Multivariable Operator Theory at the Technion

On the occasion of Baruch Solel's 65th Birthday

Technion, Haifa, Israel

June 18-22, 2017

Useful Information

- All the lectures, except the Colloquium, will take place in Room 232 on the second floor of the Math Building (Amado). The Colloquium will take place on Monday, and will be in Room 233 on the same floor of the same building. Note that the schedule on Monday is a bit different because of the Colloquium.
- Most talks are scheduled for 50 minutes, which means 45 minutes plus 5 minutes for questions. The colloquium is 50+10, and there are three talks on Thursday that are 25+5.
- The Mathematics Building (called the Amado Building) is connected to the Segoe Building, which is the home of Architecture and Town Planning; in the linked map they are both in square E3 (`http://www.technion.ac.il/wp-content/uploads/2012/06/TechnionMap_2010.pdf`). It is usually convenient to enter the Math building from Segoe, a white triangle in a blue circle indicates the entrance on the map.
- If you are staying at the Bay View Hotel: the taxis will drop you off, and pick you up, at the parking lot at the end of Yaakov Dori Road; in the linked map this is the parking lot that appears just to the left of Architecture and Town Planning, in square E3 (`http://www.technion.ac.il/wp-content/uploads/2012/06/TechnionMap_2010.pdf`).
- The Forchheimer guesthouse is located in sqaure D3 of the linked map (`http://www.technion.ac.il/wp-content/uploads/2012/06/TechnionMap_2010.pdf`).
- The banquet will take place at 18:00 on Wednesday in the lounge on the 8th floor of the Amado building.
- Lunch and Coffee breaks will be served in the Faculty Lounge on the 8th floor of the Amado Building. There is a cafeteria on the third floor of the Amado buiding. For information about other cafetrias/restaurants on campus, ask the locals.
- Besides the cafetria, you can also hang out in the faculty lounge on the 8th floor of Amado, or in the library, which is on the fourth floor. The library has two halls — one for quiet self study, and the other suitable for joint work.
- The Reception on Sunday evening is a buffet style dinner. Food will be available between 19:00 and 21:00.

Schedule

	Sunday
18:30	Pickup at Forchheimer (to the hotel)
19:00 – 21:00	Reception at the Bay View Hotel
21:15	Pickup back to Forccheimer

	Monday
8:15	Pickup at the hotel
9:00 – 9:10	Opening
9:10 - 10:00	Quanlei Fang *Operator theory in Drury-Arveson space*
10:00 – 10:30	Coffee break
10:30 - 11:20	Michael Hartz *Interpolating sequences in complete Pick spaces*
11:20 – 11:30	Short break
11:30 - 12:20	Jaydeb Sarkar *Variations on a theme of Beurling and Hilbert modules*
12:20 – 14:10	Lunch break
14:10 - 15:00	Yi Wang *A complex harmonic analysis approach to the geometric Arveson-Douglas conjecture*
15:00 – 15:30	Coffee break
15:30 - 16:30	Ken Davidson (Room 233, joint with Colloquium) *Choquet order and hyperrigidity for function systems*
16:30 – 16:40	Short break
16:40 - 17:30	Joerg Eschmeier *Bergman inner functions and wandering subspaces*
17:45	Pickup back to the hotel

	Tuesday
8:15	Pickup at the hotel
9:10 - 10:00	John McCarthy *Non-commutative Function Theory - is it about matrices or operators? Yes.*
10:00 – 10:30	Coffee break
10:30 - 11:20	Jurij Volčič *Multipartite rational functions and NC difference-differential calculus*
11:20 – 11:30	Short break
11:30 - 12:20	Victor Vinnikov *On the 100th anniversary of the birth of M.S. Livsic: from the characteristic function of a nonselfadjoint operator to free noncommutative interpolation and extension theorems*
12:20 – 14:20	Lunch break
14:20 - 15:10	Gelu Popescu *Hyperbolic geometry on noncommutative polyballs*
15:10 – 15:40	Coffee break
15:40 - 16:30	Guy Salomon *The isomorphism problem for noncommutative analytic varieties*
16:30 – 16:40	Short break
16:40 - 17:30	Bill Helton *TBA*
17:45	Pickup back to the hotel

