

Research Group on *Operator Algebras*

IMAR Participants: F. Boca, R. Gologan, F. Radulescu, B. Ramazan, S. Stratila

Romanian Cooperations: Bucharest University; Bucharest Polytechnical University. Two master students have been trained on this program .

International Cooperations:

Italy: Universita Roma 2 “Tor Vergata”

Denmark: Copenhagen University

France: Universite d'Orleans

Belgium: Leuven University

Germany: Humboldt University Berlin

UK: Swansea University

USA: Iowa University and Illinois University at Urbana-Champaign.

Workpackages involved: A1, B1, C1, C2.

Scientific Objectives:

1. The spectral theory of discrete Schrodinger operators with almost periodic potential and noncommutative tori.
2. Number theoretical methods in the study of the statistics of the periodic 2D Lorentz gas.
3. Homotopy Classes of Partial Isometries in von Neumann Algebras.

Main Scientific Results:

1. F. P. Boca, A. Zaharescu, Norm estimates of almost Mathieu operators, preprint arXiv math-ph/0201028.
2. F. P. Boca, R. N. Gologan, A. Zaharescu, The average length of a trajectory in a certain billiard in a flat two-torus, New York J. Math. 9 (2003), 303-330.
3. F. P. Boca, R. N. Gologan, A. Zaharescu, The statistics of a certain billiard in a flat two-torus, Comm. Math. Phys. 240 (2003), 53-73.
4. F. P. Boca, A. Zaharescu, The distribution of the free path lengths in the periodic two-dimensional Lorentz gas in the small-scatterer limit, preprint arXiv math.NT/0301270.
5. Mostafa Mbekhta and Serban Stratila: Homotopy Classes of Partial Isometries in von Neumann Algebras, Acta Sci.Math.(Szeged), 68(2002), 271-277.

Monographies:

1. F. P. Boca, Rotation C^* -algebras and almost Mathieu operators, Theta Series in Advanced Mathematics, 1. The Theta Foundation, Bucharest 2001, xviii+172 p.
2. Serban Stratila, Laszlo Zsido - Operator Algebras: A Banach Algebra Approach, to appear at The Theta Foundation, Bucharest.

Research Activity:

- A research group has been organized at IMAR, first in June-July 2001 and secondly in June-July 2003. This group has been formed by researchers from IMAR (Serban Stratila, Florin Radulescu, Florin Boca, Florin Panaite, Birant Ramazan, Ciprian Pop) and from several EU Universities.

Main research topics.

- connections between Operator algebras and Hopf algebras
- non-commutative dynamical systems
- the possibility of extending parts of the classification results from the simple to the non-simple case (of purely infinite C^* -algebras).
- Prof. F. Radulescu (IMAR and Universita Roma 2 «Tor Vergara») has given two series of lectures at IMAR, on *Classification of type III factors*. He supervised the research training activity of several young researchers at IMAR (F. Iagar, V. Lie, B. Udrea).
- Collaboration with the Mathematical Physics Group on Deformation quantization and spectral theory for quantum Hamiltonians.

Conferences, talks, seminars:

1. Alfons Van Daele: *An introduction to multiplier Hopf algebras with integrals*, conference at IMAR (June 2001)
2. Alfons Van Daele: *The Heisenberg commutation relations for multiplier Hopf algebras*, conference at IMAR (June 2001).
3. N. Christopher Phillips (University of Oregon): *Nonclassification: without nuclearity, the Elliott conjecture fails badly*, conference at IMAR (June 2001).
4. Marius Dadarlat (Purdue University): *Exact Groups*, conference at IMAR (June 2001).
5. Mikael Rordam (University of Copenhagen): *Infinite C*-algebras*; 2 conferences at IMAR (July 2001).
6. Laszlo Zsido (Univ. Roma 2): *The fixed points algebra of compact group actions through automorphisms*, conference at IMAR (April 2002).
7. Marius Dadarlat (Purdue University - West Lafayette): *C*-algebras; K-theory and Elliot' Conjecture*, conference at IMAR (June 2002).
8. F. Radulescu (IMAR and Univ. Roma 2): *On Connes conjecture*, conference at IMAR on November 28, 2003.

Lectures at the Workshop: Operator Algebras and Mathematical Physics, IMAR June-July 2003:

1. *An introduction to exact groups*, M. Dadarlat (Purdue Univ.)
2. *Purely infinite C*-algebras*, M. Rordam (Univ. of Southern Denmark)
3. *Convex trace inequalities for functions of several variables*, G. Pedersen (Copenhagen Univ.)
4. *The theory of amenable C*-algebras*, G. Elliott (Copenhagen Univ.)

