

SEAM 21 - W&L - Titles & Abstracts - April 8-9, 2005

Alphabetical by last name of speaker

Principal Speakers

Raúl E. Curto Department of Mathematics, University of Iowa, 14 MLH, Iowa City, IA 52242
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Title: *The lifting problem for hyponormal pairs of commuting subnormal operators*

Abstract: In joint work with Jasang Yoon, we construct three different families of commuting pairs of subnormal operators, jointly hyponormal but not admitting commuting normal extensions. Each such family can be used to answer in the negative a 1988 conjecture of R. Curto, P. Muhly and J. Xia. We also obtain a sufficient condition under which joint hyponormality does imply joint subnormality.

Our tools include the use of 2-variable weighted shifts, the six-point test for joint hyponormality, disintegration of measures techniques, the theory of multivariable moment problems, and matrix positivity. We obtain new necessary conditions for the existence of a lifting, and generate new pathology associated with bringing together the Berger measures associated to each individual weighted shift.

For subnormal 2-variable weighted shifts, we then find the precise relationship between the Berger measure of the pair and the Berger measures of the shifts associated to horizontal rows and vertical columns of weights.

Finally, we consider the (multivariable) spectral theory of these hyponormal pairs, and discover some unexpected new phenomena, not present in the single variable theory.

Ken Davidson Department of Pure Mathematics, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada,
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Title: *Norms of Schur Multipliers**

Abstract: We characterize subsets \mathcal{P} of \mathbb{N}^2 which are *Schur bounded* in the sense that every set of bounded scalar entries supported on this ‘pattern’ are bounded Schur multipliers on $\mathcal{B}(\mathcal{H})$. This also yields a new more elementary proof of results of Varopoulos and Pisier.

We also compute the precise Schur norm of certain Schur idempotents with a large symmetry group. This is quite surprising, as exact calculations of such norms is usually not possible. *with Allan Donsig

Steve Krantz Department of Mathematics, Campus Box 1146, Washington University in St. Louis, St. Louis, MO 63130, e-mail: sk@math.wustl.edu

Title: *Analysis on the Worm Domain*

Abstract: In 1977 Klas Diederich and John Erik Fornaess produced a stunning example—the worm domain—to provide a counterexample to a longstanding conjecture about the geometry of domains in complex space. In more recent years, the worm domain has proved to be important in other contexts, particularly in the study of the $\bar{\partial}$ -Neumann problem. As an instance, in 1996 Michael Christ proved that the important Condition R of holomorphic mapping theory fails on the (smooth) worm domain.

In joint work with Marco Peloso, we study the harmonic analysis of the (non-smooth) worm domain. In particular, we calculate the Bergman kernel and study mapping properties of the Bergman projection.

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Title: *Geodesics and the Zipper algorithm for conformal mapping*

Abstract: In the early 1980’s an elementary algorithm for computing conformal maps was discovered independently by R. Kühnau and the speaker. The algorithm is fast and accurate, but convergence was not known. Given points z_0, \dots, z_n in the plane, the algorithm computes an explicit conformal map of the unit disk onto a region bounded by a piecewise analytic curve γ with $z_0, \dots, z_n \in \gamma$. In this joint work with S. Rohde we prove convergence for Jordan regions in the sense of uniformly close boundaries, and give corresponding uniform estimates on the closed disc for the mapping functions. Improved estimates are obtained if the data points lie on a C^1 curve or a K -quasicircle. The algorithm was discovered as an approximate method for conformal welding, however it can also be viewed as a discretization of the Löwner differential equation. The ideas are simple enough to give a constructive proof of the Riemann mapping theorem suitable for a first course in complex analysis.

Contributed Talks

John Akeroyd Department of Mathematics, Science-Engineering 301, University of Arkansas, Fayetteville, AR 72701, e-mail: jakeroyd@uark.edu

Title: *Minimal Kernels, Quadrature Identities and Proportional Harmonic Measures* (Joint work with K. Karber and A. Solynin)

Abstract: We describe nonnegative “kernels” that are minimal at a given point of \mathbb{T} and are related to quadrature identities for harmonic functions. The problem has a geometric interpretation in terms of a system of crescent regions carrying proportional harmonic measures. This system occurs as circle domains of quadratic differentials with second order poles. Our results have applications to harmonic polynomial approximation.

