

## Session I

**Tirthankar Bhattacharyya, IISc. Bangalore**

**Title: Commutant Lifting Theorem.**

Abstract: We shall describe this classical theorem and its applications to complex analysis like Nevanlinna-Pick interpolation. We shall also see another interesting feature: the lifting in general is not unique. In certain situations, we can tailor it to suit additional purposes. This will link with complex geometry.

**S. S. Roy, IISER Kolkatta**

**Title:  $\Gamma_n$  contractions and functional models for  $\Gamma_n$  contractions**

Abstract: We show that a weighted Bergman space on the polydisc splits up into the orthogonal direct sum of subspaces, each corresponding to an irreducible representation of the symmetric group. The multiplication by the  $n$ -tuple of elementary symmetric functions is a  $\Gamma_n$ -contraction on each of these subspaces. We also discuss some properties of these subspaces.

**M N Namboodiri, CUSAT**

**Title: Haar criterion and Cebesev systems in  $C^*$ -algebras**

Abstract: This lecture is about recent developments in Noncommutative Approximation Theory especially noncommutative Korovkin sets (Initiated by W.B.Arveson) and non commutative Čebyšev systems (Initiated by A.G.Robertson). A comparison between the the classical Haar criterion for function spaces and the non commutative Haar criterion introduced in [2] for  $C^*$  algebras is discussed. A few related questions are also presented.

## REFERENCES

- [1] M. N. N. Namboodiri, *Developments in noncommutative Korovkin-type theorems*, RIMS Kokyuroku Series [ISSN1880-2818]737-Non Commutative Structure Operator Theory and its Applications, 2011.
- [2] M.N.N.Namboodiri,S.Pramod and A.K.Vijayarajan *Finite dimensional Čebesev subspaces of  $C^*$  algebras*,J. Ramanujan Math. Soc. 29, No.1 (2014) 6374.233-236.
- [3] M.N.N.Namboodiri,S.Pramod and A.K.Vijayarajan *CEBYSEV SUBSPACES OF  $C^*$  - ALGEBRAS - A SURVEY*, Operator Algebras and Mathematical Physics, Operator Theory: Adv. and Appl., Vol. Nr. 247, Springer Basel AG, Basel, 2015.

**Debashish Goswami, ISI Kolkata**

**Title: Quantum Isometry Groups.**

Abstract: I'll sketch the theory of an analogue of the group of isometries in the framework of quantum groups acting on classical and noncommutative manifolds. Some recent developments and open questions will be mentioned.

## Session II

**Jaydeb Sarkar, ISI Bangalore**

**Title: Operator positivity and analytic model**

Abstract: We discuss briefly recent and not so recent results about analytic models and operator positivity of bounded linear operators on Hilbert spaces (stressing the role of

Beurling-Lax-Halmos type theorem). We also show related results for doubly commuting tuples of operators on Hilbert spaces in the spirit of tensor product structure of reproducing kernel Hilbert spaces over unit polydisc. This is a joint work with Monojit Bhattacharjee.

**S. Podder, IIT Bombay**

**Title: On the Reflexivity of Certain Operator Tuples**

Abstract: We discuss the subnormality and reflexivity of certain operator tuples referred to as spherically quasinormal tuples (of which quasinormal tuples are a special case). This is a joint work with Ameer Athavale.

**V. M. Sholapurkar, S. P. College, Pune**

**Title: Completely Monotone Functions of Finite Order and Agler's Conditions**

Abstract: Motivated by some structural properties of Drury-Arveson  $d$ -shift, we investigate a class of functions consisting of polynomials and completely monotone functions defined on the semi-group  $\mathbb{N}$  of non-negative integers, and its operator theoretic counterpart which we refer to as the class of completely hypercontractive tuples of finite order. We obtain a Lévy-Khinchin type integral representation for the spherical generating tuples associated with such tuples and discuss its applications.

