

CURRICULUM VITAE

Name: Mary Beth Ruskai
Home Address: 710 Wake Robin Dr., Shelburne, VT 05482
Telephone: 802 489 4954 802 829 0085 (cell -- no voice mail)
e-mail: mbruskai@gmail.com home page: mbruskai.info
Citizen: USA Birth Date: 26 February 1944

Education

B.S.	1965	Chemistry	Notre Dame College, Cleveland, Ohio
M.A.	1969	Mathematics	University of Wisconsin, Madison, Wisconsin
Ph.D.	1969	Physical Chemistry	University of Wisconsin, Madison, Wisconsin

Professional Experience

2016-present	Adjunct Professor, University of Vermont
2013-16	Associate Member
2011-13	Visiting Scientist, (2 months per academic year) Institute for Quantum Computing, Waterloo, Ontario, Canada
2003-2013	Research Professor, Tufts University, Medford, Massachusetts
Jan.-May, 2006	Visiting Professor, Perimeter Institute, Waterloo, Canada
April-July, 2003	E.T.S. Walton Visitor, Dublin Institute of Technology, Ireland
2002-present	Professor Emeritus, Department of Mathematics
1977-2002	Assistant; Associate (1982); Professor (1986) of Mathematics University of Massachusetts Lowell, Lowell, Massachusetts
Fall, 1997	Visiting Professor, Georgia Tech, Atlanta, GA
Jan.-May, 1995	Flora Stone Mather Visiting Professor Case Western Reserve University, Cleveland, Ohio
1991-92	Visiting Professor, Department of Mathematics University of Michigan, Ann Arbor, Michigan
1988-89	Visiting Member, Courant Institute of Mathematical Sciences NYU, New York, New York
1983-85	Science Scholar, The Bunting Institute Radcliffe College, Cambridge, Massachusetts

March-July, 1981	Guest Professor, Institute for Theoretical Physics University of Vienna, Vienna, Austria
Sept, 1980 - Feb, 1981	Visiting Assistant Professor, Physics Division The Rockefeller University, New York, New York
1973-76	Assistant Professor, Department of Mathematics University of Oregon, Eugene, Oregon
1972-73	Research Associate, Theoretical Physics Institute University of Alberta, Edmonton, Alberta, Canada
1971-72	Research Associate, Department of Mathematics MIT, Cambridge, Massachusetts
1969-71	Battelle Fellow, Institut de Physique Théorique University of Geneva, Geneva, Switzerland

Consulting, Concurrent and Summer Positions

October, 1970	Consultant, National Physical Laboratory, England
March, 1973	IHES, Bur-sur-Yvette, France
April, 1973	Lyman Laboratory of Physics, Harvard University
1976-77, 1983-85	Visiting Scholar, Department of Mathematics, MIT
Summer, 1977	Software Division, Data General Corp., Westboro, Mass.
1983 – 1995	Affiliate of the Physics Department, Harvard University
April, 1984	Visiting Associate, Dept of Math., Caltech, Pasadena, Cal.
Summer, 1986	ONR-ASEE Faculty Research Associate, NSWC, Silver Spring, MD
June, 1988	Visiting Professor, Rome, Italy
Summer, 1972	Consultant, Theoretical and/or Chemical Physics
Summer, 1983	AT&T Bell Laboratories
1988-89	Murray Hill, New Jersey
Spring, 1991	Visiting Scientist, ITAMP, Harvard-Smith. Center., Cambridge, MA
Feb., 1993	Mittag-Leffler Institute, Stockholm, Sweden
March, 1993	University of Leiden, The Netherlands
April, 1993	Professeur Associé, CEREMADE, Univ. Paris IX, France
May, 1993	CERN, Geneva, Switzerland
June, 1994	Professeur Associé, Univ. of Toulon, France

March, 1998	Professeur Associé, Univ. of Reims, France
Nov., 1999	Consultant, Microsoft Research, Redmond, Washington
Summer, 2000	Guest Professor, Technische Universität, Berlin, Germany
Nov., 2001	Participant, ITP Program on Quantum Information
Oct., 2009	University of California, Santa Barbara
Spring, 2002	University of Massachusetts Amherst, Faculty Exchange
Fall, 2002	Research Professor, MSRI, Berkeley, CA
Fall, 2004	Fellow, Program on Quantum Information,
Fall, 2013	Isaac Newton Institute, Cambridge, UK
Fall, 2010	Scientific Organizer, Program on Quantum Information Theory Mittag-Leffler Institute, Stockholm, Sweden
April-May, 2012	Benjamin Meaker Visiting Professor, IAS, University of Bristol, UK (cancelled for medical reasons)
Fall, 2017	Trimester on “Analysis in Quantum Information” Institut Henri Poincare, Paris, France (did not participate for medical reasons)

Honors

NSF Predoctoral Fellowship (1965-69)
 Elected to Sigma Xi (1969)
 Battelle Postdoctoral Fellowship (1969-71)
 Bunting Science Scholar Fellowship (1983-85)
 NSF Career Advancement Award (1988-89)
 NSF Visiting Professorship for Women Award (1991-92)
 Fellow of the American Association for the Advancement of Science (1992)
 Flora Stone Mather Visiting Professor (Case Western Reserve University, 1995)
 E.T.S. Walton Visitor Award, Dublin Institute of Technology (2003)
 Benjamin Meaker Visiting Professor, IAS, University of Bristol, UK (2012)
 Fellow of the American Mathematical Society (2013, inaugural group)
 Fellow of the American Physical Society (2019)
 Fellow of the Association for Women in Mathematics (2022)