Lectures at the 2004 IMAR Workshop (22 – 26 June 2004):

1. *A survey on type II₁ factors*, F. Radulescu (IMAR and Univ. Roma 2)
2. *Analytic number theory and exact results in the Lorentz model*, R. Gologan (IMAR) – common work with F. Boca and A. Zaharescu.
- *Homotopic equivalence of partial isometries in C*-algebras*, S. Stratila (IMAR)

Lecture Series:

- *Type II₁ factors*, F. Radulescu (IMAR and Univ. Roma 2)

Organization of:

- **The 4-th Operator Algebras International Conference on Operator Algebras & Mathematical Physics (OAMP-1).**

The OAMP-1 Conference has taken place at Constantza (Romania) in the period 2 - 7 July 2001. Talks have been given at the University "Ovidius" of Constantza (one large hall for plenary sessions and 2 halls of 50 places for parallel sessions).

There have been 23 invited talks of 50 minutes each and 41 communications on 2 parallel sessions: 16 of 30 minutes each and 25 of 25 minutes each. The Conference has been attended by 100 researchers: 42 from EU countries, 1 from Switzerland, 1 from Poland, 1 from Czech Republic, 1 from Moldavia, 3 from USA, 1 from Australia, 6 from Japan, 4 from Korea and 40 from Romania (Institute "Simion Stoilow", Institute of Atomic Physics and several Universities from Romania).

The Proceedings of the Conference will be published by the Theta Foundation, Bucharest (publisher of the *Journal of Operator Theory*). The Editors of the volume are: Jean-Michel Combes (Marseille), Joachim Cuntz (Munster), George Elliott (Copenhagen/Toronto), Gheorghe Nenciu (Bucharest), Heinz Siedentop (Munche), Serban Stratila (Bucharest).

Scientific Program:

- C. Anantharaman-Delaroche: On the Spectral Characterizations of Amenability
- J. Renault: AF Equivalence Relations and Cocycles
- N.P. Landsman: Functoriality of the Tangent Groupoid
- V. Georgescu: C*-algebras of Quantum Hamiltonians
- J. Zacharias: On Exactness of Discrete Groups
- D. Pask: Some Intrinsic Properties of Simple Graph Algebras

C.-K. Ng: The Category of Comodules and Injectivity
 F. Panaite: Doubles of Hopf Algebras and some examples of Quantum Groupoids
 S. Yamagami: Free Products of Tensor Categories and the Semisimplicity of Fuss-Catalan Algebras
 M. Mantoiu: Dynamical Systems at Infinity and the Essential Spectrum of Schroedinger Operators
 H. Cornean: On the Magnetization of a Charged Bose Gas in the Canonical Ensemble
 A. Iftimovici: Localizations at Infinity and Essential Spectra of Quantum Hamiltonians
 B. Kuckert: Covariant Thermodynamics of Quantum Systems; Semipassivity, the Spectrum Condition, and the Unruh Effect
 C. Ferrari: Intermixture of two Kinds of Eigenvalues in Finite Magnetic Random Systems with two Boundaries
 H. Siedentop: The Quantized Relativistic Electron-Position in Quasifree States
 E. Skibsted: Long-Range Three-Body Scattering
 P. Stollman: Quasicrystals and Aperiodic Order
 P. Duclos: Weakly Regular Floquet Hamiltonians with Pure Point Spectrum
 T. Banica: Free Quantum Groups
 D. Guido: Natural Energy Bounds in Quantum Thermodynamics
 M. Landstad: Another Look at Hecke Groups and Hecke Operators
 N. Larsen: Representations of Hecke Algebras and Dilations of Semigroup Crossed Products
 M. Buneci: Haar Systems and Homomorphisms on Groupoids
 J. Kellendonk: The Integer Quantum Hall Effect and Bott Periodicity Non-commutative Topology: Linking Bulk and Boundary
 E. Blanchard: Unitary Tensor Categories
 R.N. Gologan: Trajectories of Billiards on the Torus and Kloosterman Sums
 H. Oyono-Oyono: The trace Conjecture of J. Bellissard
 M. Muger: The (Bi)Categorical View of Subfactors and some Applications
 W.A. Majewski: On the Measure of Entanglement
 D.E. Evans: Critical Phenomena, Modular Invariants and Subfactors
 E. Kirchberg: Classification of Non-Simple Purely Infinite C^* -algebras
 A. Van Daele: The Heisenberg Commutative Relations, Commuting Squares and the Haar Measure on Locally Compact Groups
 J.-M. Combes: Edge States and Localized States in Quantum Hall Systems
 A. Verbeure: Goldstone Bosons Normal Coordinates
 J. Cuntz: Quantum Spaces and their Non-commutative Topology
 M. Dadarlat: On the Approximation of Amenable Maximally Almost Periodic Groups
 F. Hiai: Automorphisms of Free Product Type and their Crossed Products
 N. Popa: Some Banach Spaces of Infinite Matrices
 K. Kawamuro: An Induction for Bimodules Arising from Subfactors
 J.A Jeong: C^* -algebras with Real Rank Zero
 G. Morsella: The Structure of Charges in the Ultraviolet and an Intrinsic Notion of Confinement
 N. Anagelescu : Fluctuations and Response in the Stochastic Heisenberg Model
 P. Exner: δ -systems: Wannier, Stark and inverse Klauder
 N. Mandache: On the Stability of the Inverse Scattering Problem
 T. Constantinescu: Lattice Structure for Quantum Channels
 D. Popovici: Wold-Slocinsky-type Decompositions in Hilbert C^* -modules
 O. Bratelli: Operator Theory in Wavelet Analysis
 M. Rordam: A Simple C^* -algebra with a Finite and an Infinite Projection
 G.A. Elliott: An Amenable (Non-simple!) Properly Infinite C^* -algebra with a Full Finite Projection
 N.C. Phillips: The Structure of C^* -algebras of Minimal Diffeomorphisms
 R. Conti: On Group Automorphisms Conserving Classes of Unitary Representations
 M. Choda: Actions of the Group $GL(n, \mathbb{Z})$ on the Free Factor $L(F_k)$
 T. Katsura: AF-embedding of Crossed Products of Cuntz Algebras
 E. Vasselli: Crossed Product of $C(X)$ -algebras by Vector Bundles and Group Bundle Duality
 S.-K. Kye: Facial Structures for Positive Linear Maps between Matrix Algebras