Session III

**C R Jayanarayanan, IIT Kanpur**

**Title: Optimization of proximality properties through dense sets**

Abstract: For a subspace  $Y$  of a Banach space  $X$ , one of the basic problems in approximation theory is the existence of a best approximation from  $Y$  for an element  $x$  of  $X$ . If this happens for every  $x \in X$ , then  $Y$  is said to be a proximal subspace of  $X$ . It is known that the existence of best approximation at all points of a dense set need not imply proximality. In this talk, since  $X$  is weak\*-dense in  $X^{**}$ , we discuss the possibility of  $Y^{\perp\perp} \subseteq X^{**}$  to possess two stronger forms of proximality even when the constraints are imposed only on vectors in  $X$ . This is my joint work with Prof. T. S. S. R. K. Rao.

**Rani Kumari, IIT Kanpur**

**Title: A Wold-type decomposition for Row  $\nu$ -hypercontractions.**

Abstract: For a positive integer  $k$  and  $d$ -tuple  $T = (T_1, \dots, T_d)$ , consider

$$D_{T,k} := \sum_{l=0}^k (-1)^l \binom{k}{l} \sum_{|p|=l} \frac{l!}{p!} T^{*p} T^p.$$

A commuting  $d$ -tuple  $T$  is a row  $\nu$ -hypercontraction if  $D_{T^*,k} \geq 0$  for  $k = 1, \dots, \nu$ . The multiplication  $d$ -tuple  $M_{z,\nu}$  on the reproducing kernel Hilbert space  $H(\kappa_\nu)$  associated with the kernel  $\kappa_\nu(z, w) = (1 - \langle z, w \rangle)^{-\nu}$  is a basic example of row  $\nu$ -hypercontraction. Under some spectral assumption, we prove that any row  $\nu$ -hypercontraction  $d$ -tuple  $T$ , for which  $D_{T^*,\nu}$  is a projection, decomposes into  $S_\nu \oplus V^*$  for a direct sum  $S_\nu$  of  $M_{z,\nu}$  and a spherical isometry  $V$ . In addition, if  $T$  is a spherical expansion and  $d \geq \nu$ , then  $T$  decomposes into  $S_\nu \oplus U$  for a spherical unitary  $U$ . This generalizes a theorem of Richter-Sundberg (the

case  $\nu = 1$ ). The results of this note enable us to identify extremals of the family of joint  $\nu$ -hypercontractive  $d$ -tuples in case  $d > \nu$ .

**Abdullah Bin Abu Baker, AMU**

**Title: Generalized 3-circular Projections on Function Spaces.**

Abstract: We give complete description of Generalized 3-circular projections on  $C(\Omega)$ , where  $\Omega$  is a compact connected Hausdorff space.

**D Sukumar, IIT Hyderabad**

**Title: Biggest open ball in invertible elements of a Banach algebra.**

Abstract: Let  $A$  be a unital Banach algebra and  $G(A)$  be the set of invertible elements of  $A$ . For  $a \in G(A)$ , we know that  $B\left(a, \frac{1}{\|a^{-1}\|}\right)$  is completely contained in  $G(A)$ . An element  $a \in G(A)$  is said to satisfy BOBP (Biggest open ball property) if  $B\left(a, \frac{1}{\|a^{-1}\|}\right)$  is the biggest ball which is centered at  $a$  and is completely contained in  $G(A)$ . That is the boundary of the ball  $B\left(a, \frac{1}{\|a^{-1}\|}\right)$  necessarily intersects the set of non-invertible elements. A Banach algebra  $A$  is said to satisfy BOBP if every  $a \in G(A)$  satisfies BOBP. We make an attempt on understanding as well as characterising all Banach Algebras which satisfy BOBP and which do not. To actualise the above mentioned objective, we discuss the observations made in some classical Banach Algebras.

Session IV

**Santanu Dey, IIT Bombay**

**Title: Functional Models and Minimal Contractive Liftings** (Joint work with Rolf Gohm and Kalpesh J. Haria)

Abstract: Based on a careful analysis of functional models for contractive multi-analytic operators we establish a one-to-one correspondence between unitary equivalence classes of minimal contractive liftings of a row contraction and injective symbols of contractive multi-analytic operators. This allows an effective construction and classification of all such liftings with given defects. Popescu's theory of characteristic functions of completely non-coisometric row contractions is obtained as a special case satisfying a Szegő condition. In another special case of single contractions and defects equal to 1 all non-zero Schur functions on the unit disk appear in the classification. It is also shown that the process of constructing liftings iteratively reflects itself in a factorization of the corresponding symbols.