	Wednesday
8:15	Pickup at the hotel
9:10 - 10:00	Paul Muhly *Matrix bundles in free analysis: where free functions live and thrive*
10:00 – 10:30	Coffee break
10:30 - 11:20	Ben Passer *Matrix convex sets and dilations*
11:20 – 11:30	Short break
11:30 - 12:20	Daniel Markiewicz *Classification of C*-envelopes of tensor algebras arising from stochastic matrices*
12:20 – 14:20	Lunch break
14:20 - 15:10	Valentin Deaconu *Cuntz-Pimsner algebras from group representations*
15:10 – 15:40	Coffee break
15:40 - 16:30	Rachel M. Norton *Pick interpolation and the displacement equation*
16:30 – 16:40	Short break
16:40 - 17:30	Baruch Solel *Hardy algebras associated with W^*-correspondences*
18:00 – 20:00	Banquet
20:15	Pickup back to the hotel

	Thursday
8:15	Pickup at the hotel
9:10 - 10:00	Michael Dritschel *Traces of analytic uniform algebras on subvarieties and test collections*
10:00 – 10:30	Coffee break
10:30 - 11:20	Evgenios Kakariadis *Semigroup actions on operator algebras*
11:20 – 11:30	Short break
11:30 - 12:20	Magdalena Georgescu *Approximation of groupoids*
12:20 – 14:20	Lunch break
14:20 - 14:50	Dinesh Kumar Keshari *Rigidity of the flag structure for a class of Cowen-Douglas operators*
14:50 – 15:00	Short break
15:00 - 15:30	Dominik Schillo *Schatten-class perturbations of Toeplitz operators*
15:30 – 16:00	Coffee break
16:00 - 16:30	Adam Dor-On *Representations of Toeplitz-Cuntz-Krieger algebras*
16:30 – 16:40	Short break
16:40 - 17:30	Elias Katsoulis *Crossed products of operator algebras: applications of Takai duality*
17:45	Pickup back to the hotel

Abstracts

Choquet order and hyperrigidity for function systems

Kenneth R. Davidson

The Choquet order on measures is used to establish that states on a function system always have a representing measure supported on the set of extreme points of the state space (in a technical sense). We introduce a new operator-theoretic order on measures, and prove that it is equivalent to the Choquet order. This leads to some improvements in the classical theory, but more importantly it leads to some new operator-theoretic consequences. In particular, we establish Arveson's hyperrigidity conjecture for function systems. This yields a significant strengthening of the classical approximation theorems of Korovkin and Šaškin. This is joint work with Matthew Kennedy.

Cuntz-Pimsner algebras from group representations

Valentin Deaconu

We discuss various constructions of C^*-correspondences arising from group representations and from the action of a group on a graph. The class of the associated Cuntz-Pimsner algebras is very large and in some cases we can identify them as graph C^*-algebras or crossed products and determine their K-theory. There are connections with Doplicher-Roberts algebras, Nekrashevych algebras of self-similar group actions and with Cuntz-Pimsner algebras considered by Kumjian. We illustrate with several examples.

Representations of Toeplitz-Cuntz-Krieger algebras

Adam Dor-On

By a result of Glimm, we know that classifying representations of non-type-I C^*-algebras up to unitary equivalence is essentially impossible (at least with countable structures). Instead of this, one either restricts to a tractable subclass or weakens the invariant.

In the theory of free semigroup algebras, this is done for Toeplitz-Cuntz algebras, and is achieved via two key results in the theory: the first is a theorem of Davidson, Katsoulis and Pitts on the 2×2 structure of free semigroup algebras, and the second, a Lebesuge-von Neumann-Wold decomposition theorem of Kennedy.

This talk is about joint work with Ken Davidson and Boyu Li, where we generalize this theory to representations of Toeplitz-Cuntz-*Krieger* algebras associated to a directed graph G. We prove a structure theorem akin to that of Davidson, Katsoulis and Pitts, and provide a Lebesuge-von Neumann Wold decomposition using Kennedy's theorem. We discuss some of the difficulties and similarities when passing to the more general context of operator algebras associated to directed graphs.

Traces of analytic uniform algebras on subvarieties and test collections

Michael Dritschel

Given a complex domain Ω and analytic functions $\varphi_1, \ldots, \varphi_n : \Omega \to \mathbb{D}$, we discuss geometric conditions for $H^\infty(\Omega)$ to be generated by functions of the form $g \circ \varphi_k$, $g \in H^\infty(\mathbb{D})$. This is applied to the extension of bounded functions on an analytic one-dimensional complex subvariety of the polydisk $\mathbb{D}^n$ to functions in the Schur-Agler algebra of $\mathbb{D}^n$, with an estimate on the norm of the extension.

