

BIOGRAPHICAL SKETCH

Bruno Nachtergaele

Address

Department of Mathematics
University of California at Davis
Davis CA 95616-8633

office: (530) 752-8061
fax: (530) 752-6635
e-mail: bxn@math.ucdavis.edu

Professional Preparation

UG Inst.:	University of Leuven	Physics	Licenciaat 1984
G Inst.:	University of Leuven	Theoretical Physics	Ph.D. 1987
P Inst.:	Princeton University	Mathematical Physics	09/01/1991–06/30/1993

Appointments

2007–	Department Chair of Mathematics, University of California, Davis.
2000–	Professor of Mathematics, University of California, Davis.
1996–2000	Associate Professor of Mathematics, University of California, Davis.
1993–1996	Assistant Professor of Physics, Princeton University.
1991–1993	Instructor, Department of Physics, Princeton University.
1991	Research Associate, Physics Department, K.U. Leuven, Belgium.
1989–1990	Research Associate, Depto de Física, U. de Chile, Santiago de Chile.
1984–1988	Researcher I.I.K.W., Physics Department, K.U. Leuven, Belgium.

Synergistic Activities

1) Graduate Group in Applied Mathematics, UC Davis, an interdisciplinary graduate program with members from 18 science and engineering departments, member (10/1996–present), chair (07/2001–07/2004). 2) UC Davis Academic Senate Committee on Research, chair (08/1999–08/2001). 3) UC Davis Academic Senate Committee on Planning and Budget, chair (2006-07 and 2008-09). 4) The arXiv: moderator math-ph/math.MP section (05/1998–present), member of Physics Advisory Board (04/2005–present). 5) International Association of Mathematical Physics, member Executive Committee, 01/2006–present; Vice-President 2009-11.

Editorial Activities

1) Journal of Mathematical Physics, Editor, 01/01/2006–present. 2) Reviews in Mathematical Physics, Associate Editor, 01/01/2004–present. 3) Mathematical Physics Electronic Journal, Editorial Board, 03/01/2002–present.

Short Stays

Newton Institute, Cambridge, UK (July 4 – 16, 1993). CNRS Luminy, France (May 15 – August 15, 1995). Erwin Schrödinger Institute, Vienna, Austria (August 26 – September 8, 1995). EPFL, Lausanne (October 4–25, 1998). ETH, Zurich (October 26–31, 1998). CPT, University of Marseille (July 1999). Courant Institute, New York University (14–23 October 2000, 28 March – 6 April 2001, 4–15 September 2001). Department of Mathematics, University of Bologna (June 2-15, 2001). Erwin Schrödinger Institute for Mathematical Physics, Vienna (Fall 2004). Université de Marseille (April 2005).

Funding history

1) Fundación Nacional de Desarrollo Científico y Tecnológico, Chile: one year (1990). 2) National Science Foundation: 1996 - present, continuous funding including a Vertical Integration of Graduate Research and Education (VIGRE) training grant, July 2002- June 2007, and a Focused Research Group on Quantum Spin Systems: Theory and Applications in Quantum Computation, July 2008 - June 2011. 3) Department of Education: Graduate Assistance in Areas of National Need (co-PI):, August 2000 - present.

Honors

International Congress of Mathematicians, Beijing, 2002, invited lecture.
Elected Fellow of the American Association for the Advancement of Science (2007).

Thesis Advisor and Postgraduate-Scholar Sponsor

Thesis Advisor: Shannon Starr (Rochester University), Justin Abbott (Science Application International Corporation), Li Lei, Nigie Shi, Austin Calder (National Security Agency), Jeremy Clark (KU Leuven, Belgium), Spyridon Michalakis (Los Alamos National Laboratory), Ram Puri (UC Davis), Hillel Raz (UC Davis), Katy Marchand (UC Davis), Jaideep Mulherkar (UC Davis).

