Sarah J. Plosker

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Research Interests

Quantum information theory, operator theory, and matrix analysis, with current focus on operator systems, quantum state transfer, applications of majorization, and measures of coherence.

Academic Positions

- **Dept. Math & Computer Science, Brandon University** Brandon, MB
  Professor *2022 – present*
  Tier 2 Canada Research Chair (CRC) in Quantum Information Theory *2017 – present*
  Associate Professor *2016 – 2022*
  Assistant Professor *2013 – 2015*
- **Manitoba Quantum Institute** Winnipeg, MB
  Member *2020 – present*
- **Dept. Mathematics University of Manitoba** Winnipeg, MB
  Adjunct Professor *2014 – present*
- **Dept. Math & Statistics, University of Regina** Regina, SK
  Adjunct Professor *2014 – present*
- **Dept. Math & Statistics, University of Guelph** Guelph, ON
  Adjunct Professor *2016 – 2022*
- **Winnipeg Institute for Theoretical Physics** Winnipeg, MB
  Member *2013 – present*

Education

- Ph.D. Applied Mathematics, University of Guelph, Guelph, ON
  Dissertation: *Operator and matrix theory applications to quantum information*
  Advisor: David Kribs, July 2013

- M.Sc. Mathematics, University of Regina, Regina, SK
  Dissertation: *Capacities of completely positive maps*
  Advisor: Remus Floricel, August 2010

- B.Sc. Combined Mathematics and Statistics, University of Regina, Regina, SK, April 2008
  Co-op option (work terms at Saskatchewan Learning, Saskatchewan Dept. of Highways and Transportation, and Statistics Canada)
  Natural Sciences and Engineering Research Council of Canada Undergraduate Student Research Award
  (NSERC USRA, 2008), Supervisor: Dr. Don Stanley, Topic: Commutative Algebras

Awards, Grants & Honours

- **Tier 2 Canada Research Chair (CRC)** in Quantum Information Theory, 2017 – 2028, $1,000,000; Additional stipend from the program, 2018 – 2023, $80,000; Stipend from Brandon University, 2017 – 2028, $50,000

- **Canada Foundation for Innovation (CFI) John R. Evans Leaders Fund (JELF)**, funding for a "virtual lab" for my research group, 2023, $75,000; funding for a Quantum Computing Lab at Brandon University, 2017, $66,295

- CFI Infrastructure Operating Fund (IOF) allocation, for the ongoing operating and maintenance costs related to the JELF funding, 2017 – 2023, $19,889

- **NSERC Discovery Grant**, 2019 – 2024, $95,000

- **Canadian Internet Registration Authority (CIRA) Community Investment Program Grant** (co-Principal Investigator with Gautam Srivastava), 2019 – 2022, $20,659

- University of Regina Alumni Crowning Achievement Outstanding Young Alumni Award, 2021, $0

- Outstanding Woman in Science Recognition, International Women's Day, Faculty of Science, Brandon University, Mar. 8, 2019, $0

- Senate Award for Excellence in Research, Brandon University, Spring 2018, $0

- **NSERC Discovery Grant & Early Career Researcher Supplement**, 2014 – 2019, $75,000

- Brandon University Research Committee Research Award, 2018 – 2020, $2,354.67; 2014, $7,500

- **Governor General's Gold Medal**, University of Guelph, 2014, $0

- **NSERC Postgraduate Scholarship (PGS D)**, 2010 – 2013, $63,000

- Over $55,000 of internal funding at the University of Guelph (despite the university at the time suspending all major entrance awards due to budget constraints), 2010 – 2013

- **NSERC Alexander Graham Bell Canada Graduate Scholarship (CGS M)**, 2009 – 2010, $17,500

- Seven additional, university-wide awards totaling over $26,000 (reached upper limit of internal funding), University of Regina, 2008 – 2010

- NSERC Undergraduate Student Research Award (USRA), Spring/Summer 2008, $6,000

- University Prize in Science (awarded to the top student in the Faculty graduating with their first degree), 2008, $0