Bergman inner functions and wandering subspaces

Joerg Eschmeier

Let $H_m(\mathbb{B}, \mathcal{D})$ be the $\mathcal{D}$-valued functional Hilbert space with reproducing kernel $K_m(z,w) = (1 - \langle z, w\rangle)^{-m} 1_{\mathcal{D}}$. A closed subspace $\mathcal{W} \subset H_m(\mathbb{B}, \mathcal{D})$ is called a wandering subspace if $\mathcal{W} \perp M_z^\alpha \mathcal{W}$ for all $\alpha \in \mathbb{N}^n \setminus \{0\}$. Obvious examples arise as images $W(\mathcal{E})$ of K_m-inner functions that is, operator-valued analytic functions $W : \mathbb{B} \to L(\mathcal{E}, \mathcal{D})$ such that $\|Wx\|_{H_m(\mathbb{B},\mathcal{D})} = \|x\|$ for all $x \in \mathcal{E}$ and $(W\mathcal{E}) \perp M_z^\alpha (W\mathcal{E})$ for all $\alpha \in \mathbb{N}^n \setminus \{0\}$. Among other things, we show that each wandering subspace $\mathcal{W} \subset H_m(\mathbb{B}, \mathcal{D})$ is of this form and that the K_m-inner functions are precisely the transfer functions $W : \mathbb{B} \to L(\mathcal{E}, \mathcal{D})$,$W(z) = D + C\sum_{k=1}^m (1 - ZT^*)^{-k} ZB$, where $T \in L(H)^n$ is a pure m-hypercontraction and the operators T^*, B, C, D form a suitable 2×2-operator matrix. Thus we extend results proved by Olofsson on the unit disc to the case of the unit ball $\mathbb{B} \subset \mathbb{C}^n$.

Operator theory in Drury-Arveson space

Quanlei Fang

The Drury-Arveson space is one of the natural multivariable generalizations of the classic Hardy space. It also has the structure of a Hilbert module given by a commuting tuple of operators acting on it. In this talk I will discuss some recent operator-theoretical results on this space.

Approximation of groupoids

Magdalena Georgescu

I will describe a method of approximating a Lindelöf groupoid G as an inverse limit of second countable groupoids which are quotients of G. Some of the nice properties of G can be shown to pass to the quotient groupoids. The construction is such that structures associated to G (e.g. system of Haar measures or Fell bundles) can also be approximated. I will conclude by discussing an application of this approach to representation theory. This is joint work with Kyle Austin and Joav Orovitz.

Interpolating sequences in complete Pick spaces

Michael Hartz

A classical theorem of Carleson characterizes sequences in the unit disc which are interpolating for H^∞. Bishop and Marshall–Sundberg established an analogue of Carleson's theorem for the multiplier algebra of the Dirichlet space. I will talk about a generalization of these results to multiplier algebras of complete Pick spaces, which applies in particular to the Drury-Arveson space. This is joint work with Alexandru Aleman, John McCarthy and Stefan Richter.

TBA

J. William Helton

TBA

Semigroup actions on operator algebras

Evgenios Kakariadis

The study of operator algebras arising from dynamical systems is almost as old as the study of operator algebras themselves. Recently the research has turned the focus to actions of semigroups on an arbitrary operator algebra by endomorphisms and their dilation to group actions. In this talk we will present recent findings for the free abelian semigroup. These include the Cuntz-Nica-Pimsner algebra that generalises the Cuntz-Pimsner algebra of the one variable case and the usual C*-crossed product for group actions. In particular we will present a technique for dilating commuting endomorphisms to commuting automophisms on a larger C*-algebra such that the corresponding (minimal) Cuntz-Nica-Pimsner algebras are strong Morita equivalent. Hence we can reduce problems on semigroup actions to problems on group actions. Further consequences of our analysis include the association of the ideal structure/nuclearity/exactness of the Nica-Pimsner algebras with minimality-freeness/nuclearity/exactness of the C*-dynamics. The talk is based on a joint work with Ken Davidson and Adam Fuller (Memoirs AMS) and sole-authored work (IMRN).

Crossed products of operator algebras: applications of Takai duality

Elias G. Katsoulis

We will review the theory of crossed products of arbitrary operator algebras with an emphasis on applications, e.g., Hao Ng isomorphism. We will also present new results: using Takai duality we establish connections with the theory of semicrossed products, studied by Arveson, Davidson, Peters, Muhly, Solel and others. We will use these connections to answer problems stemming from the earlier work of the authors. (Joint work with Chris Ramsey.)

