CURRICULUM VITAE

Konrad Schmüdgen

General

Birth	11 November 1947, Gräfendorf
Marital status	single
Citizenship	German
Employment	Professor emeritus, Universität Leipzig
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Academic qualifications

1966 – 1971	Study of Mathematics, University of Leipzig
1973	Ph. D. in Mathematics, Leipzig (summa cum laude)
1976	Promotion B (Habilitation), University of Leipzig

Professional career

1973 – 1977	Assistant, Mathematical Institute, University of Leipzig
1977 – 1980	Docent, Mathematical Institute, University of Leipzig
1980 – 1982	Professor for Analysis, University of Greifswald
1982 – 2012	Professor for Analysis, University of Leipzig
1986	Ehrenmedaille (Research) of the Mathematical Society of the GDR
1985 – 1990	Vice Director for Research of the Mathematical Institute
1988 – 1989	Director of the Mathematical Institute
Fall 1985	Visiting Professor, University of Iowa (USA)
Spring 1991	Visiting Professor, University of Heidelberg
1991, 1994, 1996, 1999, 2003	Visiting Professor, University of Fukuoka (Japan)
2004	Theodor-Litt-Preis (Teaching) of the University of Leipzig
since 2013	Professor emeritus, University of Leipzig

Research

My research fields are mainly in analysis and mathematical physics, in particular, functional analysis, unbounded operator algebras, unbounded representation theory, operator theory, quantum groups, noncommutative geometry, and Lie groups. In the last decades I also worked on real algebraic geometry, especially on noncommutative real algebraic geometry, and on the moment problem, in particular, on truncated moment problems.

My books deal with these research fields:

- [UO] unbounded operator algebras, topologization, and representation theory,
- [QG] quantum groups and noncommutative differential calculus,
- [MP] one-dimensional and multidimensional moment problems,
- [UR] unbounded representation theory of $*$-algebras on Hilbert space.

Research projects supported by the German Science Foundation

1. Lie theory and harmonic analysis. 1992–1994, Az: SCHM 1009/2-1, two research assistents.
2. Quantum groups. 1995–1997, Az: SCHM 1009/2-2, one research assistent.
3. Noncommutative geometry on quantum spaces. 1999-2000, Az: SCHM 1009/3-1, one research assistent.
4. Unbounded operators and representations. 2009-2010, Az: SCHM 1009/4-1.
5. Unbounded representations of group graded $*$-algebras in Hilbert space, 2012- 2014, Az: SCHM 1009/5-1.
6. The truncated multidimensional moment problem. 2016-2023, Az: SCHM 1009/6-1, one assistent.

Graduate college

From 1995 till 2004 a graduate college "Quantum field theory" at the Department of Physics of Leipzig University was approved by the German Science Foundation. I was one of the founding members of this graduate college. I contributed with my research fields "Quantum groups" and "Noncommutative Geometry" to this college.

Organization of Conferences

- First Conference on Operator Algebras, Ideals and Applications in Theoretical Physics, Leipzig, 1977.
- Second Conference on Operator Algebras, Ideals and Applications in Theoretical Physics, Leipzig, 1983.
- X.th Congress of the International Association on Mathematical Physics (IAMP), Leipzig, 1991.
- Noncommutative Geometry, Hesselberg, 1995 (together with J. Cuntz).
- Real Algebraic Geometry and Convexity, Leipzig, 2011 (together with T. Netzer and A. Thom).

Invited Talks at Conferences (selected list, after 2004)

2004 Conference on Real Algebraic Geometry, Dortmund
2004 Conference on Operator Theory, Timisoara
2005 British Functional Analysis Seminar, Edinburgh
2005 Conference on Positive Polynomials, Marseille
2005 Conference on Theory and Linear Matrix Inequalities, Palo Alto
2005 Conference on Operator Algebras and Mathematical Physics, Settat
2006 Conference on Operator Theory and Operator Algebras, Lisbon
2007 Conference on Positive Polynomials and Optimization, Banff
2008 Conference on Linear Algebra, Granska Gora
2009 Conference on Positivity, Valuation and Quadratic Forms, Konstanz
2010 Conference on Convex Optimization and Algebraic Geometry, IPAM , Los Angeles
2011 Conference on Operator Algebras and Quantum Groups, Warsaw
2012 Conference on Real Algebraic Geometry, Magdeburg
2012 Conference on Operator Theory, Timisoara
2013 Conference on Inverse Moments, Singapore
2014 Conference on Operator Theory and Applications, Sankt Petersburg
2015 Conference on Ordered Algebraic Structures and Related Topics, Marseille
2017 Conference on Real Algebraic Geometry and its Applications, Innsbruck
2017 IWOTA 2017, Chemnitz
2019 Mini-Course on the Moment Problem at the VIASM, Hanoi
2022 Conference on Operator Theory and Beyond, Krakow