Research Publications of Mary Beth Ruskai

1. “N-Representability Problem for an Odd Number of Fermions” *Phys. Rev.* **169**, 101–113 (1968) [with J.E. Harriman].
2. “N-Representability Problem: Conditions on Geminals” *Phys. Rev.* **183**, 129–141 (1969).
3. “N-Representability Problem: Particle-Hole Equivalence” *J. Math. Phys.* **11**, 3218–24 (1970).
4. “Time Development of Quantum Lattice Systems” *Commun. Math. Phys.* **20**, 193–204 (1971).
5. “N-Completeness, N-Representability, & Geminal Expansions” *Phys. Rev.* **A5**, 1336–41 (1972).
6. “Inequalities for Traces on von Neuman Algebras” *Commun. Math. Phys.* **26**, 280–289 (1972).
7. “Comment on the Peltzer-Brandstatter Papers: Two Counterexamples” *J. Math. Anal. Appl.* **44**, 131–135 (1973).
8. “Local Products as Operators” *J. Math. Phys.* **14**, 1199–1201 (1973). [with J. Klauder].
9. “A Fundamental Property of the Quantum-Mechanical Entropy” *Phys. Rev. Lett.* **30**, 434–436 (1973) [with E. Lieb].
10. “Proof of the Strong Subadditivity of Quantum Mechanical Entropy” *J. Math. Phys.* **14**, 1938–1941 (1973) [with E. Lieb].
11. “A Generalization of Entropy Using Traces on von Neuman Algebras” *Ann. Inst. H. Poincaré A: Physique Theorique* **XIX**, 357–373 (1973).
12. “Some Operator Inequalities of the Schwarz Type” *Adv. Math.* **12**, 269–273 (1974) [with E. Lieb].
13. “Absence of Discrete Spectrum in Highly Negative Ions” *Commun. Math. Phys.* **82**, 457–469 (1982).
14. “Absence of Discrete Spectrum in Highly Negative Ions II. Extension to Fermions” *Commun. Math. Phys.* **85**, 325–327 (1982).
15. “Binding Limit in the Hartree Approximation” *J. Math. Phys.* **25**, 2099–2103 (1984) [with F. Stillinger].
16. “Density Functional Approach to Quantum Lattice Systems” *J. Stat. Phys.* **38**, 497–518 (1985) [with J. T. Chayes and L. Chayes].
17. “Entropy of Reduced Density Matrices” in *Density Matrices and Density Functionals* ed. by R. Erdahl and V. Smith, pp. 213–230 (Reidel, 1987).
18. “Extremal Properties of Relative Entropy in Quantum Statistical Mechanics” *Reports in Math. Phys.* **26**, 143–150 (1988).
19. “Location of Essential Spectrum of Intermediate Hamiltonians Restricted to Symmetry Subspaces” *J. Math. Phys.* **29**, 2236–2240 (1988) [with C. Beattie].

20. “Limits on Stability of Positive Molecular Ions” *Lett. Math. Phys.* **18**, 121–132 (1989).
21. “Convexity Inequalities for Estimating Free Energy and Relative Entropy” *J. Phys. A: Math. Gen.* **23**, 2421–2437 (1990) [with F. Stillinger].
22. “Limit on the Excess Negative Charge of a Dynamic Diatomic Molecule” *Ann. Inst. H. Poincaré A: Physique Theorique* **52**, 397–414 (1990).
23. “Absence of Bound States in Extremely Asymmetric Positive Diatomic Molecules” *Commun. Math. Phys.* **137**, 553–566 (1991).
24. “Relative Entropy under Mappings by Stochastic Matrices” *Lin. Alg. Appl.* **179**, 211–235 (1992) [with J.E. Cohen, Y. Isawa, G. Rautu, E. Seneta, & G. Zbaganu].
25. “Asymptotic Neutrality of Polyatomic Molecules” in *Schrödinger Operators: The Quantum Mechanical Many-body Problem* (Proceedings of a Workshop at Aarhus, Denmark, May-Aug. 1991) *Lecture Notes in Physics* **403**, ed. by E. Balslev. pp. 153–174 (Springer-Verlag, 1992) [with J.P. Solovej].
26. Introduction to *Wavelets and Their Applications* ed. by M.B. Ruskai, et al, pp. 3–13 (Jones & Bartlett, 1992).
27. “Equivalence of Certain Entropy Contraction Coefficients” *Lin. Alg. Appl.* **208/209**, 29–36 (1994) [with M.D. Choi and E. Seneta].
28. “Beyond Strong Subadditivity? Improved Bounds on the Contraction of Generalized Relative Entropy (with an Appendix on Applications to Logarithmic Sobolev Inequalities)” *Rev. Math. Phys.* **6**, 1147–1161 (1994); reprinted in *The State of Matter* ed. by M. Aizenman and H. Araki, pp. 350–366 (World Scientific, 1994).
29. “Improved Estimates on the Number of Bound States of Negative Bosonic Atoms” *Ann. Inst. H. Poincaré A: Physique Theorique* **61**, 153–162 (1994).
30. “Localization of Outer Electrons in Negative Atoms” in *Differential Equations and Mathematical Physics* (Proceedings of a Conf. at Univ. of Alabama at Birmingham, Mar. 1994), ed. by R. Lewis and I Knowles pp. 187–192 (International Press, 1995).
31. “Contraction of Generalized Relative Entropy under Stochastic Mappings” *Quantum Probability and Infinite Dimensional Analysis* **1**, 83–89 (1998) [with D. Petz].
32. “Relative Entropy and Monotone Riemannian Metrics on Non-Commutative Probability Spaces” *J. Math. Phys.* **40**, 5702–5724 (1999) [with A. Lesniewski].
33. “A One-Dimensional Model for Many-Electron Atoms in Extremely Strong Magnetic Fields: Maximum Negative Ionization” *J. Phys. A: Math. Gen.* **32**, 2567–2582 (1999) [with R. Brummelhuis].

Summaries appeared in “Advances in Differential Equations and Mathematical Physics” *Contemporary Mathematics* **217**, 109–120 (AMS Press, 1998), and *Recent Progress in Many-Body Theories* pp. 110–113 (World Scientific, 1998).

34. “Study of a Class of Regularizations of $1/|x|$ using Gaussian Integrals” *SIAM J. Math. Anal.* **32**, 435–463 (2000). [with E. Werner].
35. “One Dimensional Regularizations of the Coulomb Potential with Application to atoms in Strong Magnetic Fields” *Differential Equations and Mathematical Physics*, ed. by G. Weinstein and R. Weikard, pp. 43–51 (International Press, 2000) [with R. Brummelhuis and E. Werner]
36. “Pauli-Exchange Errors in Quantum Computation” *Phys. Rev Lett.* **85**, 194–197 (2000).
A slightly expanded version appeared in *Quantum Computation and Information*, ed by S.J. Lomonaco and H.E. Brandt, *Contemporary Mathematics* **305**, 251–264 (AMS Press, 2002)
37. “Minimal Entropy of States Emerging from Noisy Quantum Channels” *IEEE Trans. Info. Theory* **47**, 192–209 (2001) [with C. King] (quant-ph/9911079).
38. “Capacity of Channels Using Product Measurements” *J. Math. Phys.* **42**, 87–98 (2001) [with C. King] (quant-ph/0004062).
39. “A Characterization of Completely-Positive Trace-Preserving Maps on M_2 ” *Lin. Alg. Appl.* **347**, 159–187 (2002). [with S. Szarek and E. Werner] (quant-ph/0101003)
40. “Qubit Channels Can Require More than Two Inputs to Achieve Capacity” *Phys. Rev. Lett.* **88**, 057901 (2002) [with C. King and M. Nathanson] (quant-ph/0109079).
41. “Comments on Adiabatic Quantum Algorithms” in *Mathematical Results in Quantum Mechanics* ed by R. Weder, P. Exner, and B. Grébert, *Contemporary Mathematics* **307**, 265–274 (AMS Press, 2002). (quant-ph/0203127)
42. “Inequalities for Quantum Entropy: A Review with Conditions for Equality” *J. Math. Phys.* **43**, 4358–4375 (2002); erratum **46**, 019901 (2005). (quant-ph/0205064).
43. “Entanglement Breaking Channels” *Rev. Math. Phys.* **15**, 629–641 (2003) [with M. Horodecki and P. Shor] (quant-ph/030203).
43. “Qubit Entanglement Breaking Channels” *Rev. Math. Phys.* **15**, 643–662 (2003) (quant-ph/0302032).
45. “Permutationally Invariant Codes for Quantum Error Correction” *Lin. Alg. Appl.* **392**, 255–288 (2004) [with H. Pollatsek] (quant-ph/0304153).
46. “Some Bipartite States do not Arise from Channels” *IBM Journal of Research and Development* **48**, 111–114 (2004) (quant-ph/0303141).
47. “Introduction to Quantum Information Theory” invited chapter in *Handbook of Nanotechnology* ed. by A. Lakhtakia, pp. 395–464 (SPIE Press and ASM, 2004).
48. “One-Dimensional Models for Many-Electron Atoms in Extremely Strong Magnetic Fields II: Antisymmetry in the Lowest Landau Level” *J. Stat. Phys.* **116**, 547–570 (2004). [with R. Brummelhuis] (math-ph/0308040).