Ariyadasa Aluthge 1 John Marshall Drive, Marshall University, Huntington, West Virginia 25755
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Title: *Some results relating to the operator transform $\tilde{T} = |T|^{1/2}U|T|^{1/2}$*

Abstract: Let $T = U|T|$ be a bounded linear operator on a complex Hilbert space H . Define the operator transform $\tilde{T} = |T|^{1/2}U|T|^{1/2}$. In this talk I will present several results relating to the above operator transform. In particular, I will present results showing how the above transform can be used to study the properties involving the spectrum and the numerical range. I will also discuss some results relating to the operator inequality $|\tilde{T}| \geq |T| \geq |\tilde{T}^*|$.

John T. Anderson Department of Mathematics and Computer Science, College of the Holy Cross, Worcester, MA 01610-2395, e-mail: anderson@mathcs.holycross.edu

Title: *Boundary Behavior of Cauchy Transforms of Characteristic Functions on the Sphere in \mathbb{C}^2* (joint work with Joseph A. Cima)

Abstract: Let Ω be a smoothly bounded relatively open subset of the unit sphere S in \mathbb{C}^2 , with boundary Γ . Let $E(\Gamma)$ be the set of points at which Γ has a complex tangent, and let χ_Ω be the characteristic function of Ω . We prove: *if f satisfies a Lipschitz condition with exponent α on S , then the Cauchy transform of $f\chi_\Omega$ has admissible limits at each point of $S \setminus E(\Gamma)$.*

Valentin Andreev Department of Mathematics, P. O. Box 10047, Lamar University, Beaumont, TX 77710, e-mail: andreev@math.lamar.edu

Title: *The Identity Function Maximizes the Chang-Marshall Inequality Over the Beurling Functions*

Abstract: S.-Y. A. Chang and D. E. Marshall showed that the functional $\Lambda(f) = (1/2\pi) \int_0^{2\pi} \exp\{|f(e^{i\theta})|^2\} d\theta$ is bounded on the unit ball \mathcal{B} of the space \mathcal{D} of analytic functions in the unit disk with $f(0) = 0$ and Dirichlet integral not exceeding one. Andreev and Matheson conjectured that the identity function $f(z) = z$ is a global maximum on \mathcal{B} for the functional Λ . We prove that Λ attains its maximum at $f(z) = z$ over a subset of \mathcal{B} determined by kernel functions, which provides a positive answer to a conjecture of Cima and Matheson. We use the theory of the *-function introduced by Albert Baernstein, II.

Catherine Beneteau Department of Mathematics and Computer Science, Seton Hall University, South Orange, NJ 07079, e-mail: beneteca@shu.edu

Title: *Extremal problems for non-vanishing functions in Bergman spaces*

Abstract: In this talk, I will discuss general extremal problems for non-vanishing functions in Bergman spaces. In a wide class of such problems, solutions exist and are unique. I will examine certain regularity results: the extremal functions in the problems considered must be in a Hardy space, and in fact must be bounded. Finally, I will look at the specific problem of minimizing the norm of non-vanishing Bergman functions whose first two Taylor coefficients are given. Surprisingly, the conjectured form of the extremal is not continuous in the closed disk! This seems to be the first example of its kind. The talk is based on joint work with D. Aharonov, D. Khavinson, and H. Shapiro.

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Title: *Commutant lifting for *-regular dilation of a bicontraction* (Joint work with J. A. Ball)

Abstract: We will discuss a general technique for obtaining commutant lifting results starting with the corresponding results for $C_{.,0}$ (or $C_{0,.}$) case. A "multivariate" adjustment of this technique will then be applied to obtain a generalization of the Ball-Li-Timotin-Trent commutant lifting result for the polydisc .