- 15 additional, university-wide awards totaling over $24,000, University of Regina, 2004 – 2008

Training of Highly Qualified Personnel

Undergraduate Student Supervision

1. Juliana Hiebert, NSERC USRA, 2023

2. Kayleigh Tanner, (co-supervised with Gautam Srivastava), Canadian Internet Registration Authority (CIRA) Community Engagement project, 2023

3. Alexis Cing-Mars, (co-supervised with Gautam Srivastava), Canadian Internet Registration Authority (CIRA) Community Engagement project, 2022

4. Kendra Simpson, (co-supervised with Gautam Srivastava), Canadian Internet Registration Authority (CIRA) Community Engagement project, 2022

5. Saniya Minase, Undergraduate Research Student, Fall 2021 – Winter 2021

6. Darian McLaren, Research Assistant, 2019 – 2020; NSERC USRA, 2018; Advanced Topics in Mathematics research course supervisor, 2017; NSERC USRA, 2017

7. Candace Richard (co-supervised with Gautam Srivastava), Canadian Internet Registration Authority (CIRA) Community Engagement project, 2019 – 2020

8. Farrah Huntinghawk, NSERC USRA, 2020, 2019; CIRA Community Engagement project (co-supervised with Gautam Srivastava), 2019 – 2020; series of 10 outreach events at the Indigenous Peoples' Center, Brandon University Students' Union Work Study Program, 2016 – 2017

9. Rebecca Storey, NSERC USRA, 2016

10. Bailey Kacsmar, Advanced Topics in Mathematics research course supervisor, 2015

11. Ryan Bergen, NSERC USRA, 2015

12. Whitney Gordon, NSERC USRA, 2015

13. Jin Li, Advanced Topics in Mathematics research course supervisor, 2014

14. Amie Teetaert, Advanced Topics in Mathematics research course supervisor, 2014

15. Jarrad Perron, Brandon University Research Committee (BURC) Research Award, 2014

Graduate Student Supervision

1. Hermie Monterde, PhD co-advisor (with Steve Kirkland), Fall 2021 – present; MSc co-advisor (with Steve Kirkland), University of Manitoba, Fall 2019 – Summer 2021

2. Avner Sadikov, MSc co-advisor (with Remus Floricel), University of Regina, Fall 2021 – Summer 2023

3. Michael Chesterton, MSc co-advisor (with Remus Floricel), University of Regina, Fall 2021 – Summer 2022

4. Emeka Ezeh, Masters in Development Practice (MDP), field placement co-supervisor (with Gautam Srivastava), University of Winnipeg, 2022

5. Oluwatobi Ruth Ojo, MSc co-advisor (with Doug Farenick), University of Regina, Fall 2019 – Summer 2021

6. Julius Adili Masanika, MSc co-advisor (with Doug Farenick), University of Regina, Winter 2019 – Summer 2020

7. Xiaohong Zhang, PhD co-advisor (with Steve Kirkland), University of Manitoba, Fall 2014 – Summer 2019

8. Shirin Moein, visiting PhD student from Isfahan University of Technology, Isfahan, Iran (with Rajesh Pereira), University of Guelph, Fall 2017 – Spring 2018

Post Doctoral Fellow Supervision

1. Shirin Moein, Mount Allison University (with Rajesh Pereira and Nathaniel Johnston), Winter 2021 – Winter 2023

2. Chris Ramsey, Brandon University, Fall 2017 – Spring 2018

Graduate Student Committee Member

1. Sarobidy Razafimahatratra, PhD in Math, advisory committee member, University of Regina, 2019 – 2021

2. Kyle Monkman, PhD in Physics, advisory committee member, University of Manitoba, 2019 – 2021

3. Ryan Tessier, PhD in Math, advisory committee member and thesis examination committee member, University of Regina, 2015 – 2019

4. Kyler Johnson, "Limiting operations for quantum random variables and a quantum martingale convergence theorem", MSc in Statistics, external thesis examiner, University of Regina, 2014

Publications

Peer-Reviewed Journal Articles[1]

36. N. Johnston and S. Plosker, *Laplacian $\{-1, 0, 1\}$- and $\{-1, 1\}$-diagonalizable graphs*, submitted.

35. D. McLaren*, H. Monterde*, and S. Plosker, *Weak Hadamard matrices and Weakly Hadamard diagonalizable graphs*, submitted.