49. “Comments on Multiplicativity of p-norms for $p = 2$ ” in *Quantum Information, Statistics and Probability* ed. by O. Hirota, pp. 102–114 (Rinton Press, 2004); reprinted in *Quantum Inf. Comput.* **4**, 500–512 (2004) [with C. King] (quant-ph/0401026).
50. “Qubit Channels Which Require Four Inputs to Achieve Capacity: Implications for Additivity Conjectures” *Quantum Inf. Comput.* **5**, 13–31 (2005).
[with M. Hayashi, H. Imai, K. Matsumoto and T. Shimono] (quant-ph/0403176).
51. “Lieb's simple proof of concavity of $\text{Tr } A^p K^* B^{(1-p)} K$ and remarks on related inequalities” *Internat. Jour. Quant. Info.* **3**, 570–590 (2005); erratum 4, 747 (2006) (quant-ph/0404126).
52. “Conditions for multiplicativity of maximal p-norms of channels with fixed integer p” *J. Math. Phys.* **46**, 042105 (2005) [with V. Giovannetti and S. Lloyd] (quant-ph/0408103).
53. “Multiplicativity properties of entrywise positive maps” *Lin. Alg. Appl.* **404**, 367–379 (2005).
[with C. King and M. Nathanson] (quant-ph/0409181)
54. “Maximal output purity and capacity for asymmetric unital qudit quantum channels” *J. Phys. A: Math. Gen.* **38**, 9785–9802 (2005). [with N. Datta] (quant-ph/0505048).
55. “Multiplicativity of completely bounded p-norms implies a new additivity result” *Commun. Math. Phys.* **266**, 37–63 (2006) [with I. Devetak, C. King, M. Junge] (quant-ph/0506196).
56. “Properties of conjugate channels with application to additivity and multiplicativity” *Markov Process and Related Fields* **13**, 391–423 (2007).
[with C. King, K. Matsumoto and M. Nathanson] (quant-ph/0509126).fPOVM
57. “Contractivity of positive and trace preserving maps under L_p norms” *J. Math. Phys.* **47**, 083506 (2006). [with D. Perez-Garcia, D. Petz and M. Wolf] (math-ph/0601063).
58. “Comment on “Stronger subadditivity of entropy” by Lieb and Seiringer” *Phys. Rev. A* **74**, 026303 (2006) (math-ph/0603022).
59. “Bounds for the adiabatic approximation with applications to quantum computations” *J. Math. Phys.* **48**, 102111 (2007) [with S. Jansen and R. Seiler] (quant-ph/0603175).
60. “Another short and elementary proof of strong subadditivity of quantum entropy” *Reports on Math. Physics* **60**, 1–12 (2007) (quant-ph/0604206)
61. “Pauli diagonal channels constant on axes” *J. Phys. A: Math. Theor.* **40**, 8171–8204 (2007). [with M. Nathanson] arXiv:quant-ph/0611106
62. “Improved gap estimates for simulating quantum circuits by adiabatic evolution” *Quantum Inf. Process* **6**, 121–125 (2007). [with P. Deift and W. Spitzer] (quant-ph/0605156).
63. “Connecting N-representability to Weyl's problem: The one particle density matrix for $N = 3$ and $R = 6$ ” *J. Phys. A: Math. Theor.* **40**, F961–F967 (2007) (arXiv:0706.1855).
64. “Some Open Problems in Quantum Information Theory” (arXiv:0708.1902)
65. “The structure of degradable quantum channels” *J. Math. Phys.* **49**, 102104 (2008).
[with T. Cubitt and G. Smith] (arXiv:0802.1360).

66. “Qubit channels with small correlations” *Phys. Rev. A* **77**, 052323 (2008).
[with F. Caruso, V. Giovannetti and C. Machiavelli] (arXiv:0803.3172).
67. “States of low rank are almost surely entangled” *J. Phys. A: Math. Theor.* **40**, 095303 (2009)
[with E. Werner] (arXiv:0812.0405).
68. “Some connections between frames, mutually unbiased bases and POVM's in quantum information theory” *Acta. Appl. Math.* **108**, 709-719 (2009).
69. “A Unified Treatment of Convexity of Relative Entropy and Related Trace Functions, with Conditions for Equality” *Rev. Math. Phys.* **22**, 1099-1021 (2010) [with A. Jencova]
(arXiv:0903.2895).
70. “The χ^2 -divergence and mixing times of quantum Markov processes” *J. Math. Phys.* **51**, 122201 (2010) [with K. Temme, M. J. Kastoryano, M. M. Wolf, F. Verstraete]
(arXiv:1005.2358).
71. “Comment on “Transitions in the Communication Capacity of Dissipative Qubit Channels”
Phys. Rev. Lett. **105**, 188902 (2010) [with Michael Nathanson].
71. “Quantum codes give counterexamples to the unique pre-image conjecture of the N-representability problem” *Phys. Rev. Lett.* **106**, 110501 (2011) (arXiv:1010.2717).
[with S.A. Ocko, Xie Chen, Bei Zeng, Beni Yoshida, Zhengfeng Ji, I.L. Chuang]
72. “Comment on some results of Erdahl and the convex structure of reduced density matrices”
J. Math. Phys. **53**, 072203 (2012) (arXiv:1205.3682).
[with Jianxin Chen, Zhengfeng Ji, Bei Zeng, Duan-Lu Zhou]
73. “Remarks on Kim's Strong Subadditivity Matrix Inequality: Extensions and Equality Conditions” *J. Math. Phys.* **54**, 102202 (2013) (arXiv:1211.0049)
74. “Families of completely positive maps associated with monotone metrics” *Lin. Alg. Appl.* **439**, 1749–91 (2013) [with F. Hiai, M. Kosaski, D. Petz] (arXiv:1212.1337)
75. “The Quantum Entropy Cone of Stabiliser States” 8th TQC Proceedings. *LIPICs. Leibniz Int. Proc. Inform.*, **22**, 270-284 *Schloss Dagstuhl. Leibniz-Zent. Inform., Wadern* (2013) [with N. Linden, F. Matús, and A. Winter] (arXiv:1302.5453)
76. “Bounds on the Concavity of Quantum Entropy” **56**, 092201 *J. Math. Phys.* (2014)
[with I. Kim]. (arxiv:1404.5999)
77. “Contraction Coefficients for Noisy Quantum Channels” *J. Math. Phys.* **57**, 015211 (2016)
[with F. Hiai] (arxiv:1508.03551)
78. “Extreme Points and Convex Structure of Factorizable Quantum Channels” *Annales Henri Poincaré* **22**, 3455-3496 (2021) [with M. Musat and U. Haagerup] (arxiv:2006.03414)
79. “Yet another proof of the joint convexity of relative entropy”. *Lett. Math. Phys.*, **112**, (4)81 (2022).
80. “Local Additivity Revisited” submitted to *J. Math. Phys.* [with J. Yard] (arxiv:2111.11385)