Postgraduate-Scholar Sponsor: Oscar Bolina (U. de Sao Paulo, Brazil), Jean-Bernard Bru (U Vienna, Austria), Pierluigi Contucci (U. de Bologna, Italy), Wolfgang Spitzer (U Erlangen, Germany), Daniel Ueltschi (U Warwick, UK), Tom Michoel (U. Ghent, Belgium), Robert Sims (U Arizona), Yoshiko Ogata (Tokyo U, Japan), Motohisa Fukuda (UC Davis), Sven Bachmann (UC Davis).

Society memberships

Member of the International Association of Mathematical Physicists, the American Mathematical Society, the American Physical Society, and the American Association for the Advancement of Science.

Invited Talks at Conferences:

- Workshop on Mathematical Methods in Statistical Mechanics, Leuven, June 1988, invited lecture: *The Mathematical Structure of Spin-Boson Models*.
- Workshop on Phase Transitions, São Paulo, July 1989, invited talk: *Exact Ground States for a class of Quantum Antiferromagnets*.
- Third International Workshop on Instabilities and Non-Equilibrium Structures, Valparaiso, December 1989, invited talk: *Quantum Spin Chains with Residual Entropy*.
- Sixth Vilnius Conference on Probability Theory and Mathematical Statistics, Vilnius, 28 June - 3 July, 1993, invited lecture: *Quasi-state decompositions for quantum spin systems*.
- *Stochastic geometric aspects of some quantum spin chains*, NATO Advanced Research Workshop *Micro, meso and macro approaches in Physics*, Leuven, 19-24 July, 1993, invited lecture: *Stochastic geometric aspects of some quantum spin chains*.
- Hard Problems in Mathematical Physics - A meeting to celebrate the sixtieth birthday of Paul Federbush, Ann Arbor, Michigan, 2-4 May 1994, invited lecture: *Dimerization in Ring-Shaped Molecules*.
- The XIth International Congress of Mathematical Physics, Paris, 18-23 July 1994, invited speaker for the session on “Equilibrium statistical mechanics, random media and disordered systems, constructive field theory methods, and condensed matter”: *Dimerization in ring-shaped molecules: the stability of the Peierls instability*.
- Electron-Phonon Workshop, 5-16 September 1994, Mathematics Research Centre, University of Warwick, invited lecture: *The stability of the Peierls instability and dimerization in annulene molecules*.
- Disordered Systems and Statistical Physics: Rigorous Results, 21-26 August 1995, Budapest. Invited lecture: *Interface Ground States in the XXZ Ferromagnet*.
- Workshop on the Hubbard and Heisenberg Models, in the special semester on “Condensed Matter Physics — Dynamics, Geometry, and Spectral Theory”, August 27 - September 9, 1995, Erwin Schrödinger Institute, Vienna: *Review on the Heisenberg model*, four lectures jointly with Tom Kennedy.
- Joint Meeting of the American Mathematical Society, Orlando, January 10-13, 1996, invited talk in the Special Session on Mathematical Physics: *Low-Lying Spectrum of Quantum Interfaces*.
- 16th Annual Western States Mathematical Physics Meeting, February 24-25, 1997, California Institute of Technology, Pasadena. Invited talk on *Quantum Interfaces*.
- Workshop on *Quantum Probability (QP97)*, Gdańsk, 1-6 July 1997. Invited Talk on *Quantum Interfaces*.