Vladimir Bolotnikov Department of Mathematics, College of William and Mary, P.O.Box 8795, Williamsburg, VA 23187-8795, e-mail: vladi@math.wm.edu

Title: *On negative inertia of Pick matrices associated with generalized Schur functions*

Abstract: Let \mathcal{S}_0 be the Schur class of functions analytic on the unit disk \mathbb{D} and mapping it into the closed unit disk. More generally, given an integer $\kappa \geq 0$, let \mathcal{S}_κ be the generalized Schur class consisting of functions f of the form $f = \frac{S}{b}$ where $S \in \mathcal{S}_0$ and b is a finite Blaschke product of degree κ having no common zeros with S . It is well known that for every $f \in \mathcal{S}_\kappa$, every integer n and every choice of n points z_1, \dots, z_n in the domain of definition of f , the $n \times n$ Pick matrix $\left[\frac{1-f(z_i)f(z_j)^*}{1-z_i\bar{z}_j} \right]_{j,i=1}^n$ has at most κ negative eigenvalues. It is also known that for every nonempty open subset $\Omega \subseteq \mathbb{D}$, there exist points $z_1, \dots, z_n \in \Omega$ such that the corresponding Pick matrix has exactly κ negative eigenvalues. We will discuss the following question: given a function $f \in \mathcal{S}_\kappa$ and a domain $\Omega \subseteq \mathbb{D}$, does there exist an integer n_0 such that any Pick matrix based on $n \geq n_0$ points z_1, \dots, z_n in Ω has κ negative eigenvalues? The answer will be given for the case when $\Omega = \mathbb{D}$ and for the case when $\bar{\Omega} \subset \mathbb{D}$. Two additional examples will demonstrate that the original question is not simple. The talk is based on a joint work with A. Kheifets.

Melkana Brakalova 441 East Fordham Rd, Math Dept, Fordham University, Bronx, NY 10458
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Title: *On the degenerate Beltrami equation and μ - homeomorphisms*

Abstract: Let D be a domain in the complex plane and let $\mu(z)$ be a complex valued function in D . It is well known that the solutions to the Beltrami equation $w_{\bar{z}}(z) = \mu(z)w_z(z)$ are quasiconformal mappings if $\|\mu(z)\|_\infty < 1$ in D . The Beltrami equation is called degenerate in D if one allows $\|\mu(z)\|_\infty = 1$. The solutions to the degenerate Beltrami equation, if they exist, are often called μ - homeomorphisms and the study of their existence, uniqueness and properties have lately been of considerable interest. I'll discuss some of the new results in this area including some of my joint work with James A. Jenkins.

Joseph A. Cima Dept. of Mathematics, Univ. of North Carolina, Phillips Hall 3250, Chapel Hill, 27599-3250,
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Title: *Projections on Bergman space*

Abstract: It has been known (Bekolle-78) that the Bergman projection of an L^1 function (on the disc, Lebesgue measure) is in the vector space weak- L^1 (of the disc). We show that this result is valid for finite Borel measures and that given a measure μ one can produce an L^1 function that yields the same Bergman projection. This is valid in domains more general than the disc.

John Daughtry Department of Mathematics, East Carolina University, Greenville, NC 27858
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Title: *The unit ball in certain operator algebras*

Abstract: Aron and Lohman introduced the concept of a "lambda property" (along with a "uniform" version) for the unit ball in a Banach space. G. Pederson (1991) showed that lambda is at least 1/2 in a von Neumann algebra. Barnet Weinstock and Daughtry exhibit a sequence of nonselfadjoint algebras with the "uniform lambda property" such that the largest possible lambda goes to 0 as the index approaches infinity.

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Title: *Interpolation in semigroupoid algebras*

Abstract: A seminal result of Jim Agler characterises the so-called Schur-Agler class of functions on the polydisk in terms of a unitary colligation transfer function representation. Michael Jury found a way, by looking at algebras of functions over an ordered commutative monoid, to unify several familiar interpolation problems. We generalise Agler and Jury's work, incorporating ideas of Calin Ambrozie to consider the unit ball of the algebra of multipliers for a family of test functions over a broad class of semigroupoids with a natural ordering. There is then an associated interpolation theorem. This provides an umbrella covering the familiar Nevanlinna-Pick and Cartheodory-Fejer interpolation problems, generalizations of these to multiply connected domains, multivariable commutative and noncommutative versions, as well as a variety of exotic hybrids and species nova.