Funded Research

1987-88*	PI, NSF ROW Research Planning Grant DMS-87-09805 “Analytic Analysis of Multi-Particle Coulomb Systems” \$12,000.
1988-89	PI, NSF ROW Career Advancement Award DMS-88-08112 “Analytic Analysis of Multi-Particle Systems” \$21,692.
1989-93*	PI, NSF Grant DMS-89-08125 “Analysis of Multi-Particle Systems” \$76,000.
1991-92	PI, NSF Grant RII-91-03315 “Analysis of Multi-Particle Hamiltonians” \$136,000.
1994-96*	PI, NSF Grant DMS-94-08903 “Analysis of Multi-Particle Systems” \$40,000.
1997-2000	PI, NSF Grant DMS-97-06981 “Analysis of Multi-Particle Systems” \$60,000.
1998-2002	PI, ARO/NSA/ARDA Grant DAAG55-98-1-0374, “Optimization of Communication in Noisy Quantum Channels” \$111,442.
2000-02	PI, NSF Grant DMS-0074566 “Quantum Information Theory” \$50,000.
2002-06	PI, ARO/NSA/ARDA Grant DAAD19-02-1-0065/-03-1-0052 “Noisy Quantum Communication and Computation” \$113,000
2003	E.T.S. Walton Award, Science Foundation Ireland, Euro 75,000
2002-06* [†]	PI, NSF Grant DMS-0203211/0314228 “Quantum Information Theory” \$147,000.
2006-11* [†]	PI, NSF Grant DMS-0604900 “Quantum Information Theory” \$102,000.
2010-14	PI, NSF Grant CCF-1018401 “Quantum Information Theory” \$100,000.

Funding for Special Projects

Conference Director, NSF/CBMS Regional Conference in the Mathematical Sciences on Wavelets; Lowell, Mass. (June 11-15, 1990) NSF Grant DMS-89-13319, \$22,700.

PI and Selection Committee Chair, Block Travel Grant for Conference on “The State of Matter” Copenhagen (30 July – 1 Aug. 1992) NSF DMS-92-01934, \$12,250.

PI and Selection Committee Chair, Block Travel Grant for XI-th “International Congress of Mathematical Physics” Paris (18–23 July 1994) NSF Grant DMS-93-22707[†], \$16,250.

PI and Selection Committee Chair, Block Travel Support for US participation in Nordita/Mittag-Leffler conference and programs on quantum information." DMS-1015193 \$35,000.[†]

* joint funding with physics

[†] funding component from International

Major Conference Organization

CBMS Conference on *Wavelets* (U Mass Lowell, June, 1990)

Co-organizer (by invitation) of Workshop on Quantum Information and Cryptography
Mathematical Sciences Research Institute, Berkeley, CA (Nov., 2002)

Co-organizer, Workshop on *Information Geometry*, McMaster Univ. (May, 2004)

Co-organizer, Workshop on *Mathematical Aspects of Quantum Adiabatic Approximation* Perimeter
Institute, Waterloo, Ontario (9-11 Feb., 2006). Co-sponsored by Fields Inst, and IQC.

Chair of organizing committee, Workshop on *Operator Structures in Quantum Information Theory*, BIRS,
Banff, Canada (11 - 16 Feb. 2007).

Co-organizer, Program on *Quantum Information Theory*, Fields Institute (Toronto, July-Aug., 2009)
Main organizer, Workshop on *Operator Structures in Quantum Information* (6-10 July, 2009)
Main organizer, Workshop on *Quantum marginals and density matrices* (26-31 July, 2009)

Chair of organizing committee, Program on *Quantum Information Theory* at the Mittag-Leffler Institute,
Stockholm, Sweden (Sept-Dec., 2010).

Chair of organizing committee, Workshop on *Operator Structures in Quantum Information Theory*
BIRS, Banff, Canada (26 Feb. - 2 March, 2012).

Chair of organizing committee, Workshop on *Hypercontractivity and log Sobolev Inequalities in Quantum
Information Theory*, BIRS, Banff, Canada (26 Feb. - 2 March, 2015)

Scientific advisory committee, Trimester in *Analysis in Quantum Information* Institut Henri Poincare, Paris,
France (Fall, 2017)

Scientific advisory committee, QMath13, Georgia Tech, (October, 2016).

Chair of organizing committee, Workshop on *The Many-Faceted Connes Embedding Problem*, BIRS,
Banff, Canada (14-19 July 2019)

American Association for Advancement of Science: Symposia at annual meetings

Women in Physics: Why so Few? joint with APS/AAPT	Jan., 1989
Mathematics in the Science Policy Arena	Feb., 1991
Mathematical Advances in Signal Processing	Feb., 1995
Quantum Information Theory Boston, MA Feb., 2008	

Editorial Work

Editorial Board, *Communications in Mathematical Physics* (Springer, 2003-2013)

responsible for papers on quantum information theory

Search Committee for new Editor-in-Chief (2021).

Associate Editor (for quantum information), *Journal of Mathematical Physics* (AIP, 2008-2015)

Editorial Board, (2001-2003 and 2007-2009).