**Bata Krishna Das, ISI Bangalore**

**Title: Essential normality and boundary representations for quotient modules of  $H^2(\mathbb{D}^n)$ .**

Abstract: In this talk, we will consider essential normality of various classes of quotient modules of  $H^2(\mathbb{D}^n)$ . This extends a recent work of Guo & Wang ([3]) on the essential normality of Beurling type quotient modules of  $H^2(\mathbb{D}^2)$ . Exploiting a natural connection

between essential normality of a quotient module  $\mathcal{Q}$  of  $H^2(\mathbb{D}^n)$  and boundary representations (in the sense of [1] and [2]) of the Toeplitz  $C^*$ -algebra corresponding to  $\mathcal{Q}$ , we will see that Arveson's result on boundary representations can be extended for these classes of quotient modules of  $H^2(\mathbb{D}^n)$ .

This is a joint work with S. Gorai and J. Sarkar.

**Shibananda Biswas, IISER, Kolkata**

**Title: On curvature inequality and infinite divisibility**

Abstract : The curvature of a contraction in the Cowen-Douglas class of rank one on the unit disc is bounded above by the curvature of the backward shift operator. However, in general, an operator satisfying the curvature inequality need not be contractive. With Dinesh K. Keshari and Gadadhar Misra, we have found a stronger inequality for the curvature which forces contractivity of the operator which generalizes to the case of commuting tuples. With Prahlad Deb, we have shown that similar phenomenon holds for certain class of Cowen-Douglas operators of rank higher than one.

**Gadadhar Misra, IISc, Bangalore**

**Title: TBA.**

Session V

**Lalithambigai**

**Title: TBA**

**P. Shunmugaraj, IIT Kanpur**

**Title: Geometric aspects in Banach spaces and proximality**

Abstract: In this talk we discuss about characterizations of some geometric properties of Banach spaces and proximality properties in best approximation theory in terms of convergence of slices.

**P. Bandyopadhyay, ISI Kolkata**

**Title Ball remotality in Banach spaces, a survey!**

Abstract:TBA

Session VI

**Kalpesh Haria, IIT RM**

**Title: Outgoing Cuntz scattering system for a coisometric lifting and transfer function.**

Abstract: We study a coisometry that intertwines Popescu's presentations of minimal isometric dilations of a given operator tuple and of a coisometric lifting of the tuple. Using this we develop an outgoing Cuntz scattering system which gives rise to an input-output formalism. A transfer function is introduced for the system. We also compare the transfer function and the characteristic function for the associated lifting.

**Lalit Kumar, Delhi University**

**Title: Extension of Bessel Systems to Frames in  $L^2(\mathbb{R})$ .**

Abstract: In this talk, we present sufficient conditions for the extension of a pair of wave packet Bessel sequences to dual wave packet frames in  $L^2(\mathbb{R})$ . The finite extension of a pair of Hilbert Bessel sequences in a separable Hilbert space to a pair of Hilbert dual frames is also discussed.

**Aneesh M, IIT Kanpur**

**Title: Hypercyclic and frequently hypercyclic subspaces for elementary operators of order one.**

Abstract: In this talk, we consider the existence of hypercyclic and frequently hypercyclic subspaces for the map  $C_{A,B}(S) = ASB$  (an elementary operator of order one) defined on some familiar Banach algebras of operators. We first obtain a condition for  $C_{A,B}$  to be frequently hypercyclic on  $S_p(H)$  (the Schatten-von Neumann classes of a complex Hilbert space  $H$ ) and also, on  $\mathcal{K}(X)$  (the space of all compact operators on a Banach space  $X$ ). We characterize frequently hypercyclic  $C_{M_\varphi^*, M_\psi}$  on the trace-class of the Hardy space, where  $M_\varphi$  denotes the multiplication operator associated to  $\varphi$ . Finally, we consider the existence of hypercyclic and frequently hypercyclic subspaces for  $C_{A,B}$ . In particular, it is proved that if  $T$  satisfies the Hypercyclicity Criterion, then the map  $S \rightarrow TST^*$  possesses a hypercyclic subspace in  $S_p(H)$  and  $\mathcal{K}(H)$  for any  $1 \leq p < \infty$ .