2023 Conference on Functional Analysis and Quantum Physics, Palermo
2023 Conference on Quadratic Forms and Real Algebra, Dortmund
2023 British Functional Analysis Seminar, Newcastle (England)

Publications

Articles.

(1) The order structure of topological $*$-algebras of unbounded operators I. Reports Math. Physics **7** (1975), 215–227.
(2) Über LMC*-Algebren. Math. Nachr. **68** (1975), 168–181.
(3) Uniform topologies and strong operator topologies on polynomial algebras and on the algebra of CCR. Reports Math. Physics **10** (1976), 369–384.
(4) Lokal multiplikativ konvexe Op$*$-Algebren. Math. Nachr. **85** (1979), 161–170.
(5) On trace representation of linear functionals on unbounded operator algebras. Commun. Math. Physics **63** (1978), 113–130.
(6) Positive cones in enveloping algebras. Reports Math. Physics **14** (1978), 385–404.
(7) Ein positives Element der einhüllenden Algebra der $sl(2,\mathbb{R})$, das keine Quadratsumme ist. Wiss.Z. KMU Leipzig, Math.-Naturw. R. **27** (1978), 299–301.
(8) A positive polynomial which is not a sum of squares. A positive, but not strongly positive functional. Math. Nachr. **88** (1979), 385–390.
(9) A proof of a theorem on trace representations of strongly positive linear functionals on Op$*$-algebras. J. Operator Theory **2** (1979), 301–309.
(10) Uniform topologies on enveloping algebras. J. Funct. Analysis **39** (1980), 57–66.
(11) On topologization of unbounded operator algebras. Reports Math. Phys. **17** (1980), 359–371.
(12) Two theorems about topologies on countably generated Op$*$-algebras. Acta Math. Acad. Sci. Hungar. **35** (1980), 139–150.
(13) Graded and filtrated $*$-algebras I. Graded normal topologies. Reports Math. Phys. **18** (1980), 211–229.
(14) Perturbations of self-adjoint operators with point spectra by restrictions and self-adjoint extensions. Math. Ann. **256** (1981), 233–248.
(15) On the Heisenberg commutation relation I. J. Funct. Analysis **50** (1983), 8–49.
(16) On the Heisenberg commutation relation II. Publ. RIMS Kyoto Univ. **19** (1983), 601–671.
(17) On a class of representations of the Heisenberg commutation relation $PQ-QP=-i$ I. Operator theory: Adv. and Appl. **11** (1983), 333–344.
(18) Graded and filtrated $*$-algebras II. The closure of the positive cone. Revue Roum. Math. Pures App. **29** (1984), 89–96.
(19) On domains of powers of closed symmetric operators. J. Operator Theory **9** (1983), 53–75. Correction: ibid **12** (1984), 199.
(20) On restrictions of unbounded symmetric operators. J. Operator Theory **11** (1984), 379–393.
(21) On commuting unbounded self-adjoint operators. Acta Sci. Math. (Szeged) **47** (1984), 131–146.
(22) (with J. Friedrich) On commuting unbounded self-adjoint operators.II. J. Integral Equ. Operator Theory **7** (1984), 815–867.
(23) On commuting unbounded self-adjoint operators.III. Manuscripta Math. **54** (1985), 221–247.