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Title: *An extremal truncated moment problem*

Abstract: In the multivariable truncated moment problem, to have a representing measure for the moment data, it is necessary that the rank of the associated moment matrix is less than or equal to the cardinality of the algebraic variety associated to the data. We discuss recent results concerning the case when the rank and cardinality are equal. (Joint work with Raul Curto and Michael Moeller)

Stephan Garcia Department of Mathematics, U.C. Santa Barbara, Santa Barbara, CA, 93106-3080

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Title: *Refined Polar Decomposition for Complex Symmetric Operators*

Abstract: The class of complex symmetric operators includes all normal, Hankel, and compressed Toeplitz operators (including the compressed shift) as well as many standard integral and differential operators (including the Volterra operator). We discuss a refinement of the standard polar decomposition that applies to such operators and highlight a few applications.

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Title: *Sampling sets and Composition operators on the Bloch space*

Abstract: If φ is a holomorphic self-map of the unit disk D and C_φ is the corresponding composition operator on the Bloch space \mathbf{B} , let $\tau_\varphi(z) = \frac{(1-|\varphi(z)|^2)\varphi'(z)}{1-|z|^2}$ and $G_\epsilon = \{\varphi(z), |\tau_\varphi(z)| > \epsilon\}$. C_φ has closed-range on \mathbf{B} if and only if G_ϵ is a sampling set for derivatives of Bloch functions (as defined by Seip). If φ is univalent, then this holds if some pseudohyperbolic-neighborhood of G_ϵ covers D .

Gajath Gunatillke Department of mathematics, Purdue University, 150 North University street, West Lafayette, IN 47907, e-mail: gajathg@math.purdue.edu

Title: *Spectrum of a compact weighted composition operator*

Abstract: For ψ analytic on the unit disk and φ an analytic map of the unit disk into itself, the weighted composition operator $C_{\psi,\varphi}$ is the operator on the Hardy space H^2 given by

$$(C_{\psi,\varphi}f)(z) = \psi(z)f(\varphi(z))$$

When ψ is in H^∞ , the weighted composition operator is bounded for any analytic map φ of the disk into itself, but for some ψ and φ , the operator $C_{\psi,\varphi}$ is bounded even though ψ is unbounded in the disk.

In this talk, we describe the spectrum of this operator when it is compact. Since $C_{\psi,\varphi}(1) = \psi$, if $C_{\psi,\varphi}$ is bounded on H^2 , the function ψ belongs to H^2 and can be extended to the unit circle. We will compute the spectrum in the case that ψ is bounded away from zero on the unit circle, that is, $\inf\{|\psi(w)| : |w| = 1\} > 0$.

Gilbert Groenewald, Department of Mathematics, North-West University, Potchefstroom, 2520, South Africa, e-mail: wskg@puk.ac.za

Title: *Conservative linear systems with evolution along a free semigroup and noncommutative function theory*
Abstract: The operator-valued Schur class consists of functions analytic on the unit disk with values equal to contraction operators between two Hilbert spaces. Equivalently, the operator-valued function $S(z)$ belongs to the Schur class if and only if $[I - S(z)S(w)^*]/(1 - z\bar{w})$ is a positive kernel, or equivalently, if and only if $S(z)$ can be realized as $S(z) = D + zC(I - zA)^{-1}B$ where $U = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$ is a unitary operator. We discuss a generalized Schur-class where $S(z)$ becomes a formal power series in noncommuting indeterminates $z = (z_1, \dots, z_d)$ with operator coefficients. Such formal power series appear in the theory of automata and formal languages, robust control and the search for Linear-Matrix-Inequality representations for quadratic functions of noncommuting formal variables in control theory applications.

Christopher Hammond Connecticut College, Box 5384, 270 Mohegan Avenue, New London, CT 06320 e-mail: cnham@conncoll.edu

Title: *The norm of a composition operator with linear symbol acting on the Dirichlet space*
Abstract: This talk will discuss the general problem of determining the norm of a composition operator acting on a Hilbert space of analytic functions. We will review the results that are already known in the context of the Hardy space and the weighted Bergman spaces, before turning our attention to the Dirichlet space. In this setting, we will obtain a representation for the norm of a composition operator induced by a map of the form $\varphi(z) = az + b$. We will compare this result to an upper bound for $\|C_\varphi\|$ that is valid whenever φ is univalent. Our work relies heavily on an adjoint formula recently discovered by Gallardo-Gutiérrez and Montes-Rodríguez.