- Workshop on *Recent Trends in Infinite-Dimensional Non-Commutative Analysis*, Research Institute for Mathematical Sciences, Kyoto University, 15-17 October 1997. Title: *The ground state problem of quantum spin chains*.
- Workshop on "Infinite-Dimensional Analysis and Quantum Probability" Nagoya University, 20-22 October 1997. Series of three lectures on *Quantum Markov Chains*.
- Workshop on *Systems with Strong Quantum Fluctuations*, 11-13 December 1997, University of California, Santa Cruz. Title: *On the complete set of ground states for quantum spin chains*.
- STATPHYS 20 Satellite Colloquium on *Mathematical Results in Statistical Mechanics*, 27-31 July 1998, University of Marseille. Title: *Interface states of quantum spin systems*.
- AMS Meeting, 13-15 November 1998, University of Arizona. Title: *Edge States of Quantum Spin Chains*.
- 1999 UAB-GIT International Conference on Differential Equations and Mathematical Physics, Birmingham, Alabama, 16-20 March, 1999 Title: *Interface states of quantum lattice models*.
- Symposium on Mathematical Physics and Quantum Field Theory, Celebrating the Seventieth Birthday of Eyvind H. Wichmann, Berkeley, 11-13 June, 1999 Title: *Quantum interfaces as examples of ground state selection*.
- $M \cup \Phi$ VII, Mathematical Physics Days, on the occasion of the 60th anniversary of André Verbeure, Leuven, 18-19 May, 2000. Title: *Derivation of the Euler equations from quantum dynamics*.
- International Conference on Mathematical Physics, London, 17-22 July, 2000 Title: *Interfaces and their excitations in quantum lattice models*.
- Joint meeting of the American Mathematical Society and the Sociedad Matemática Mexicana, 23-26 May 2001, Morelia, Mexico. Title: *From Schrödinger Dynamics to the Euler Equations*
- International Symposium on topics in Mathematical Physics, May 28-30, 2001, Guanajuato, Mexico. Title: *The Low-Lying Spectrum of the XXZ Heisenberg Model*.
- Quantum Markov chains and their applications in physics and quantum information, 14-20 December, 2001, Trento. Title: *Quantum Spin Systems and Finitely Correlated States*.
- 2002 UAB International Conference on Differential Equations and Mathematical Physics, Birmingham, Alabama, March 26-30, 2002. Title: *From Schrödinger dynamics to the Euler equations*.

- Frontiers of Non-Commutative Analysis and Mathematical Quantum Theory, on the occasion of H. Araki's 70th birthday, 7-11 August, 2002, Fukuoka. Title: *Derivation of the Euler equations from many-body quantum mechanics.*
- International Congress of Mathematicians 2002, 18-28 August, 2002, Beijing. Title: *Derivation of the Euler Equations from many-body quantum mechanics.*
- Mathematical Analysis of Quantum Systems, 19-21 September, 2002, DIAS, Dublin, Ireland. Title: *Recent results and conjectures on the low-lying spectrum of some XXZ Heisenberg models.*
- Inhomogeneous Random Systems, 28-29 January, 2003, Cergy-Pontoise. Title: *Interfaces and Droplets in the XXZ Heisenberg Model.*
- Classical and quantum phase transitions, crystal formation and Bose-Einstein condensation, 17-28 March, 2003, Luminy-Marseille. Titles: *Interfaces in quantum spin systems. Derivation of the Euler equations from many-body quantum mechanics and Some recent results on the XXZ Heisenberg model.*
- Percolation , Particle Systems and Random Media, 12-17 January 2004, Santiago de Chile. Title: *Particle dynamics, quantum spin models, and quantum computation.*
- QMATH9, 12-16 September 2004, Giens, France. Title: *Ordering of Energy Levels in Heisenberg Models and Applications.*
- Leuven Mathematical Physics Days, 20-22 September 2004, Leuven, Belgium. Title: *Ordering of Energy Levels in Heisenberg models.*
- Mathematical Analysis of Quantum Systems, 28 September - 2 October, 2004, DIAS, Dublin, Ireland. Title: *Ferromagnetic Ordering of Energy Levels and Applications.*
- Progress in mathematical many-body quantum theory, 1-4 December 2004, ESI, Vienna, Austria. Title: *A Ferromagnetic Lieb-Mattis Theorem.*
- Workshop on Quantum Lattice Models, 15-16 March 2005, Warwick, England. Title: *Ferromagnetic Ordering of Energy Levels and Applications.*
- Conference to honour the memory of the late J. T. Lewis, his contributions to mathematics and its applications, Dublin, 14-17 June 2005. Title: *What's new in quantum spin systems?*
- Leuven Mathematical Physics Days, 12-14 September 2005, Leuven, Belgium. Title: *A To-Do List of Problems in Quantum Spin Systems*
- International Congress on the Applications of Mathematics, 13-17 March 2006, Santiago de Chile. Title: *The Exponential Clustering Theorem and Related New Results in Quantum Spin Systems.*
- Statistical Mechanics, Rutgers, 7-9 May 2006. Title: *Propagation of Correlations, Exponential Clustering, and Related New Results.*