(24) On commuting unbounded self-adjoint operators.IV. Math. Nachr. **125** (1986), 83–102.
(25) A formally normal operator having no normal extension. Proc. Amer. Math. Soc. **95** (1985), 503–504.
(26) A note on commuting unbounded self-adjoint operators affiliated to properly infinite von Neumann algebras.II. Bull. London Math. Soc. **18** (1986), 287–292.
(27) Topological realizations of Calkin algebras on Frechet domains of unbounded operator algebras. Z. Anal. Anw. **5** (1986), 481–490.
(28) On a generalization of the classical moment problem. J. Math. Anal. Appl. **125** (1987), 461–470.
(29) Unbounded commutants and intertwining spaces of unbounded symmetric operators and $*$-representations. J. Funct. Analysis **71** (1987), 47–68.
(30) Strongly commuting self-adjoint operators and commutants of unbounded operator algebras. Proc. Amer. Math. Soc. **102** (1988), 365–372.
(31) Spaces of continuous sesquilinear forms associated with unbounded operator algebras. Z. Anal. Anw. **7** (1988), 309–319.
(32) (with J. Friedrich) n-Positivity of unbounded $*$-representations. Math. Nachr. **141** (1989), 233–250.
(33) (with S. Ôta) On some classes of unbounded operators. Integral Equ. Operator Theory **12** (1989), 211–226.
(34) The K-moment problem for compact semi-algebraic sets. Math. Ann. **289** (1991), 203–206.
(35) Non-commutative moment problems. Math. Z. **206** (1991), 623–650.
(36) On determinacy notions for the two dimensional moment problem. Arkiv Mat. **29** (1991), 277–284.
(37) Operator representations of $\mathbb{R}_q^2$. Publ. RIMS Kyoto Univ. **29** (1993), 1030–1061.
(38) (with A. Schüler) Covariant differential calculi on quantum spaces and quantum groups. C. R. Acad. Sci. Paris **316** (1993), Ser. I, 1155–1160.
(39) Integrable operator representations of $\mathbb{R}_q^2$, $X_{q,\gamma}$ and $SL_q(2,\mathbb{R})$. Commun. Math. Phys. **159** (1994), 217–237.
(40) Operator representations of the real twisted canonical commutation relations. Journ. Math. Phys. **35** (1994), 3211–3229.
(41) (with J. Apel) Classification of three dimensional covariant differential calculi on Podles' quantum spheres. Letters Math. Phys. **32** (1994), 25–36.
(42) (with A. Schüler) Bicovariant differential calculi on quantum groups A_{n-1}, B_n, C_n and D_n. In: Generalized Symmetries in Physics, Edts.: H.Doebner and V.Dobrev, World Scientific, Singapore, 1994, pp. 185–195.
(43) (with A. Schüler) Classification of bicovariant differential calculi on quantum groups of type A, B, C and D. Commun. Math. Phys. **167** (1995), 635–670.
(44) (with A. Schüler) Classification of bicovariant differential calculi on quantum linear groups. Commun. Math. Phys. **170** (1995), 315–335.
(45) An operator-theoretic approach to a cocycle problem in the complex plane. Bull. London Math. Soc. **27** (1995), 341–346.
(46) Operator representations of $\mathcal{U}_q(sl_2(\mathbb{R}))$. Lett. Math. Phys. **37** (1996), 211–222.
(47) (with A. Schüler) Left-covariant differential calculi on $SL_q(2)$ and $SL_q(3)$. J. Geom. Phys. **20**(1996), 87–115.