Michael Jury Department of Mathematics, Purdue University, 150 N. University Street, West Lafayette, IN 47907-2067, e-mail: jury@math.purdue.edu

Title: *Toeplitz-composition C^* -algebras, noncommutative geometry, and the Fredholm index*
Abstract: If Γ is a Fuchsian group, then the C^* -algebra generated by the shift and the composition operators C_ϕ with symbols in Γ (acting on H^2) gives rise to an extension of the crossed product C^* -algebra $C(\mathbb{T}) \times \Gamma$. Using techniques from noncommutative geometry, in particular the Chern-Connes character and the pairing of (periodic) cyclic cohomology with K -theory, we prove some index theorems for sums of weighted composition operators whose symbols lie in Γ .

A sample result: let Γ be a cocompact, torsion-free Fuchsian group. For $\gamma \in \Gamma$, let ϕ be the Möbius transformation that implements γ , and let U_γ be the unitary obtained from the polar decomposition of C_ϕ . An operator $T = \sum T_{f_\gamma} U_\gamma$ is Fredholm if and only if its “symbol” $f = \sum f_\gamma u_\gamma$ is invertible in $C(\mathbb{T}) \times \Gamma$, and writing $f^{-1} = \sum g_\gamma u_\gamma$, we have

$$-\text{ind}(T) = \sum_{\gamma \in \Gamma} \int_{\mathbb{T}} g_\gamma(\gamma^{-1}(x)) df_{\gamma^{-1}}(x).$$

H. Turgay Kaptanoğlu Middle East Technical University, Ankara, Turkey. Currently on Sabbatical at Department of Mathematics, University of Virginia, Box 400137, Kerchof Hall, Cabell Drive Charlottesville, VA 22904, e-mail: htk3s@virginia.edu

Title: *Carleson Measures for Diagonal Besov Spaces*
Abstract: We define Carleson measures by considering natural imbeddings of diagonal Besov spaces into Lebesgue classes via certain combinations of radial derivatives. We characterize these measures in terms of Berezin transforms and Bergman metric balls. We also characterize weak convergence in diagonal Besov spaces to work with vanishing Carleson measures, and exhibit weakly convergent sequences.

Brian Kelly, University of Louisiana at Monroe, 305 Airway Bldg, ULM, Monroe, LA 71209, e-mail: kelly@ulm.edu

Title: *Optimal Mappings of the Unit Disk*
Abstract: We seek to bound the number of zeros for an H_2 function on a subdisk of the unit disk in the complex plane. When the subdisk is not centered at the origin, we will use conformal mappings to move the subdisk towards the origin. This paper examines which mappings give the optimal estimate for the number of zeros.

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Title: *Representations and the classification of directed graph algebras*

Abstract: Recently there has been an interest in non-selfadjoint operator algebras associated with directed graphs. Motivating examples include non commutative generalizations of the disc algebra and the analytic Toeplitz algebra. In this talk we develop a representation theory for these algebras and use it to classify them up to algebraic isomorphism.

Dmitry Khavinson University of Arkansas and National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230, e-mail: dkhavins@nsf.gov

Title: *Zeros of Harmonic Rational Functions and Gravitational Microlensing*

Abstract: The Fundamental Theorem of Algebra first rigorously proved by Gauss states that each complex polynomial of degree n has precisely n complex roots. In recent years various extensions of this celebrated result have been considered. In this talk we discuss the extension of the FT of algebra to harmonic polynomials of degree n . In particular, a recent theorem of D. Khavinson and G. Swiatek proves that the harmonic polynomial $\bar{z} - p(z)$, $\deg(p) = n > 1$ has at most $3n - 2$ roots as was conjectured in the early 90's by T. Sheil-Small and A. Wilmshurst. The case $n = 3$ was settled by B. Crofoot and D. Sarason. Unexpectedly, the proof of the general result involves complex dynamical systems. Still nothing is known for harmonic polynomials with conjugate degree of \bar{z} larger than 1. Last year G. Neumann and D. Khavinson showed that the maximal number of zeros of rational harmonic functions $\bar{z} - r(z)$, $\deg(r) = n > 1$ is $5n - 5$. It turned out this result resolved the conjecture by several astrophysicists dealing with the estimate on maximal number of images of a star one can see if the light is deflected by n co-planar masses. The first nontrivial case of one mass was already studied by A. Einstein in the 30s. Further applications and open problems will be discussed as well.