Chair of Review Panel, Oct. 2001; Consultant to Review Panel (1991-92)

Co-Editor of special issue on Quantum Information Theory (Sept. 2002) which received

Honorable Mention for "Best Single Issue of a Journal" by American Assoc. of Publishers

Co-Editor of special issue on Quantum Information Theory (Jan. 2016)

Editorial Board, *International Journal of Quantum Information* (World Scientific Press, Singapore, 2009-2016)

Invited to Editorial Board (declined), *Encyclopedia of Mathematical Physics* Academic Press, 2002

Advisory Editorial Board, *International Journal of Quantum Chemistry* (1996-2000)

Editorial Board, *Notices of the American Mathematical Society* (1994-1999)

Editor-in-Chief, *Wavelets and Their Applications* (Jones & Bartlett Publishers, 1992)

co-edited with G. Beylkin, R. Coifman, I. Daubechies, S. Mallat, Y. Meyer, L. Raphael

Co-Editor of *Inequalities: Selecta of E. Lieb* (Springer, 2002) [with M. Loss].

Program Committee, Theory of Quantum Computing (May, 2014)

Program Committee, 14th Asian Quantum Information Science Conference (Aug. 2014)

(These program committees function as editorial boards to select conference papers as in computer science.)

Selected Conference Participation

Battelle Rencontres on Statistical Mechanics, Seattle, Washington (1971).

NSF International Travel Grants: IHES, France (1973); ICM, Vancouver, Canada, (1974).

NATO Advanced Study Inst.on Rigorous Atomic and Molecular Physics, Erice, Sicily (1980).

International Congresses of Mathematical Physics: Lausanne, Switz (1979), received travel grant; West Berlin (1981); Boulder, Colo. (1983); Swansea, Wales (1988)

Leipzig, Germany (1991) Invited special session speaker

Paris, France (1994) and Brisbane, Australia (1997) U.S. block travel grant organizer

London, England (July, 2000), Entropy Round Table Panelist

Lisbon, Portugal (July, 2003) Session chair and U.S. travel grant reviewer

Rio de Janeiro, Brazil (Aug., 2006) Co-organized session on Quantum Information Theory

Invited Speaker in AMS Special Sessions at National (Jan.), International, and Section Meetings

Scattering and Spectral Theory	Cincinnati, Ohio	Jan., 1982
The Schrödinger Equation	Louisville, Kentucky	Jan., 1990
Dynamics of Infinite Systems	San Antonio, Texas	Jan., 1993
Many-Body Quantum Theory (organizer)	Lexington, Kentucky	Mar., 1994
Operator Theory	Manhattan, Kansas	Mar., 1994
Computational Harmonic Analysis (declined)	Orlando, Florida	Jan., 1996
Mathematical Physics (declined)	Orlando, Florida	Jan., 1996
Mathematical Physics of many-body systems (co-org)	Melbourne, Australia	July, 1999
Quantum Computation and Information	Washington, DC	Jan., 2000
Quantum Information Theory (co-organizer)	Lowell, Mass.	April, 2000
Analytical Problems in Mathematical Physics (declined)	Birmingham, AL	Nov, 2000
Quantum Error Correction (co-organizer)	Hoboken, NJ	April, 2001
Quantum Information Theory (co-organizer)	Boston, Mass.	Oct., 2002
Quantum Computation and Information	Baltimore, MD	Jan., 2003
Frames and Operator Theory (AMS-SIAM session)	San Antonio, Texas	Jan., 2006
Quantum Information Theory (co-organizer)	Warsaw, Poland	Aug., 2007
Mathematics of quantum information theory	Boston, Mass.	April, 2018

Invited Speaker, Workshop and Symposium on Density Matrices and Density Functionals in Honor of A.J. Coleman, Queen's University, Kingston, Ontario (August, 1985)

Workshop on Atomic and Molecular Dynamics, IMA, Univ. of Minn. (June-July, 1987)

Seminar Speaker, Nordic Summer School on Schrödinger Operators, Denmark (Aug., 1988)

Invited Speaker, Western States Math Physics Meeting, Caltech (Feb., 1990)

Invited Session Speaker and/or Chair, International Conference Series on Differential Equations and Mathematical Physics: Univ. Alabama, Birmingham (Mar, 90); GeorgiaTech, Atlanta (Mar, 92); UAB (Mar, 94); GaTech (Mar, 97); UAB (Mar, 99).

Invited Speaker, Semi-Classical Methods and Microlocal Analysis, Paris, France (Feb., 1991)

Oberwolfach (Germany) Workshops: Schrödinger Equation (May, 1990); Large Coulomb Systems (Aug., 1999); Mini-Workshop on Geometry of Quantum Entanglement (Dec., 2009)

Stieltjes Lecturer, University of Leiden, (3 March 1993).

Frontiers of Science Lecturer, University of Florida, Gainesville (29 Sept., 1993).

Invited Speaker, Inverse Problems Conf., Euler Math. Inst., St. Petersburg, Russia (Oct., 1993)

Invited Speaker, Workshop on Operator Theory, Banach Center, Warsaw, Poland (Jan., 1996)

Invited Speaker, Workshop on Convexity Inequalities, MSRI, (May, 1996)

Invited Speaker, Workshop on Microlocal Analysis and Mathematical Physics
Fields Institute, Toronto (Sept. 1997)

Invited Speaker, Workshop on Systems in Magnetic Fields, Schrödinger Inst., Vienna (Jun, 1998)

Invited Speaker, Wavelets and Applications in Physics, ITAMP, Harvard (8-10 Oct. 98).

Short Course Lecturer, Quantum Computing, Berlin, Germany (22-26 March 1999).

Invited Speaker, Session on Mathematical Physics, CMS winter meeting, Montreal (Dec., 1999).

Plenary Speaker, AMS Eastern Section Meeting, Lowell, Mass. (April, 2000)

Invited Speaker, Workshop on Mathematics of Quantum Computation, MSRI (Feb., 2000)

Principle speaker, A2 Quantum Information Consortium monthly workshop, Berlin (19 June 2000)

Short Course Lecturer, Quantum Computing, Iztapalapa campus of Universidad Autonoma Metropolitana, Mexico City, (23-27 Oct., 2000).

Invited speaker in special session on "Quantum Computing and Quantum Search", 31st Winter Colloquium on Physics of Quantum Electronics (PQE), Snowbird, Utah (Jan. 2001)

Invited speaker, Mini-Symposium on Quantum Computation, Texas A&M, 4 May 2001.

Invited speaker, Workshop on Information Theory, Banach Center, Warsaw, Poland (May, 2001)

Invited speaker, Quantum Information Processing weekly seminar, MIT (29 Oct. 2001).

Participant, ITP Program on Quantum Information, UCSB (Nov, 2001);
speaker in conference (3-7 Dec 2001)

Invited speaker, Workshop on Quantum Computation, Dublin, Ireland (March, 2002).

Invited speaker, Conference on Information Geometry and its Applications (Italy, 1-5 July, 2002)

Invited speaker, Conf. on Non-Commutative Phenomena, PIMS, Vancouver (6-9 Aug., 2002).

Invited speaker, "Feynman Festival" University of Maryland (23-27 August 2002).