(48) (with I. Heckenberger) Bicovariant differential calculi on $SL_q(N)$ and $Sp_q(N)$. Czechoslovak J. Phys. **47** (1997), 1145–1151.
(49) (with I. Heckenberger) Levi-Civita connections on the quantum groups $SL_q(N)$, $O_q(N)$ and $Sp_q(N)$. Commun. Math. Phys. **185**(1997), 177–196.
(50) (with A. Schüler) Left-covariant differentail calculi on $SL_q(N)$. In: Quantum Groups and Quantum Spaces. Editors: R. Budzynski, W. Pusz, S. Zakrewski, PWN Warsaw, 1997, pp. 185–191.
(51) (with I. Heckenberger) Classification of bicovariant differential calculi on the quantum groups $SL_q(n+1)$ and $Sp_q(2n)$. J. reine angew. Math. **502**(1998), 141–162.
(52) Operator representations of a q-deformed Heisenberg algebra. J. Math. Phys. **40** (1999), 4596–4604.
(53) On the construction of covariant differential calculi on quantum homogeneous spaces. J. Geom. Phys. **30**(1999), 23–47.
(54) On coquasitriangular bialgebras. Commun. Algebra **27**(1999), 4919–4928.
(55) Commutator representations of differential calculi on the quantum group $SU_q(2)$. J. Geom. Phys. **31**(1999), 241–264.
(56) A polar decomposition of holomorphic function on a strip. Bull. London Math. Soc. **33** (2001), 309–319.
(57) On well-behaved unbounded representations. J. Operator Theory **48** (2002), 487–502.
(58) On the quantum quarter plane and the real quantum plane. Intern. J. Math. **13** (2002), 279–331.
(59) Commutator representations of covariant differential calculi on quantum groups. Lett. Math. Phys. **59** (2002), 95–106.
(60) (with. E. Wagner): Hilbert space representations of cross product algebras. J. Funct. Analysis **200** (2003), 451–439.
(61) (with S. Ôta): Some self-adjoint 2×2 operator matrices associated with closed operators. Int. Equ. and Operator Theory **45** (2003), 475–484.
(62) (with E. Wagner) Examples of twisted cyclic cocycles from covariant differential calculi. Lett. Math. Phys. **64** (2003), 245–254.
(63) On the moment problem of closed semi-algebraic sets. J. reine angew. Math. **558** (2003), 225–234.
(64) Commutator representations of covariant differential calculi. Banach Center Publ. Warsaw **61** (2003), 189–198.
(65) (with E. Wagner) Dirac operator and a twisted cyclic cocycle on the Standard Podles quantum sphere. J. reine angew. Math. **574** (2004), 219–235.
(66) A strict Positivstellensatz for the Weyl algebra. Math. Ann. **331** (2005), 779–794.
(67) (with E. Wagner) Hilbert space representations of cross product algebras II. Alg. Represent. Theor. **9** (2006), 431–464.
(68) A strict Positivstellensatz for enveloping algebras, Math. Z. **254** (2006), 641–653. Erratum: Math Z. **259** (2008), 231.
(69) (with E. Wagner) Representations of crossed product algebras of Podles quantum spheres. J. Lie Theory **17** (2007), 751–790.
(70) (with M. Putinar) Multivariate determinateness. Indina Univ. Math. J. **57** (2008), 2931–2968.
(71) Noncommutative real algebraic geometry - some basic concepts and first ideas. In: Emerging Applications of Algebraic Geometry. 325–350, IMA Vol. Math. Appl. **149**, Springer, New York, 2009 .

(72) (with Y. Savchuk) A noncommutative version of the Fejer-Riesz theorem. Proc. Amer. Math. Soc. **138** (2010) 1243–1248.
(73) Algebras of fractions and strict Positivstellensätze for $*$-algebras. J. reine angew. Math. **645** (2010), 57–86.
(74) (with Y. Savchuk) Positivstellensätze for algebras of matrices. Linear Algebra Appl. **436** (2012), 758–788.
(75) Around Hilbert's 17th problem. Doc. Math. 2012, Extra volume: Optimization stories. 433–438.
(76) (with M. Malamud) Spectral theory of Schrödinger operators with infinitely many point interactions and radial positive definite functions. J. Funct. Analysis **263** (2012), 3144–3194.
(77) (with Y. Savchuk) Unbounded induced representations of $*$-algebras. Algebras Repres. Theory **16** (2013), 309–376.
(78) (with M. Malamud) Schrödinger operators with point interactions and radial positive definite functions. (Russian) Dokl. Akad. Nauk **448** (2013), 510–514.
(79) (with J. Cimprič and Y. Savchuk) On q-normal operators and quantum complex plane. Trans. Amer. Math. Soc. **366** (2014), 135–158.
(80) (with V. Ostrovskyi) A resolvent approach to the real quantum plane. Integral Equ. Operator Theory **79** (2014), 45–476.
(81) Transition probabilities of positive functionals on $*$-algebras. J. Operator Theory **73** (2015), 443–463.
(82) (with R. Gebhardt), Unbounded operators on Hilbert C^*-modules. Internat. J. Math. **26** (2015), 1550093, 48 pp.
(83) The multi-dimensional truncated moment problem: maximal masses. Methods Funct. Anal. Topology **21**(2015), 266-281.
(84) (with B. Mourrain) Flat extensions on $*$-algebras. Proc. Amer. Math. Soc. **144**(2016), 4873–4885.
(85) A general fibre theorem for moment problems and some applications. Israel J. Math. **218**(2017), 43–66.
(86) (with Ph. di Dio) The multi-dimensional truncated moment problem: Caratheodory numbers. J. Math. Anal. Appl. **461**(2018), 1606–1638.
(87) (with Ph. di Dio) The multi-dimensional truncated moment problem: atoms, determinacy, core variety. J. Funct. Analysis **274** (2018), 3124–3148.
(88) Unbounded operators on Hilbert C^*-modules and C^*-algebras. In: The diversity and beauty of applied operator theory. Oper. Theory Adv. Appl. **268** (2018), 429–441.
(89) On the infinite-dimensional moment problem. Ark Mat. **56**(2018), 441–459.
(90) (with F. Gesztesy) On a theorem of Z. Sebestyen and Zs. Tarcsay. Acta Sci. Math. (Szeged) **85**(2019),291–293.
(91) Ten lectures on the moment problem. 81 pp. ArXiv 2008.12698.
(92) The Stieltjes condition and multidimensional K-moment problems. Arch. Math. (Basel) **117**(2021), 179–188.
(93) $*$-Bimodules. Proc. Amer. Math. Soc. **149**(2021), 3923–3938.
(94) (with Ph. di Dio) The multi-dimensional truncated moment problem: the moment cone. J. Math. Anal. Appl. **511**(2022), Nr. 126066, 38 pp.
(95) Adjoint pairs and unbounded normal operators. Acta Sci. Math. (Szeged) **88**(2022), 3449–467.
(96) (with M. Schötz) Positivstellensätze for semirings. Math. Annalen 2023.