- Complex quantum and classical systems and effective equations, June 2006, ESI, Vienna, Austria. Title: *Entanglement in Finitely Correlated States*.
- Statistical Mechanics and Quantum Field Theory, Sao Paulo, 1-4 August 2006. Title: *Finite Speed of Propagation in Quantum Spin Systems and Applications*.
- BIRS Workshop on Operator Structures in Quantum Information Theory, 12-16 February 2007, Banff, Canada. Title: *Lieb-Robinson Bounds and Their Applications in Quantum Information Theory*.
- Workshop on Lieb-Robinson Bounds, 20-24 February 2007, ESI, Vienna, Austria. Title: *Lieb-Robinson bounds and the Lieb-Schultz-Mattis Theorem*.
- Mathematical Analysis of Quantum Systems, 2-4 April, 2007, DIAS, Dublin, Ireland. Title: *New applications of Lieb-Robinson bounds*.
- Meeting on Large Quantum Systems, 11-15 June 2007, Warwick, UK. Title: *A Multi-Dimensional Lieb-Schultz-Mattis Theorem*.
- Computational Complexity of Quantum Hamiltonian Systems, 23-27 July 2007, Lorentz Center, Leiden, The Netherlands. Title: *Locality in Quantum Dynamics and Applications*.
- First Joint International Meeting between the American Mathematical Society and the Polish Mathematical Society, 31 July - 3 August 2007, Warsaw, Poland. Title: *Locality in Quantum Dynamics and Applications*.
- ESF Conference on Operator Theory, Analysis and Mathematical Physics - OTAMP2008, 15-22 June 2008, Bedlewo, Poland. Title: *Quasi-Locality of Quantum Lattice Dynamics*.
- Workshop on Integrable Quantum Systems and Solvable Statistical Models, 29 June - 5 July 2008, CRM Montreal, Canada. Title: *A Lieb-Schultz-Mattis Theorem in d Dimensions*.
- Summer School on Current Topics in Mathematical Physics, July 21-31, ESI Vienna, Austria. Mini-course on *Quantum Spin Dynamics and Applications to Quantum Information and Computation*.
- Workshop on Mathematical Approaches to Collective Phenomena in Large Quantum Systems, 30 August - 5 September 2008, MFO Oberwolfach, Germany. Overview talk on *Lieb-Robinson Bounds and Applications*.
- Workshop on Quantum Many-Body Systems and Bose-Einstein Condensation, 28 September - 4 October 2008, CRM Montreal, Canada. Title: *New Results for the XXZ Chain*.
- Entropy and the Quantum. A school on analytic and functional inequalities with applications Tucson, Arizona, March 16-20, 2009. Minicourse on *Quantum Entropy in Condensed Matter and Information Theory*.

- 101st Statistical Mechanics Meeting, Rutgers University, May 10-12, 2009. Title: *Applications of Lieb-Robinson Bounds*.
- 1st Pacific Rim Mathematical Association (PRIMA) Congress, University of New South Wales, Sydney, Australia, July 6-10, 2009. Title: *Lieb-Robinson bounds for quantum lattice systems and applications*.
- XVIth International Congress on Mathematical Physics, Prague, August 3-8, 2009. Title: Lieb-Robinson bounds and the existence of infinite-system dynamics.