains unresolved: Is every compact operator a commutator of compact operators? The progress made on this problem is purely constructive in nature involving matrices. We also present some new constraints on the solutions of the commutator equation that do not depend on the innards of matrix representations.

6. **Sameer Chavan (IIT Kanpur)**

   TITLE: The wandering subspace problem for norm-increasing m-concave operators

   Abstract: We overview the wandering subspace problem for norm-increasing $m-$concave operators and discuss some partial solutions to this problem. We also try to understand the structure of a norm-increasing $m-$concave operator, which admits the wandering subspace property. This talk is based on a joint work with Shailesh Trivedi.

7. **Ranjana Jain (University of Delhi)**

   TITLE: Centres of certain tensor products of Banach algebras

   Abstract: For $C^*$-algebras $A$ and $B$ with centres $Z(A)$ and $Z(B)$, there is a natural identification of the centre of the $*$-algebraic tensor product $A \otimes B$ with $Z(A) \otimes Z(B)$. It is thus natural to ask for which tensor norms $\alpha$, the centre of $A \otimes_\alpha B$ is precisely $\overline{Z(A) \otimes Z(B)}^{\|\cdot\|_\alpha}$. Over the last five decades or so, affirmative answers have been obtained by several prominent operator algebraists for different tensor norms ($W^*$, $C^*$ as well as non-$C^*$).

   In this talk, after a quick review of those results, we present our contributions in the context of Banach space projective tensor product, and of operator space

projective tensor product. In the due process, we shall also discuss the centre of the generalized group algebra $L^1(G, A)$, $G$ being a locally compact group and $A$ being a Banach algebra, which enables us to answer this question for some non $C^*$-algebras. We shall also present some interesting applications of these identifications.

This talk is based on some articles written in collaboration with Ajay Kumar, Ved Prakash Gupta and Bharat Talwar.

8. **Ved Prakash Gupta (JNU)**

   TITLE: A notion of angle between intermediate subalgebras

   Abstract: The project of classifying von Neumann algebras and $C^*$-algebras containing subalgebras with some specific properties has been an active area of research. In the same context, understanding relative positions of subalgebras becomes crucial. People have developed various tools to take up this challenge. In a joint project with Keshab Chandra Bakshi, we have recently made a humble addition to this line of research by introducing a new tool, namely, the notion of (interior) angle between the intermediate $C^*$-subalgebras of certain finite-index inclusions of unital $C^*$-algebras. This talk will aim at providing an overview of this recent development and will be based on joint works with Keshab Chandra Bakshi and Deepika Sharma.

9. **Jaydeb Sarkar (ISI Bangalore)**

   TITLE: Isometric pairs

   Abstract: By isometric pairs, we mean pairs of commuting isometries. Part of the talk will be devoted to convincing the audience why isometric pairs matter. For example, how isometric pairs could have a significant impact in function theory, operator theory, operator algebras, etc. The remaining part would be devoted to reporting some fresh understanding of isometric pairs.

10. **C R Jayanarayanan (IIT Palakkad)**

    TITLE: On proximinality of the closed unit ball of M-ideals in certain class of Banach spaces

    Abstract: In this talk, we study the proximinality of the unit ball of a special class of subspaces, namely the M-ideals. We study these problems in $L_1$-predual spaces and the space of bounded operators on Banach spaces.

11. **Subrata Shyam Roy (IISER Kolkata)**

    TITLE: Toeplitz operators on the proper images of bounded symmetric domains

    Abstract: Let $\Omega$ be a bounded symmetric domain in $\mathbb{C}^n$ and $\boldsymbol{f} : \Omega \to \Omega'$ be a proper holomorphic mapping factored by (automorphisms) the group $G$. Suppose

that $G$ is a finite pseudoreflection group. We define an appropriate notion of the Hardy space $H^2(\Omega')$ on $\Omega'$ which can be realized a closed subspace of a $L^2$ space on the Šilov boundary of $\Omega'$. We study various algebraic properties of Toeplitz operators (such as the (generalized) zero product property, commuting property etc.) on $H^2(\Omega')$. For $\Omega = \mathbb{D}^n$ and $G = G(m, p, n)$ for positive integers $m, p, n$ with $p$ divides $m$, we sketch a proof of a Brown-Halmos type characterization for Toeplitz operators on $H^2(\Omega'), \mathbb{D}$ being the open unit disc in the complex plane.