This is a joint work with Prof. Manjul Gupta.

**Raj Kumar, Delhi University**

**Title:  $\Theta$ -Irregular Weyl-Heisenberg Frames in  $L^2(\mathbb{R})$ .**

Abstract: Gávruta [Frames for operators, *Appl. Compu. Harmon. Appl.*, 32, (2012), 139–144] introduced and studied  $K$ -frames for separable Hilbert spaces. In this talk we discuss the  $\Theta$ -irregular Weyl-Heisenberg frames in  $L^2(\mathbb{R})$ , where  $\Theta$  is a bounded linear operator on  $L^2(\mathbb{R})$ . This is an extension of the notion of  $K$ -frames in Hilbert spaces. A characterization of a system in  $L^2(\mathbb{R})$  to be a  $\Theta$ -irregular Weyl-Heisenberg frame is given. Necessary and sufficient conditions for the existence of  $\Theta$ -irregular Weyl-Heisenberg frames in  $L^2(\mathbb{R})$  are obtained.

Session VII

**Amin Sofi, Kashmir University**

**Title: Some Aspects of Riemann Inregrability Related to Continuity of Functions in Infinite Dimensional Spaces**

Abstract: In classical analysis, the relationship between continuity and Riemann integrability of a function is an intimate one: a continuous function is always Riemann integrable whereas a Riemann integrable function is continuous almost everywhere. In the setting of functions taking values in infinite dimensional abstract spaces that include quasi Banach spaces, one encounters certain curious phenomena involving the breakdown

of the above stated phenomena, besides the failure involving the fundamental theorem of calculus and the existence of primitives for continuous functions! While the latter property can be salvaged within the class of Banach spaces, it turns out that the Riemann integrability of functions which are continuous with respect to certain well known linear topologies on  $X$  (resp. on weaker than the norm topology imposes rather severe restrictions on the space in question. The present talk is devoted to a discussion of these issues which will be examined in the setting of Banach and Frechet spaces on the one hand and of quasi Banach spaces on the other.

**Anil Karn, NISER, Bhubaneswer**

**Title: Notion of  $p$ -compact sets in Banach spaces: Story of a definition.**

Abstract: In this talk we shall deliberate on origin of the notion “ $p$ -compact sets” in a Banach space and its contribution in the theory of the approximation property in Banach spaces and in that of Banach operator ideals.

**G Ramesh, IIT Hyderabad**

**Title: Absolutely minimum attaining Closed Operators.**

Abstract: We define and discuss properties of the class of unbounded operators which attain minimum modulus. Also we define absolutely minimum attaining operators (possibly unbounded) and characterize all injective absolutely minimum attaining operators as those with compact inverse. We give several consequences of this result.

**TSSRK Rao, ISI Bangalore**

**Title: Extremely strict ideals in Banach spaces**

Abstract: Motivated by the notion of an ideal introduced by Godefroy, Kalton and Saphar, in this paper we introduce and study the notion of an extremely strict ideal. For a Poulsen simplex  $K$ , we show that the space of affine continuous functions on  $K$  is an extremely strict ideal in the space of continuous functions on  $K$ . For injective tensor product spaces, we prove a cancelation theorem for extremely strict ideals. We also exhibit non-reflexive Banach spaces which are not strict ideals in their fourth dual.

Session IX

**Divya Khurana, IIT Kanpur**

**Title: Subspaces of  $L_p$  defined on trees.**

Abstract: In this talk we will consider a class of subspaces of  $L_p$  first introduced by Bourgain, Rosenthal and Schechtman. These spaces may be defined in two different ways; however for this talk we will consider the realization through well founded trees. We will show some glimpses of  $L_p$  index theory of this class. Finally by using an arithmetic characterization of Sidon sets given by Pisier we will show that the tree subspace of  $L_p$  corresponding any tree of finite order is Hilbertian subspace.

**Sudeshna Basu, George Washington University**

**Title: TBA**

**A K Roy, RKMV University, Belur**

**Title: Korovkin's Theorem.**

Abstract: :In this talk,a generalized version of Korovkin's theorem will be presented along with some examples and associated material to illuminate the discussion.