Member of U.S. Delegation, IUPAP General Assembly, Berlin, Germany (October, 2002).

Invited speaker, Workshops on Quantum Information and Cryptography (4-8 Nov., 2002; co-org) and Quantum Information Processing (13-17 December, 2002). MSRI Berkeley

Participant, Quantum Information Workshops, Benasque, Spain (June, 2003; June, 2005; June, 2007; June, 2009, June 2011). Speaker in 2003 and 2005.

Invited speaker and member of Program Committee, Quantum Information Theory Workshop QIT-EQIS03 (2- Sept, 2003, Kyoto)

Invited speaker, Symposium on Applications of Renormalization Group Methods in Mathematical Sciences, RIMS, Kyoto University (10-12 September, 2003)

Invited speaker, "Quantum Information, Control and Computing" Madeira (Oct., 2003)

Invited speaker, von Neumann Centennial Conference, Budapest, Hungary (October, 2003).

Short course lecturer, Pavia, Italy (15–26 March, 2004); Trieste, Italy (29 Mar–2 Apr, 2004).

Speaker and co-organizer, Workshop on information geometry, McMaster Univ. (May, 2004).

Invited speaker, Entanglement Information and Noise, Krzyzowa, Poland (14-20 June, 2004).

Invited speaker, mini-symposium on Quantum Information, Sixteenth International Symposium, on Mathematical Theory of Networks and Systems, (Leuven, Belgium, 5-9 July 2004).

Long-term visitor, Program on Quantum Information Science, Isaac Newton Institute for Mathematical Sciences in Cambridge, England (Sept.-Nov., 2004).

Invited speaker, Korean Physical Society meeting and lecturer at KIAS (April, 2005).

Invited speaker, Workshop on Quantum Information and Robustness, Center of Excellence Program, University of Tokyo (25 April 2005).

Invited speaker, Special Session on Mathematical Aspects of Quantum Information, summer meeting of Canadian Mathematical Society, Waterloo, Ontario (4-6 June, 2005).

Invited speaker, Conference in memory of John T. Lewis, Dublin, Ireland (June, 2005).

Invited speaker, 38th Symposium on Mathematical Physics "Quantum Entanglement and Geometry" Torun, Poland (4-7 June 2006).

Invited speaker, Conference on Theory and Technology in Quantum Information, Communication, Computation and Cryptography, Abdus Salam ICTP, Trieste, Italy (19-23 June 2006).

Invited speaker, PASI workshop on Probability and Analysis in Quantum Physics, Santiago, Chile, (30 July - 4 August, 2006).

Plenary speaker, Canadian Operator Theory Symposium, Guelph, Canada (5-8 June 2007).

Invited participant, Workshop on Computation Complexity of Quantum Hamiltonian Systems, Lorentz Center, Leiden, Netherlands (23-27 July 2007).

Invited speaker, Workshop on operator algebras, Chiba University, Japan (Nov. 2007)

Invited speaker in session on Quantum Information Theory in conjunction with the conference for CN Yang 85th Birthday, Singapore (1-3 Nov. 2007).

Short course lecturer on quantum information theory, UNAM, Mexico City, (TBA, 2008-09).
[cancelled for medical reasons].

Invited speaker, International Spring Workshop on "The Mathematical Foundations of Quantum Control and Quantum Information Theory" Madrid, Spain (26-30 May 2008).

Key participant in the Operator Algebras in Quantum Information component of the workshop on Mathematical Horizons for Quantum Physics (Singapore, August, 2008).

Invited speaker, Special Session on Mathematical Aspects of Quantum Information, winter meeting of Canadian Mathematical Society, Ottawa, Ontario (5-7 Dec. 2008).

Invited short course lecturer on Quantum Information Theory, Summer School and Advanced Workshop on Trends and Developments in Linear Algebra, ICTP, Trieste, Italy (June, 2009).

Invited speaker in session on mathematical physics [declined due to prior commitment], Pacific Rim Mathematical Association Congress, Sydney, Australia (6-10 July 2009).

Invited participant in workshop on Matroids at BIRS, Banff, Alberta, Canada (3-7 August 2009).

Invited participant in program at Schrödinger Institute, Vienna (Sept., 2009)

Invited participant, ICTP program on quantum Information, Santa Barbara (Oct.-Nov., 2009)

Invited participant in IMS program on "Complex Quantum Systems", National University of Singapore (March, 2010)

Invited participant, BIRS program on "Non-commutative L_p spaces, Operator spaces and Applications", (Banff, Canada, 27 June – 2 July, 2010)

Invited speaker (declined) Quantum Information and Quantum Entanglement (Leipzig, July 2010).

Invited participant, Perspectives in High Dimension, CWRU, (Cleveland, 2-7 August 2010).

Invited speaker (declined) and member of program committee, ICM Satellite conference on Quantum Systems, Institute of Mathematical Sciences, Chennai, India (14-18 Aug. 2010)

Series of 3 lectures on quantum entropy at Heriott-Watt Univeristy, Edinburgh video-broadcast to physics, mathematics & computer science departments across Scotland (9-20 May 2011).

Invited speaker [declined], "Frontiers in Mathematical Physics" Cergy-Pontoise, France (May, 2011)

Invited speaker, workshop on "Quantum information: codes, geometry and random structures" CRM, Montreal (24-26 Oct., 2011).

Invited [declined] to give two week short course on "The Functional Analysis of QIT" at IMS, Chennai, India (26 Dec. to 6 Jan. 2011).

Invited speaker, "Geometry of Quantum Entanglement" (CIRM, Luminy, France, 9-13 Jan 2012).

Invited speaker, workshop "Quantum Mechanics: From Foundations to Quantum Information Science", Bielenfeld, Germany (27 Feb. - 9 Mar, 2012); [cancelled for medical reasons].

Invited speaker, (declined for medical reasons) in session "Quantum Information and Representation Theory", XXIX International Colloquium on Group-Theoretical Methods in Physics (20-26 August 2012) Chern Institute of Mathematics, Tianjin, China.

Speaker, "Theory of Quantum Computing" Conference (May, 2013) Guelph, Canada

Invited speaker, (declined) "Mathematical Aspects of Quantum Modeling, Estimation and Control", Dept. of Information Engineering, Padua, Italy (June 25-27, 2013).

Invited speaker, "Conference in Honour of The 90th Birthday of Freeman Dyson", Institute of Advanced Studies (IAS), Nanyang Technological University, Singapore (August, 2013).

<https://www.youtube.com/watch?v=P3-xI1u1Y2s>

Invited speaker, Workshop on Quantum Marginals, Isaac Newton Institute, Cambridge, UK (14-18 Oct., 2013). Also participant in long-term program in Sept.-Oct., 2013.