Rigidity of the flag structure for a class of Cowen-Douglas operators

Dinesh K. Keshari

Motivated by homogeneous operators, we consider a subclass of Cowen-Douglas class of operators possessing a flag structure. We show that these operators are irreducible. we also show that the flag structure is rigid, that is, the unitary equivalence class of the operator and the flag structure determine each other. We also obtain a complete set of unitary invariants which are somewhat more tractable than those of an arbitrary operator in the Cowen-Douglas class. This is a joint work with Kui Ji, Chunlan Jiang and Gadadhar Misra.

Classification of C*-envelopes of tensor algebras arising from stochastic matrices

Daniel Markiewicz

In this talk we discuss the C*-envelope of the (non-self-adjoint) tensor algebra associated via subproduct systems to a finite irreducible stochastic matrix P.

We showed previously that there are examples of such C*-envelopes that are not *-isomorphic to either the Toeplitz algebra or the Cuntz-Pimsner algebra, which was somewhat unexpected. In this talk we provide a detailed identification of the boundary representations of the tensor algebra inside the Toeplitz algebra, also known as its non-commutative Choquet boundary. We apply this characterization to clarify matters by describing the various C*-envelopes that can land between the Toeplitz and the Cuntz-Pimsner algebras. More precisely, we classify the C*-envelopes of tensor algebras up to *-isomorphism and stable isomorphism, in terms of the underlying matrices.

This talk is based on the paper: A. Dor-On and D. Markiewicz, "C*-envelopes of tensor algebras arising from stochastic matrices", arXiv:1605.03543 [math.OA], to appear in *Integral Equations and Operator Theory*.

Non-commutative Function Theory - is it about matrices or operators? Yes.

John E. McCarthy

Non-commutative function theory, as developed by Kaliuzhnyi-Verbovetskyi and Vinnikov, is about generalized non-commutative polynomials, and is analogous to considering a holomorphic function a generalized commutative polynomial.

These functions can be evaluated on matrices or on operators. The former is simpler, but the latter also has important applications, and in some sense utilizes completeness. We shall start with a discussion of what non-commutative functions are, and give an apporach to pass back and forth between thinking of them as functions of matrices and functions of operators.

Matrix bundles in free analysis: where free functions live and thrive

Paul S. Muhly

In this talk, which is based upon joint work with Erin Griesenauer and Baruch Solel, I will discuss advances in the problem of identifying Arveson's boundary representations and C^*-envelopes of subalgebras of homogeneous C^*-algebras built from algebras of generic matrices. In more detail, let X be a compact subset of the d-tuples of $n \times n$ matrices, $M_n(\mathbb{C})^d$, and let $\mathbb{G}(d, n, X)$ be the closed subalgebra of $C(X, M_n(\mathbb{C}))$ generated by the "coordinate functions", $\mathcal{Z}_k$, where $\mathcal{Z}_k(\mathfrak{z}) = Z_k$, and $\mathfrak{z} = (Z_1, Z_2, \ldots, Z_d) \in M_n^d(\mathbb{C})$. The problems that I will address include: Describe the C^*-subalgebra of $C(X, M_n(\mathbb{C}))$ generated by $\mathbb{G}(d, n, X)$, $C^*(\mathbb{G}(d, n, X))$. Calculate sufficiently many boundary representations of $C^*(\mathbb{G}(d, n, X))$ for $\mathbb{G}(d, n, X)$ to determine the Shilov boundary ideal of $C^*(\mathbb{G}(d, n, X))$ for $\mathbb{G}(d, n, X)$. The key to our analysis is to view elements of $\mathbb{G}(d, n, X)$ as cross sections of a certain holomorphic matrix bundle built over the maximal ideal space of a function algebra generated by the functions $\mathfrak{z} \to tr(\mathcal{Z}^w(\mathfrak{z}))$, where $\mathcal{Z}^w(\mathfrak{z}) = \mathcal{Z}_{i_1}(\mathfrak{z})\mathcal{Z}_{i_2}(\mathfrak{z}) \cdots \mathcal{Z}_{i_k}(\mathfrak{z})$ and $w = i_1 i_2 \cdots i_k$.

Pick interpolation and the displacement equation

Rachel M. Norton

Since the original proof of Pick's interpolation theorem in 1915, there have been a variety of generalizations to operator theory, all but two of which may be recovered by Muhly-Solel's result from 2004. Muhly and Solel think of Pick interpolation as an instance of commutant lifting. Constantinescu-Johnson and Popescu, on the other hand, use the displacement equation to prove results which are fundamentally different from Muhly-Solel's. In this talk, we address the differences and discuss circumstances under which the theorems are equivalent.