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Title: *Boundary properties of uniform Frostman Blaschke products*

Abstract: A Blaschke product $B(z) = \prod_{n=1}^{\infty} \frac{|a_n|}{a_n} \frac{a_n - z}{1 - \bar{a}_n z}$ is uniform Frostman if the quantity

$$\sigma(B) = \sup_{\zeta \in \mathbb{T}} \sum_{n=1}^{\infty} \frac{1 - |a_n|^2}{|\zeta - a_n|}$$

is finite. Frostman showed that the sum is finite at $\zeta \in \mathbb{T}$ if and only if B and all of its subproducts have radial limits at ζ . The uniform Frostman condition $\sigma(B) < \infty$ imposes strong geometric constraints on the zero set of B . In particular, it is a finite union of interpolating sequences, and meets every Stolz region in a finite number of points, the number bounded by a constant depending only on $\sigma(B)$. We discuss the boundary zero spectra of uniform Frostman Blaschke products and the limit properties of functions in the star-invariant subspaces K_B^p determined by these Blaschke products.

Vivien Miller Drawer MA, Mississippi State University Mississippi State, MS 39762,

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Title: *Spectral Properties of a Certain Class of Integral Operators*

Abstract: We show that a certain class of averaging operators has the decomposition property (δ). This is joint work with E. Albrecht.

Paul McGuire Mathematics Department, Bucknell University, Lewisburg, PA 17837

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Title: *C^* -algebras with subnormal generators*

Abstract: If A is an operator, then $C^*(A)$ denotes the C^* -algebra generated by A . This talk describes recent joint work with Nathan Feldman in which previous results of P. McGuire are generalized regarding when an irreducible essentially normal operator A satisfies $C^*(A) = C^*(S)$ where S is a subnormal operator. Additionally, the question of when a hyponormal operator A has a subnormal operator as a generator for its C^* -algebra is considered.

Michael M. Neumann Dept of Mathematics and Statistics, Mississippi State University, PO Drawer MA, Mississippi State, MS 39762, e-mail: neumann@math.msstate.edu

Title: *Spectral properties of generalized Cesaro operators on Hardy and Bergman spaces*

Abstract: The classical Cesaro operator is the operator that assigns to each square-summable sequence of complex numbers the corresponding sequence of Cesaro means. This operator allows a natural representation as an averaging operator on the classical Hardy space and has been extensively studied in function-theoretic operator theory. This talk centers around the spectral picture and the spectral decomposition properties of a class of operators which may be viewed as natural generalizations of the Cesaro operator on certain Banach spaces of analytic functions. Particular emphasis will be on the finer parts of the spectrum of such operators and on the questions of subnormality, hyponormality, and subdecomposability. The results of this talk were obtained in joint work with Ernst Albrecht (Saarland University) and Len Miller (Mississippi State University).

Cornel Pasnicu Department of Mathematics, University of Puerto Rico, Rio Piedras Campus, P.O. Box 23355, San Juan, PR 00931, USA, e-mail: cpasnic@upracd.upr.clu.edu

Title: *Continuous fields of Kirchberg C*-algebras*

Abstract: We study the C*-algebras associated to continuous fields over locally compact metrizable zero-dimensional spaces whose fibers are Kirchberg C*-algebras satisfying the UCT. We show that these algebras are inductive limits of finite direct sums of Kirchberg algebras and they are classified up to isomorphism by topological invariants. This is joint work with Marius Dadarlat and will appear in the Journal of Functional Analysis.

Alexander Richman Department of Mathematics, Bucknell University, Lewisburg, PA 17837
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Title: *Weighted Composition Operators on the Hardy Space with Subnormal Adjoint*

Abstract: The question of which composition operators have subnormal adjoint on the Hardy space was solved by Cowen and Kriete in 1987. In this talk, we investigate the interrelationship between the weight and the symbol, completely characterizing which weighted composition operators have subnormal adjoint. This is joint work with Tom Kriete.

Leiba Rodman Department of Mathematics, College of William and Mary, Williamsburg, VA 23187-8795, e-mail: lxrodm@math.wm.edu

Title: *Normal operators in indefinite inner product spaces*

Abstract: Recent results will be reported concerning structure and properties of normal operators with respect to finite dimensional indefinite inner product spaces. The properties include, in particular, existence of polar decompositions. Time permitting, open problems will be stated.