E.J. Beggs: Two-forms and Noncommutative Hamiltonian Dynamics
 T. Isola: Fractals in Noncommutative Geometry
 P. Cojocaru: On the Spectrum of perturbed Dirac Operators
 B. Prunaru: Strongly Reductive Algebras
 A. Gheondea: Joint Similiarity and Dilations for Noncontractive Sequences of Operators
 Y. Kawahigashi: Nets of Subfactors on the Circle
 K. Dykema: Decomposability of DT-operators
 F.-H. Vasilescu: Positive Polynomials in C^* -algebras
 F. Radulescu: An Infinite Semicircular Element

• **The 3-rd International IMAR Workshop in Bucharest and the OAMP-2 Conference in Sinaia.**

The workshop has been dedicated to “*Operator Algebras and Mathematical Physics*” and has been organized in Bucharest at IMAR during the period June 15 - 25 and July 5 – 12, 2003, with an International Conference held in Sinaia (June 26 – July 4, 2003). The Workshop has been attended by 20 students and researchers from IMAR and from the Faculty of Mathematics of the Bucharest University and the Conference in Sinaia had 80 participants from 14 countries (Europe, United States, Canada). The Proceedings of the Conference in Sinaia will be published by THETA Foundation; editors: Ola Bratteli, Roberto Longo, Heinz Siedentop.

Scientific Program:

June 15 - 25, 2003: 1-st period of the Workshop in Bucharest at IMAR

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| D. Yafaev (University of Rennes) | Scattering in magnetic fields I |
| D. Yafaev (University of Rennes) | Scattering in magnetic fields II |
| M. Dadarlat (Purdue University) | An introduction to exact groups I |
| M. Mantoiu (IMAR) | C^* -algebras associated with quantum Hamiltonians I |
| M. Dadarlat (Purdue University) | An introduction to exact groups II |
| M. Rordam (University of Southern Denmark) | Purely infinite C^* -algebras I |
| M. Mantoiu (IMAR) | C^* -algebras associated with quantum Hamiltonians II |
| G. Elliott (Universities of Toronto and Copenhagen) | The theory of amenable C^* -algebras I |
| G. Pedersen (University of Copenhagen) | Convex trace inequalities for functions of several variables |
| G. Elliott (Universities of Toronto and Copenhagen) | The theory of amenable C^* -algebras II |
| M. Rordam (University of Southern Denmark) | Purely infinite C^* -algebras II |