34. S. Kirkland, H. Monterde*, and S. Plosker, *Quantum state transfer between twins in graphs*, Journal of Algebraic Combinatorics, accepted.

33. N. Johnston, S. Moein*, R. Pereira, and S. Plosker, *Absolutely k-Incoherent Quantum States and Spectral Inequalities for Factor Width of a Matrix*, Physical Review A, **106**, 052417, 2022.

32. N. Johnston, S. Moein*, R. Pereira, and S. Plosker, *Birkhoff–James Orthogonality in the Trace Norm, with Applications to Quantum Resource Theories*, Electronic Journal of Linear Algebra, **38**, pp. 760-776 2022.

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[1]**N. B.** An asterisk is used to identify highly qualified personnel (students, postdoctoral fellows, and research assistants) under my direct supervision. Some papers were written with HQP whom I did not formally supervise and whose supervisors were or were not co-authors; these HQP have not been identified explicitly. For all mathematics journal articles, authors are listed in alphabetical order. This is the standard in mathematics.

31. L. Cao, D. McLaren*, S. Plosker, *The Complete Positivity of Symmetric Tridiagonal and Pentadiagonal Matrices*, Special Matrices, **11** (1), 2022.

30. S. Plosker and C. Ramsey*. *Bistochastic operators and quantum random variables*, New York Journal of Mathematics, **28**, pp. 580-609,2022.

29. D. Farenick, O. Ojo*, and S. Plosker, *Universality of Weyl Unitaries*, Linear Algebra and its Applications, **634**, pp. 57–76, 2022.

28. D. Farenick, F. Huntinghawk*, A. Masanika*, and S. Plosker, *Complete order equivalence of spin unitaries*, Linear Algebra and its Applications, **610**, pp. 1-28, 2020.

27. A. Chan, S. Fallat, J.C.-H. Lin, S. Kirkland, S. Nasserasr, and S. Plosker. *Complex Hadamard diagonalisable graphs*, Linear Algebra and its Applications, **605**, pp. 158-179, 2020.

26. P. Ganesan, L. Gao, S. Pandey, and S. Plosker, *Quantum majorization on semifinite von Neumann algebras*, Journal of Functional Analysis, 108650, 2020.

25. L. Cao, D. McLaren*, and S. Plosker, *Centrosymmetric stochastic matrices*, Linear and Multilinear Algebra, pp. 1-16, 2020.

24. D. McLaren*, S. Plosker, and C. Ramsey*. *On operator valued measures*, Houston Journal of Mathematics, **46**(1), pp. 201-226, 2020.

23. M. Adm, S. Fallat, K. Meagher, S. Nasserasr, S. Plosker, and B. Yang. *Achievable multiplicity partitions in the inverse eigenvalue problem of a graph*, Special Matrices (special issue dedicated to Charlie Johnson), **7**, pp. 276-290, 2019. Received *Editor's Choice* recognition.

22. S. Kirkland, S. Plosker, and X. Zhang*. *Switching and partially switching the hypercube while maintaining perfect state transfer*, Quantum Information and Computation, **19**, no. 7& 8, pp. 0541-0554, 2019.

21. S. Moein*, R. Pereira, and S. Plosker. *A simplified and unified generalization of some majorization results*, Journal of Mathematical Analysis and Applications, **478**, pp. 1049-1058, 2019.

20. S. Plosker and C. Ramsey*. *An operator-valued Lyapunov theorem*, Journal of Mathematical Analysis and Applications, **469**, pp. 117–125, 2019.

19. S.J. Harris, R.H. Levene, V.I. Paulsen, S. Plosker, M. Rahaman. *Schur multipliers and mixed unitary maps*, Journal of Mathematical Physics, **59**, 112201 (2018).