Josie Ryan Milligan College, TN 37682, e-mail: jryan@milligan.edu

Title: *Hardy-Sobolev Spaces and Banach Algebras on the Unit Ball of \mathbb{C}^n*

Abstract: For $0 < p \leq \infty$ let $H^p(\mathbb{B}_n)$ denote the usual Hardy space of holomorphic functions on the unit ball \mathbb{B}_n in \mathbb{C}^n , $n \geq 2$. If f is a holomorphic function on \mathbb{B}_n , the radial derivative Rf or $R^1 f$ is defined by

$$Rf(z) = \sum_{i=1}^n z_i \frac{\partial f}{\partial z_i},$$

and for $m = 2, 3, \dots$, the radial derivative $R^m f$ of order m is defined by $R^m f = R(R^{m-1} f)$. The Hardy-Sobolev space $H_m^p(\mathbb{B}_n)$ of order m is defined as the set of holomorphic functions f on \mathbb{B}_n for which $R^m f \in H^p(\mathbb{B}_n)$. The main result is as follows:

Theorem: Let $1 \leq p \leq \infty$, $n \geq 2$, and $m \in \{1, 2, 3, \dots\}$. Then the following hold:

- (a) For $m \geq n$ and $1 \leq p \leq \infty$, $H_m^p(\mathbb{B}_n)$ is an algebra.
- (b) For $1 \leq m < n$ and $n < p \leq \infty$, $H_m^p(\mathbb{B}_n)$ is an algebra.
- (c) For $1 < m < n$ and $\frac{n}{m} < p \leq n$, $H_m^p(\mathbb{B}_n)$ is an algebra.

Furthermore, the norm $\| \cdot \|_{p,m,\lambda}$ defined by

$$\|f\|_{p,m,\lambda} = \|f\|_{\infty} + \sum_{k=1}^m \lambda_k \|R^k f\|_{\frac{m}{k}p}, \quad f \in H_m^p(\mathbb{B}_n),$$

where $\{\lambda_k\}_{k=1}^m$ is a sequence of positive numbers satisfying $\lambda_k \binom{k}{j} \leq \lambda_j \lambda_{k-j}$, $j = 1, \dots, k$, is a Banach algebra norm on $H_m^p(\mathbb{B}_n)$ whenever p, m satisfy one of (a), (b), or (c) above.

By example it is shown that for $1 \leq p \leq \frac{n}{m}$, $H_m^p(\mathbb{B}_n)$ is not an algebra when $1 \leq m < n$.

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Title: *An abstract approach to the Nehari-Takagi problem*

Abstract: The band method approach to interpolation and extension problems originated some twenty years ago in work of Dym and Gohberg. It provided a unified setting for seeing the common features in a collection of problems arising in a variety of settings (finite matrices, function spaces, continuous and discrete-time as well as time-invariant and time-variant systems). In this talk, we extend this abstract scheme to handle interpolation/extension problems with a prescribed number of negative squares. For example, this variant of Nehari's problem is exactly what arises in the context of model reduction with respect to the Hankel norm in linear system theory.

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Title: *Proper uniform algebras are flat*

Abstract: A Banach space is flat if it has a curve of length two in the boundary of its unit ball with antipodal endpoints. Niykos and Schaffer showed that the the familiar space of continuous functions on a compact Hausdorff space is flat when the underlying compact Hausdorff space is not scattered. By an old result of Rudin, this is a necessary condition for a compact Hasudorff space to support a proper uniform algebra. This begs the question of whether or not all proper uniform algebras are flat.

Ilya Spitkovsky Department of Mathematics, College of William and Mary, P.O.Box 8795, Williamsburg, VA 23187-8795, e-mail: ilya@math.wm.edu

Title: *On polynomials in two projections*

Abstract: Conditions are established on a polynomial f in two variables under which the equality $f(P,Q)=0$ for two orthogonal projections P,Q is possible only if P and Q commute.

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Title: *Commutant Lifting Theorem for the Bergman space*

Abstract: The question of finding the right analogue of the Commutant Lifting Theorem for the Bergman space $L_a^2(\mathbb{D})$ will be discussed. We will present our work on this problem and the analogous problem for the weighted Bergman spaces $L_{a,\alpha}^2(\mathbb{D}, dA)$, $-1 < \alpha < \infty$.