Invited speaker, [cancelled for medical reasons] workshop on “Mathematical Methods for Ab Initio Quantum Chemistry” Nice, France (7-8 Nov., 2013)

Session chair, Winter workshops at Aspen Center for Theoretical Physics (March, 2014).

Invited speaker, mini-symposium on Quantum Information (Univ. of Guelph, Canada, April, 2014)

Invited speaker, mini-symposium on Quantum Information at ILAS satellite meeting of ICM, Session chair in satellite meeting on Operator Algebras and participant in International Congress of Women Mathematicians (Seoul, Korea, August, 2014)

Invited participant (declined) workshop on “Beyond IID in Quantum Information Theory” (BIRS, Banff, Canada, July, 2015)

Keynote Speaker, Conference on Quantum Marginals, Univ. of Guelph, Canada (August, 2015)

Invited participant, BIRS workshop “Quantum Markov Processes” (Oaxaca, Mexico, Aug, 2015)

Invited speaker, Miniworkshop, Guelph, Canada, 1 Oct. 2015

Scientific Advisory Committee & session speaker, QMath 2016 (Georgia Tech, Atlanta, fall, 2016).

Invited speaker, “Mathematical Aspects in Current Quantum Information Theory” (Djaejon, Korea, 15-19 Feb. 2016)

Invited participant [declined] Tsinghua Sanya International Mathematics Forum workshop on “Complexity of Quantum Information and Computation” (China, 28 Mar to 2 Apr 2016)

Special session speaker, QMath13, Georgia Tech (October, 2016).

Plenary Speaker, Fields Institute Workshop on “Representation Theory in Quantum Information” Guelph, Canada (22-25 Aug, 2016).

Invited speaker, Probabilistic and Algebraic Methods in Quantum Information Theory (17-21 July); SUMIRFAS (21-23 July 2017) Texas A&M University.

Invited participant, trimester on “Analysis in Quantum Information Theory” Institut Henri Poincaré (Paris, France, 2017) [declined, but member of scientific advisory committee]

Special session speaker, “Mathematics of Quantum Phases of Matter and Quantum Information” Mathematical Congress of the Americas 2017, Montreal, Canada (24-28 July 2017).

Plenary Speaker, Fields Institute Workshop on “Operator Systems in Quantum Information Theory” Guelph, Canada (14-17 Aug, 2017).

Invited speaker in special session in memory of Denes Petz, Workshop on Beyond IID in Information Theory, Newton Institute, Cambridge England (23-27 July, 2018).
<https://www.newton.ac.uk/seminar/20180726164517301>

Book Reviews and Miscellaneous Publications

1. Semi-classical Analysis for the Schrödinger Operator and Applications by B. Helffer (Springer-Verlag, 1988), for *Math. Rev.* 90c:81043.
2. “MathCAD for the Macintosh” for *AMS Notices* **37**, 15 (Jan., 1990).
3. Quantum Theory in America by K. Sopka, for *Radcliffe Quarterly* pp. 28–29 (June, 1992).
4. Wavelets: Applications and Algorithms by Y. Meyer, for *Math. Intelligencer* **17**, 70-73 (1995).
5. “How Steep Can a Mountain Be? How High?” unpublished.
6. The World According to Wavelets by B.B.Hubbard for *American Scientist* **85**(1), 85-86 (1997).
7. “Response to Graham: The Quantum View” *Math. Intelligencer* **23**(1) 23–29 (2001).
8. “Confusion about Bohm” *Math. Intelligencer* **23**(4) 23–27 (2001).

Commentary in AMS Notices

1. “AMS Redirects Centennial Fellowship to Young Mathematicians” *AMS Notices* **42**, 680–681 (June, 1995) [with R. Zimmer].
2. Editorial on Elementary Math Education *AMS Notices* **42**, 740 (July, 1995).
3. “Whither Democracy?” Editorial for *AMS Notices* **43**, 188 (Feb., 1996).
4. “Whom Does the AMS Represent?” Editorial for *AMS Notices* **43**, 740 (July, 1996).
5. “Evaluating Student Evaluations” Editorial for *AMS Notices* **44**, 308 (Mar., 1997).
6. “A Community in Crisis” Editorial for *AMS Notices* **44**, 1428 (Dec., 1997).
7. “What Do Engineers Really Want?” Opinion column for *AMS Notices* **45**, 221 (Feb., 1998).
8. “The Decline of Science” Opinion column for *AMS Notices* **45**, 565 (May, 1998).
Spanish translation in *Informe de Investigaciones Educativas*, Open University of Venezuela.
9. “Improving the Job Search” Editorial for *AMS Notices* **45**, 1316 (Nov., 1998).
[with A. Knapp]
10. “A Review of Featured Reviews” Opinion column for *AMS Notices* **46**, 517 (May, 1999).
11. “Opinion and Responsibility” Opinion column for *AMS Notices* **46**, 1349 (Dec., 1999).

Miscellaneous Professional Activities

American Mathematical Society (AMS): Fellow (elected in 2012)

Committee to Select the Winner of the Levi L. Conant Prize (2004-2006); Chair, 2005-06

Eastern Section Program Committee (2000-2001); Chair (2001)

Member-at-Large of AMS Council (1998-2000)

Representative to Board of Directors of the Canadian Mathematical Society (1998-2000)

Committee on Science Policy (1999-2001)

Representative to AMS-IMS-MAA Joint Data Survey Committee (1996-2001)

Committee on the Profession (1993-95)

Joint Committee on Women in the Mathematical Sciences (1989-96); Chair, (1992-95)

Research Fellowships Selection Committee (1986-88); Fellowship Policy (1988-89)

Screening Panel for NSF-ICM travel grants (1989-90 and 1993-94)

Representative to AAAS Coalition on Public Understanding of Science (Feb., 1994)

AAAS Liaison Committee (1992-94, 2007-09); Chair (1992-94)

Chair, Cooperative Symposia Committee (1991-92)

American Association for the Advancement of Science (AAAS): Fellow (elected in 1992)

Member-at-large of Mathematics Section Steering Committee (2005-2009)

Organizer, Symposium on "Quantum Information Theory" (Feb., 2008)

Co-Organizer, Symposium on "Mathematical Advances in Signal Processing" (Feb., 1995)

Co-Organizer & Chair, Symposium "Mathematics in the Public Policy Arena" (Feb., 1991)

Nominating Committee of the Mathematics Section (1991-93)

International Union of Pure and Applied Physics (IUPAP)

Vice Chair, C18 Commission on Mathematical Physics (1999-2002); member (1999-2005)

Associate Member, Commission C15 "Atomic, Molecular & Optical Physics" (2000-2003)

US Liaison Committee of National Academy of Science (1999-2005)

American Physical Society (APS); Fellow (elected in 2019)

Committee to select winner of Heineman prize in mathematical physics (2008; chair 2009)

Mathematical Association of America (MAA):

CUPM Subcommittee on Undergraduate Research in Mathematics (1991-96)

Committee on Participation of Women (1994-96); declined reappointment for 1997-2000.