Books.

[1UO] *Unbounded Operator Algebras and Representation Theory.* Akademie-Verlag Berlin and Birkhäuser-Verlag Basel, 1990, 380 pp.

[QG] (with A.U. Klimyk) *Quantum-Groups and Their Representations.* Texts and Monographs in Physics, Springer-Verlag, Berlin, 1997, 552 pp.

[SA] *Unbounded Self-adjoint Operators on Hilbert Space.* Graduate Texts in Mathematics **265**, Springer Verlag, Dordrecht, 2012, 432 pp.

[MP] *The Moment Problem.* Graduate Texts in Mathematics **277**, Springer, Cham, 2017, 532 pp.

[UR] *An Invitation to Unbounded $*$-Representations of $*$-Algebras on Hilbert Space.* Graduate Texts in Mathematics **285**, Springer, Cham, 2020, 381 pp.

Other Publications and Editoral Boards.

- *Mathematisches Lexikon.* Bibliographisches Institut, Leipzig, 1977. Author of the field functional analysis.
- *Mathematical Physics X.* Editor of the Proceedings of the X. Congress on Mathematical Physics, Springer-Verlag, Heidelberg, 1992, 498 pp.
- *Journal of Lie Theory.* Co-Editor, Heldermann Verlag, Berlin (since 1994).
- *Methods of Functional Analysis and Topology.* Kiev, Associated Editor (since 2010).

Teaching

Basic courses:

- Analysis for mathematics students (calculus, measure theory, ordinary differential equations, complex analysis, functional analysis, partial differential equations),
- Mathematics for physic students (calculus, complex analysis, functional analysis, distributions, ordinary differential equations, partial differential equations, probability theory),
- Analytic geometry and linear algebra,
- Probability theory and statistics.

Special courses:

- Representation theory and harmonic analysis,
- C^*-algebras and von Neumann algebras,
- Spectral theory of differential operators,
- Lie groups and Lie algebras,
- Schrödinger operators,
- Mathematical physics - selected topics,
- Locally compact groups,
- Quantum groups,
- Functional analysis II -selected topics,
- Unbounded operators in Hilbert space,
- Operator algebras.

Ph. D. Students

Dr. habil. J. Friedrich, Dr. Nguyen Nhuy, Dr. A. Kasparek, Dr. R. Becker, Dr. F. Leitenberger, Dr. J. Matzke, Dr. habil. A. Schüler, Prof. Dr. habil. I. Heckenberger, Dr. M. Welk, Dr. S. Kolb, Dr. U. Hermisson, Prof. Dr. U. Kraehmer, Dr. Y. Savchuk, Dr. K. Zimmermann, Dr. D. Dubray, Dr. R. Gebhardt, Dr. Ph. di Dio.