12. **Pradipta Bandyopadhyay (ISI Kolkata)**

TITLE: On Uniform Mazur Intersection Property and super-reflexivity

Abstract: The Mazur Intersection Property (MIP)-every closed bounded convex set is the intersection of closed balls containing it-is an extremely well studied property in Banach space theory. A complete characterisation was obtained by Giles, Gregory & Sims (1978), most well-known criterion stating that the w*-denting points of $B(X^*)$ are norm dense in $S(X^*)$. Chen and Lin (1995), introduced the notion of w*-semidenting points and showed that a Banach space X has the MIP if and only if every $f \in S(X^*)$ is a w*-semidenting point of $B(X^*)$.

A much less studied uniform version of the MIP (UMIP or UI) was introduced by Whitfield and Zizler (1987). Characterisations similar to Giles, Gregory & Sims were also obtained, but an analogue of the w*-denting point criterion was missing, which perhaps is a reason for its being less pursued. In this talk, we briefly survey some relevant results on the MIP and our recent results on UMIP. For example, we have shown that a Banach space $X$ has the UMIP if and only if every $f \in S(X^*)$ is a uniformly w*-semidenting point of $B(X^*)$ (Studia (2020)), thus filling a long felt gap. Recently we have introduced two moduli of w*-semidenting points and characterised the MIP and the UMIP in terms of these moduli. Using this, we have shown that a property slightly stronger than UMIP (which we call H-UMIP) is equivalent to uniform convexity of $X^*$. We end this talk with a sketch of a possible approach to answering the long standing open question whether the UMIP implies super-reflexivity, at least in separable Banach spaces.

13. **Tirthankar Bhattacharyya (IISc)**

TITLE: Factorization of the right shift semigroup

Abstract: Let $\mathcal{S}^{\mathcal{E}} = (S_t^{\mathcal{E}})_{t\geq 0}$ on $L^2(\mathbb{R}_+, \mathcal{E})$ be the right shift semigroup for a separable Hilbert space $\mathcal{E}$. Let $\mathcal{V}_1 = (V_{1,t})_{t\geq 0}$ and $\mathcal{V}_2 = (V_{2,t})_{t\geq 0}$ be a pair of semigroups of contractions which satisfy $V_{1,t}V_{2,t} = V_{2,t}V_{1,t}$ and $S_t^{\mathcal{E}} = V_{1,t}V_{2,t}$ for every $t \geq 0$. Such a pair is called a *factorization* of $\mathcal{S}^{\mathcal{E}}$. The purpose of the talk is to describe all factorizations of $\mathcal{S}^{\mathcal{E}}$ when $\mathcal{E}$ is finite dimensional. Using the known fact that $\mathcal{S}^{\mathcal{E}}$ is unitarily equivalent to a semigroup of multiplication operators on

the vector valued Hardy space $H^2_{\mathbb{D}}(\mathcal{E})$, we employ function theoretic methods and classical convex analysis to arrive at the factorization.

14. **Arup Pal (ISI Delhi)**

    TITLE: Crystallisation of the $C^*$-algebra $C(SU_q(n+1))$

    Abstract: We will discuss the notion of crystal limits of the $C^*$-algebra of regular functions for the $q$-deformations of simple compact simply connected Lie groups, focussing on the type $A_n$ case.

15. **Dinesh Singh (KR Mangalam University)**

    TITLE: Revisiting Classical Function Theoretic Inequalities Via Functional Analysis

    Abstract: This talk deals with some very well known classical inequalities arising largely through function theory on the open unit disk such as those bearing the names of Hardy, Hilbert, Bohr and Paley. Our objective is to take a relook at them through the lens of functional analysis to shed new light on them.