Committee on Hedrick Lectures (1995-98); Chair (1997)

Joint Program Committee for Burlington Mathfest (August, 1995)

Program Committee for Orlando Meeting (January, 1996)

Committee on Science Policy meeting and lobbying (April, 2008).

Panel Organizer and Chair, BMS Annual Mathematics Chairs Meeting, Washington, DC

"Recruitment and Retention of Women Faculty" (Oct. 1993)

"The Chair's Role in Faculty Advancement" (Oct. 1994)

Papers on Gender and Science

1. "Open Letter on Feminism in Science" letter to the editor of the *Newsletter of the Association for Women in Mathematics* (AWM) **16**(3), 4-6 (May-June, 1986) and feature article in the *Gazette of the Committee on the Status of Women in Physics* (CSWP) **6**(2), 2-4 (July, 1986). Replies were published the *AWM Newsletter* **16**(6), 6-16 (Nov.-Dec., 1986) and the *CSWP Gazette* **6**(3), 1-3 (Oct.-Nov., 1986).
2. "Gender and Science" an expanded version of an invited talk for the AWM panel on Gender and Science at the AMS-MAA joint summer mathematics meeting (Univ. of Utah, Aug., 1987), *AWM Newsletter* **17**(6), 5-10 (Nov.-Dec., 1987).
3. "How Stereotypes about Science Affect the Participation of Women" invited talk in panel Women in Physics: Why so Few? APS/AAPT/AAAS meeting (San Francisco, Jan. 1989)
4. "Why Women are Discourage from Studying Scienced" *The Scientist* **4**(5), 17 & 19 (March 5, 1990); reprinted in *CSWP Gazette* **10**(2), 2-4 (June, 1990).
5. "Are There Innate Cognitive Gender Differences? Some Comments on the Evidence in Response to a Letter from M. Levin" Guest comment for *Amer. J. Phys.* **59**, 11-14 (1991); reprinted in *CSWP Gazette* **11**(2), 1-5 (Apr., 1991) and Physics Teachers CD-ROM Toolkit.
6. "More comments on the Math SAT Gender Gap" *AWM Newsletter* **21**(2), 16-18 (Mar.-Apr., 1991); excerpts reprinted in *CSWP Gazette* **11**(2), 5 (Apr., 1991).
7. "Are 'Feminist Perspectives' in Mathematics Feminist?" in *Gender and Mathematics Education Proceedings of an ICMI Study in Höör, Sweden, Oct. 1993* ed. by B. Grevholm and G. Hanna pp. 386-389 (Lund Univ. Press, 1995); revision in the *The Flight from Science and Reason: Annals of the New York Academy of Sciences* **775**, 437-441 (1996).
8. "Myths about the Role of Marital Status in Career Advancement" *AWM Newsletter* **24**(3), 9-11 (May-June, 1994)
9. Contribution to Panel on "Trends in US Mathematics" pp. 126-129 *Proceedings of the NSA Women in Mathematics Symposium* (National Security Agency, Nov., 1993)
10. "Time for Advancement" *MAA Focus* **14**(6), 25-28 (Dec. 1994).
11. Reviews of Educating Women for Success in Science and Mathematics by S.V. Rosser and B. Kelly and two related books by J. Sanders, solicited by *NWSA Journal*, but not published.
12. "Remarks to the Mathematics and Physical Science Group" at the Dec. 1995 NSF Conference on Women and Science.
13. "Thoughts on Affirmative Action" *AWM Newsletter* **26**(2), 10-15 (Mar.-Apr., 1996).
14. "Response to Graham: The Quantum View" *Math. Intelligencer* **23**(1) 23-29 (2001).
15. "Response to 'Induction vs Deduction' " *CSWP Gazette* **23**(1), p 6 (Spring, 2004).

16. Op-Ed comments on Summers remarks (submitted to, but not accepted by, Boston Globe); published, with an addendum on data in *AWM Newsletter* **35**(3), 6–8 (May-June, 2005).
17. Letter to the Editor, *New York Times*, May 16, 2015 p. A22
http://www.nytimes.com/2015/05/06/opinion/women-who-choose-engineering.html?partner=rssnyt&emc=rss&_r=0
18. Commentary (solicited) in Room for Debate, *New York Times*, June 12, 2015 on-line edition
<http://www.nytimes.com/roomfordebate/2015/06/11/nobel-winning-sexism-in-the-lab/a-few-bad-guys-in-the-lab-can-cause-women-a-lot-of-harm>

Activities and Talks Related to Women in Science

Chair, Joint Committee on Women in the Mathematical Sciences (1992-95)

Association for Women in Mathematics: Boston coordinator for Speakers' Bureau (1983-85)
 Planning Committee, Kovalevsky Research Symposium and High School Math Day (1985)
 Travel Grant Selection Committee (1990, 1995)
 Chair, AAAS Symposium Committee (1990-91); Rep. to Section L of AAAS (1996-2002)

President, New England Chapter of the Association for Women in Science (1986-87)
 Women in Science Advisory Committee, Boston Public Library, (1986-88)

Panel Organizer and Chair, BMS Annual Mathematics Chairs Meeting, Washington, DC
 "Recruitment and Retention of Women Faculty" (Oct. 1993)

Panelist, Boston Public Library (12 Nov. 1986)
 Panelist, AWM Symposium, AMS-MAA Summer Meeting, Univ. of Utah, (6 Aug. 1987)
 Panelist, Conference on Women and Science, Barnard College, New York, NY (14 Nov. 1987)
 Featured speaker, Duke University, Science and Society Round Table (22 March 1989)
 Speaker, Iowa State University Women's Week (October 2, 1989)
 Featured speaker, Women in Math. & Science Conf., Millersville Univ. of Penn. (24 Apr. 1990)
 Discussant, IOWME symposium, Assisi Italy (June 27-28, 1991).
 Discussant, Pathways Workshop, Joint Statistics Meeting, San Francisco (August, 1993)
 Panelist, ICMI Study on Gender Issues in Mathematics Education, Höör, Sweden (Oct. 1993)
 Panelist, NSA Symposium, Washington, DC (Nov. 1993)
 Co-chair, Math and Physical Sciences Group, NSF Conference on Women, Wash. DC (Dec., 1995)

Seminar Speaker: Univ of Toronto (Jan, 1988); Univ. of Michigan (Apr, 1990);
 Univ. of Manitoba (Jan, 1992); Ohio State Univ. (Feb., 1992);
 Brown Univ. (Nov. 93); CalPoly, (May, 1995); Middlebury College (Feb., 1998).

Panelist, AWM Symposium, "Larry Summers: One Year Later" (Jan., 2006).

Panelist, AWM Symposium at MAA Mathfest summer meeting, (August, 2010).