18. S. Kirkland, D. McLaren*, R. Pereira, S. Plosker, and X. Zhang*. *Perfect quantum state transfer in weighted paths with potentials (loops) using orthogonal polynomials*, Linear and Multilinear Algebra **67**, no. 5, pp. 1043–1061, 2019.

17. N. Johnston, C.-K. Li, S. Plosker, Y.T. Poon, and B. Regula. *Evaluating the robustness of k-coherence and k-entanglement*, Physical Review A, **98**, 022328, 2018

16. N. Johnston, C.-K. Li, and S. Plosker. *The modified trace distance of coherence is constant on most pure states*, Journal of Physics A: Mathematical and Theoretical, **51**, 414010, 2018.

15. N. Johnston, S. Kirkland, S. Plosker, R. Storey*, and X. Zhang*. *Perfect quantum state transfer using Hadamard diagonalizable weighted graphs.* Linear Algebra and its Applications, **531**, pp. 375–398, 2017.

14. J. Chen, S. Grogan, N. Johnston, C.-K. Li, and S. Plosker. *Quantifying the coherence of pure quantum states.* Physical Review A, **94**, 042313, 2016.

13. W. Gordon*, S. Kirkland, C.-K. Li, S. Plosker, and X. Zhang*. *Bounds on probability of state transfer with respect to readout time and edge weight.* Physical Review A **93**, 022309, 2016.

12. D. Farenick, M. J. Kozdron, and S. Plosker. *Spectra and variance of quantum random variables.* Journal of Mathematical Analysis and Applications **434**, pp. 1106-1122, 2016.

11. M. E. Carrington, G. Kunstatter, J. Perron*, and S. Plosker. *On the geometric measure of entanglement for pure states.* Journal of Physics A: Mathematical and Theoretical, **48**, 435302, 2015.

10. J. Li*, R. Pereira and S. Plosker. *Some geometric interpretations of quantum fidelity.* Linear Algebra and its Applications, **487**, pp. 158-171, 2015.

9. R. Pereira and S. Plosker. *Extending a characterization of majorization to infinite dimensions.* Linear Algebra and its Applications, **468**, pp. 80-86, 2015.

8. T. Jochym-O'Connor, D. W. Kribs, R. Laflamme, and S. Plosker. *Quantum subsystems: Exploring the complementarity of quantum privacy and error correction.* Physical Review A, **90**, 032305, 2014.

7. D. W. Kribs and S. Plosker. *Private quantum codes: introduction and connection with higher rank numerical ranges.* Linear and Multilinear Algebra, **62**, pp. 639-647, 2014.

6. T. Jochym-O'Connor, D. W. Kribs, R. Laflamme, and S. Plosker. *Private quantum subsystems.* Physical Review Letters, **111**, 030502, 2013.

5. R. Pereira and S. Plosker. *Dirichlet polynomials, majorization, and trumping.* Journal of Physics A: Mathematical and Theoretical, **46**, 225302, 2013.

4. D. Farenick, R. Floricel, and S. Plosker. *Approximately clean quantum probability measures.* Journal of Mathematical Physics, **54**, Issue 5, 052201, 2013.

3. D. W. Kribs, R. Pereira, and S. Plosker. *Trumping and power majorization.* Linear and Multilinear Algebra, **61**, pp. 1455-1463, 2013.

2. D. Farenick, S. Plosker, and J. Smith. *Classical and nonclassical randomness in quantum measurements.* Journal of Mathematical Physics, **52**, Issue 12, 122204, 2011.

1. A. Church, D. W. Kribs, R. Pereira, and S. Plosker. *Private quantum channels, conditional expectations, and trace vectors.* Quantum Information & Computation (QIC), **11**, no. 9 & 10, pp. 774-783, 2011.