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Title: *A local lifting theorem for subnormal operators*

Abstract: I'll talk about joint work with Witold Majdak, Zoltan Sebestyén, and Jan Stochel on criteria for the existence of lifts of operators intertwining subnormal operators. The main result reduces questions for general subnormal operators to questions about lifts of cyclic subnormal operators.

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Title: *Explicit H^p Solutions for the corona problem on the Polydisk*

Abstract: We discuss explicit solutions for the matrix valued corona problem on the polydisk. These solutions will tighten the recent estimates of Treil and Wick.

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Title: *Essentially normal linear-fractional composition operators in several variables*

Abstract: Essentially normal linear-fractional composition operators on $H^2(\mathbb{D})$ were characterized by Bourdon, Levi, Narayan and Shapiro. We will discuss analogous results for the Hardy space and Bergman space of the ball in \mathbb{C}^N . In particular, we will show that it is possible to determine when C_φ is essentially normal, for φ belonging to a large class of linear-fractional symbols.

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Title: *A Class of Matrix Operators*

Abstract: Let $\varphi = \{\varphi_0, \varphi_1, \varphi_2, \dots\}$ be a sequence of numbers. Consider the matrix operator M_φ defined by

$$M_\varphi = \begin{pmatrix} \varphi_0 & \varphi_1 & \varphi_2 & \dots \\ \varphi_1 & \varphi_1 & \varphi_2 & \dots \\ \varphi_2 & \varphi_2 & \varphi_2 & \dots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix}.$$

Matrix M_φ can be viewed as a discrete version of the following integral operator

$$Q_\psi(f)(x) = \int_0^\infty \psi(\max\{x, y\})f(y)dy,$$

which appears in a natural way when studying the boundedness problem for the Sturm-Liouville operator $Lu(x) = -u''(x) + q(x)u(x)$. Here the relation between functions ψ and q is $\psi(x) = \int_x^\infty q(t)dt$.

In this talk, we will discuss necessary and sufficient conditions for M_φ to be bounded, compact or in Schatten-von Neumann class. Extensions of M_φ and related properties will also be discussed on analytic function spaces such as Hardy and Bergman spaces.

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Title: *Right spectrum and trace formula of subnormal tuple of operators of finite type*

Abstract: We will study subnormal tuples of operators of finite type. The relation of the right spectrum and the conjugate set A of the joint point spectrum of the adjoint of the tuple of operators is given. The support of the Pincus principal function which is the rank of mosaic, is determined which is the set A in a Riemann surface in some algebraic varieties. Some operator identities are also introduced.

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Title: *Commutators of Maximal and Sharp Operators on Morrey Spaces*

Abstract: By using the boundedness of the maximal and sharp operators on Morrey spaces, we have proved that the commutators $[M, b]$ and $[M^\#, b]$ are bounded on Morrey spaces $L^{q, \lambda}$ if and only if b is in BMO and the negative part of b is in L^∞ .

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Title: “*Quantum Douglas Algebras*”–*Toeplitz algebras*

Abstract: Let B be a Douglas algebra and let \mathcal{B} be the algebra on the disk generated by the harmonic extensions of the functions in B . For each $\alpha > -1$, the “quantum Douglas algebra” \mathcal{B}_α is the Toeplitz algebra generated by Toeplitz operators (on the weighted Bergman space $L_a^2((1 - |z|^2)^\alpha dA(z))$) with symbols in \mathcal{B} .

Using the method similar to one used in recent joint work with Axler, we will show that the quantum Douglas algebra \mathcal{B}_α has a canonical decomposition $S = T_{\tilde{S}} + R$ for some R in the commutator ideal $\mathcal{C}_{\mathcal{B}_\alpha}$; and S is in $\mathcal{C}_{\mathcal{B}_\alpha}$ iff the Berezin transform $B_\alpha S$ vanishes identically on the union of the maximal ideal space of the Douglas algebra B and the set \mathcal{M}_1 of trivial Gleason parts of H^∞ . This result was obtained on the (unweighted) Bergman space in the joint work with Axler. It extends the McDonald-Sundberg Theorem and answers a question of Davidson and Douglas.