Matrix convex sets and dilations

Ben Passer

Given a compact convex subset K of real Euclidean space, there are possibly multiple matrix convex sets which admit K as the first level. Among these, a minimal and maximal set are easily described, which we can denote as $\mathcal{W}^{\min}(K)$ and $\mathcal{W}^{\max}(K)$. Roughly speaking, $\mathcal{W}^{\max}(K)$ includes tuples of matrices satisfying the same linear inequalities that determine K, and $\mathcal{W}^{\min}(K)$ includes tuples of matrices admitting a normal dilation (i.e., a dilation tuple of normal and commuting operators) with joint spectrum inside K.

I will discuss some recent progress on the dilation problem: when is $\mathcal{W}^{\max}(K)$ contained in $\mathcal{W}^{\min}(L)$, and when is L minimal, either as a set or as a scalar multiple of K? In particular, we have obtained explicit dilations and minimal scales for the ℓ^p balls and their positive sections. Moreover, we have seen that techniques of convex geometry may be used to find some minimal dilation hulls.

Hyperbolic geometry on noncommutative polyballs

Gelu Popescu

In this talk, we present basic results concerning the structure of free k-pluriharmonic functions on regular polyballs $\mathbf{B}_{\mathbf{n}}(\mathcal{H})$ in $B(\mathcal{H})^{n_1+\cdots+n_k}$, where $\mathbf{n}=(n_1,\ldots,n_k)\in\mathbb{N}^k$ and $B(\mathcal{H})$ is the algebra of all bounded linear operators on a Hilbert space $\mathcal{H}$. We characterize the bounded free k-pluriharmonic functions in terms of k-multi-Toeplitz operators on tensor products of full Fock spaces, and solve the Dirichlet extension problem on regular polyballs. The theory of free k-pluriharmonic functions is used to introduce hyperbolic type metrics on regular polyballs, study their basic properties, and obtain hyperbolic versions of Schwarz-Pick lemma for free holomorphic functions on these polyballs.

When specialized to the regular polydisk $\mathbf{D}^k(\mathcal{H})$ (which corresponds to the case $n_1=\cdots=n_k=1$), our hyperbolic metric δ_H is complete and invariant under the group of all free holomorphic automorphisms of $\mathbf{D}^k(\mathcal{H})$, and the δ_H-topology induced on $\mathbf{D}^k(\mathcal{H})$ is the usual operator norm topology. The restriction of δ_H to the scalar polydisk $\mathbb{D}^k$ is equivalent to the Kobayashi distance on $\mathbb{D}^k$. Most of the results are presented in the more general setting of Harnack (resp. Poisson) parts of the closed polyball $\mathbf{B}_{\mathbf{n}}(\mathcal{H})^-$.

The isomorphism problem for noncommutative analytic varieties

Guy Salomon

For a noncommutative (nc) subvariety $\mathfrak{V}$ of the nc unit ball, the algebra of bounded analytic functions on $\mathfrak{V}$ — denoted $H^\infty(\mathfrak{V})$ — can be identified as the multiplier algebra of a certain reproducing kernel Hilbert space consisting of nc functions on $\mathfrak{V}$.

In this talk I will show when two such algebras $H^\infty(\mathfrak{V})$ and $H^\infty(\mathfrak{W})$ are isometrically isomorphic (and also completely isometrically isomorphic) in terms of the varieties $\mathfrak{V}$ and $\mathfrak{W}$. We will also focus in the homogeneous case in which we were able to obtain some sharper results. In addition, we will discuss the algebras of bounded analytic functions that extend continuously to the boundary of the nc ball.

Along the way I will present a nc version of the Nullstellensatz for both the homogeneous as well as the commutative case.

The talk is based on a joint work with Eli Shamovich and Orr Shalit.

Variations on a theme of Beurling and Hilbert modules

Jaydeb Sarkar

First we will formalize the classical Beurling theorem in the Language of Hilbert modules over the ring of polynomials. With this motivation, we then survey prior work on submodules, quotient modules of general Hilbert modules, both in one and several variables, and remark on some interpretation of the invariant subspace (or, representations of submodules of Hilbert modules) problem.