June 25 – July 4, 2003: Conference in Sinaia

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| G. Pedersen | Dimensions and low ranks for limits of C^* -algebras |
| E. Beggs | Vector fields in noncommutative differential geometry |
| V. Deaconu | C^* -algebras of commuting endomorphisms |
| M. Buneci | Amenable representations of groupoids |
| C. Ivanescu | On the classification of certain non real rank zero simple ASH algebras |
| G. Elliott | New examples of amenable C^* -algebras (based on the infinite-dimensional torus) |

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| M. Rørdam | Purely infinite C^* -algebras |
| B. Burgstaller | Some multidimensional Cuntz algebras |
| B. Prunaru | Representing biduals of operator algebras |
| G. Scharf | Supersymmetric quantum gauge theories |
| S. Berceanu | Realization of coherent state algebras by differential operators |
| A. Gheondea | On generalized Luders theorem and injectivity |
| T. Constantinescu | Orthogonal polynomials in several noncommuting polynomials |
| M. Vittot | Perturbation theory and control in classical or quantum mechanics by an inversion formula |
| J. Møller | The Mourre method revisited |
| C. Ambrozie | A result of invariant subspaces |
| H. Cornean | Do bosons condense in a homogeneous magnetic field ? |
| Y. Dermenjian | Inverse problem for a nonlinear Helmholtz equation |
| F. Bentosela | Scattering by surface: two solvable models |
| W. Farkas | On pseudo-differential operators with exotic symbols |
| O. Bratteli | Operator theory and wavelets |
| D. Yafaev | Scattering in magnetic fields |
| H. Siedentop | Non-perturbative charge and mass renormalization of no-photon quantum electrodynamics |
| P. Exner | Schrodinger operators with a graph-type singular interaction |
| S. Klainerman | Mathematics for general relativity |
| M. Dadarlat | Groups, metric spaces and C^* -algebras |
| A. Thom | Connective E-theory and bivariant homology |
| V. Manuilov | C^* -extensions and asymptotic homomorphisms |
| A. Toms | On the independence of K-theory and stable rank for simple C^* -algebras |
| M. Popa | Feynman diagrams and Wick products associated with q -Fock spaces |
| F. Boca | Spectral properties of certain classes of operators in rotation algebras |
| C. Pop | Crossed products and entropy of automorphisms |
| D. Gaspar | Hilbert modules over some Banach algebras |
| H. Moscovici | Noncommutative index theory and Hopf symmetry |
| L. Zsido | Topological reduction methods yesterday and today |
| F. Goodman | Non-crossing cummulants of type B, and graded cummulants |
| A. Ocneanu | Quantum subgroups, subfactors and canonical bases for Lie Groups |
| F. Radulescu | On Connes' embedding conjecture |
| N. Dinculeanu | Stochastic integration in Banach spaces |
| Y. Kawahigashi | Classification of 2-dimensional conformal field theories and 2-cohomology vanishing for tensor categories |
| D. Evans | Modular invariants and subfactors |
| R. Longo | A dichotomy in Conformal Field Theory |

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| M. Weiner | Uniqueness of the representation of the $\text{Diff}(S^1)$ symmetry in conformal field theories |
| D. Guido | A converse Hawking-Unruh effect and dS^2/CFT correspondence |
| S. Richard | Minimal escape velocity under minimal conditions |
| M. Mantoiu | Asymptotically independent abelian C^* -algebras |
| R. Purice | Functional calculus for observables of quantum systems in magnetic field |
| T. Isola | A noncommutative approach to fractals |
| G. Nenciu | On the smoothness of gap boundaries for generalized Harper operators |
| P. Duclos | Dynamical localization in periodically driven quantum systems |

July 5 – 12, 2003: 2-nd period of the Workshop in Bucharest at IMAR

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| J. S. Moller (Mainz University) | 7 July - 10:00 | The $C(A)$ class for non-self-adjoint operators |
| G. Scharf (Zurich Univeristy) | 8 July - 10:00 | Quantum Gauge Theories |
| F.-H. Vasilescu (Lille 1 University) | 8 July - 11:00 | Operatorial measures and moment problems I |
| D. E. Evans (Cardiff University) | 8 July - 14:00 | Operator Algebras and Mathematical Physics |
| G. Scharf (Zurich Univeristy) | 10 July - 10:00 | Supersymmetric Gauge Theories |
| F.-H. Vasilescu (Lille 1 University) | 10 July - 11:00 | Operatorial measures and moment problems II |