Finally, we will discuss the Beurling's theme for a concrete (or, more tractable) case - commuting pair of isometries/contractions (that is, contractive Hilbert modules over the ring of 2 variables polynomials). Along the way, we will discuss the failure and success of the classical von Neumann inequality for a general (and contractive) Hilbert module.

Schatten-class perturbations of Toeplitz operators

Dominik Schillo

In this talk we show that, for $1 \leq p < \infty$ and a strictly pseudoconvex and bounded symmetric and circled domain $D \subset \mathbb{C}^n$, a given operator $X \in B(H^2(D))$ is a Schatten-p-class perturbation of a Toeplitz operator (i.e. $X = T_f + S$ for some $f \in L^\infty$ and S in the Schatten-p-class) if and only if $T_\theta^* X T_\theta - X$ lies in the Schatten-p-class for each inner function θ on D. This talk is based on joint work with Michael Didas and Joerg Eschmeier

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Hardy algebras associated with W^*-correspondences

Baruch Solel

This will be a survey talk focusing on my joint work with Paul Muhly on Hardy algebras that are associated with W^*-correspondences.

On the 100th anniversary of the birth of M.S. Livsic: from the characteristic function of a nonselfadjoint operator to free noncommutative interpolation and extension theorems

Victor Vinnikov

This year marks the centennial of the birth of M.S. Livsic, one of the great minds of operator theory. My purpose in this talk is both to celebrate this occasion and to discuss the latest incarnation of Livsic's greatest discovery — the notion of the characteristic function — in the blooming new field of free noncommutative analysis.

The notion of the characteristic function was originally introduced (in Livsic's seminal paper in 1946) for a nonselfadjoint operator with a one-dimensional imaginary part. It is a contractive analytic function on the upper half plane that determines the completely nonselfadjoint part of the operator uniquely up to unitary similarity. This allows to use the well developped machinery of function theory for the spectral analysis of the operator.

However, like any conceptual notion, that of the characteristic function turned out to have a life of its own. It became clear over the years that in many circumstances it is advantageous to realize a given function (or a function that one is looking for, as in interpolation problems) as the characteristic function. This is especially the case for matrix and operator valued functions, and (following J. Agler's breakthrough in the late 1980s) functions of several complex variables.

It is also the case for free noncommutative functions — graded functions from a subset of the set of square matrices of all sizes over one vector space to the set of square matrices of all sizes over another vector space that respect direct sums and similarities, that were first discovered by J.L. Taylor in his monumental work on noncommutative spectral theory in the early 1970s. I will present a realization and interpolation theorem for operator-valued noncommutative functions on a large variety of domains that generalizes considerably the previous results of Ball–Groenewald–Malakorn and of Agler–McCarthy. The domains in questions are "unit balls" with respect to an operator-valued noncommutative function defined on a full noncommutative set. Such domains could be perhaps viewed as a noncommutative analogue of analytic polyhedra. They include all (finitely open) matrix convex sets, and satisfy the following extension property which is reminiscent yet strikingly different from the extension theorems of Cartan and Henkin in several complex variables: any (operator-valued) noncommutative function on a relatively full nc subset of the domain can be extended to all of the domain without increasing the supremum norm.

The noncommutative part of the talk is based on joint work with J. Ball and G. Marx.

Multipartite rational functions and NC difference-differential calculus

Jurij Volcic

The universal skew field of fractions of a free algebra can be constructed through noncommutative rational functions and thus fits into the context of NC function theory. In this talk we present multipartite rational functions, which are higher order analogs of noncommutative rational functions. Their role is twofold: on one hand they arise from applying difference-differential operators to noncommutative rational functions, while on the other hand they form a skew field of fractions of a tensor product of free algebras. The combination of these two perspectives allowed us to prove that this skew field is universal. Tensor products of free algebras are thus examples of rings that are not Sylvester domains but still admit universal skew fields of fractions, which settles a question of P. M. Cohn. Moreover, our result yields an analog of Amitsur's theorem for multipartite rational identities. This talk is based on joint work with Igor Klep and Victor Vinnikov.

A complex harmonic analysis approach to the geometric Arveson-Douglas conjecture

Yi Wang

In many analytic Hilbert Modules such as weighted Bergman modules, the Hardy module or the Drury-Arveson module, one can obtain a submodule by taking the closure of a polynomial ideal, or taking all functions that vanish on some subvariety. The (Geometric) Arveson-Douglas Conjecture concerns the (p-) essential normality of such submodules. We use complex Harmonic analysis methods to solve this problem in several cases on weighted Bergman modules on the unit ball and show its connection with the problem of holomorphic extension.