Refereed Conference Proceedings[2]

3. S. Plosker, and G. Srivastava. *Cybersecurity Education in Rural Indigenous Canada*, Institute of Electrical and Electronics Engineers Canadian Conference of Electrical and Computer Engineering (IEEE CCECE) 2021

2. F. Huntinghawk*, C. Richard*, S. Plosker, and G. Srivastava. *Expanding Cybersecurity Knowledge Through an Indigenous Lens: A First Look*, Institute of Electrical and Electronics Engineers Canadian Conference of Electrical and Computer Engineering (IEEE CCECE) 2020.

1. B. Kacsmar*, S. Plosker, and R. Henry. *Computing Low-Weight Discrete Logarithms*, the 24th Annual Conference on Selected Areas in Cryptography (SAC 2017), In *International Conference on Selected Areas in Cryptography*, pp. 106-126. Springer, Cham,

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[2]**N.B.** For Computer Science conference proceedings, authors are listed with students first followed by faculty. For item 1, authors are listed in decreasing level of contribution within these two categories; for items 2 and 3, authors are listed in alphabetical order within these two categories.

Newsletter Articles

- *Operator Algebras Mentor Network: supporting early-career women researchers*, (with A. Duwenig, K. Eifler, P. Ganesan, L. Ismert, and K. Strung), European Women in Maths, 3 pages, Feb. 2022.

- *Quantum state transfer* (with X. Zhang*), Canadian Mathematical Society (CMS) Notes, vol. 28, no. 6, pp. 16-17.

- *Linear algebraic ties to quantum information theory*, IMAGE (the semiannual bulletin for the International Linear Algebra Society), Fall 2015, vol. 55, pp. 7-11.

- *What do trace vectors have to do with private quantum channels?*, Notes from the Margin (a semiannual publication by the Student Committee of the Canadian Mathematical Society (CMS)), Winter 2012, vol. III, pp. 6-7.

- Helped develop and oversee the total overhaul of *Notes from the Margin* (formerly *The Student Mathematical Newsletter*), a semiannual publication by the Student Committee of the Canadian Mathematical Society (CMS), 2011.

- Wrote various articles for the Student Mathematical Newsletter (former semiannual publication by the Student Committee of the CMS), 2010.

Invited Talks at Conferences

- *Operator-valued functions that are integrable against a positive, operator-valued measure*, Operator Algebras and Applications Session, *Quantum theoretic aspects of spin unitary matrices*, Quantum Information Theory Session, CMS Summer Meeting (virtual), June 7-14, 2021

- *Bistochastic operators and quantum random variables*, The 49th Canadian Operator Symposium (COSy) (virtual), May 31-June 4, 2021.

- *Centrosymmetric Stochastic Matrices*, SIAM Conference on Applied Linear Algebra (virtual), May 17-21, 2021.

- *Indigenous beadwork in a mathematics classroom*, Geometry: Education, Art, and Research (GEAR), Banff International Research Station, (virtual), Feb. 19-21, 2021.

- *Complete order equivalence of spin unitaries*, special session on Advances in Operator Algebras, Joint Mathematics Meetings (JMM), Washington, D.C. (virtual), Jan. 6-9, 2021.

- Six invited talks at national and international conferences cancelled due to COVID-19, 2020.

- *Quantum information on complex Hadamard diagonalizable graphs*, Quantum Information on Graphs Session, *Beadwork as a method of teaching linear algebra*, The Art of Mathematics Session, CMS Winter Meeting, Toronto, ON, Dec. 6-9, 2019.

- *The robustness of $\mathbf{k}$-coherence and $\mathbf{k}$-entanglement*, Algebraic and Statistical ways into Quantum Resource Theories Workshop, Banff International Research Station for Mathematical Innovation and Discovery (BIRS), Banff, AB, July 21-26, 2019.

- *Schur multipliers and mixed unitary maps*, Invited Minisymposium: Linear Algebra and Quantum Information Science, International Linear Algebra Society (ILAS) Meeting Rio, Brazil, July 8-12, 2019.

- *The robustness of k-coherence*, The Mathematics behind Quantum Information Science Session, CMS Summer Meeting, Regina, SK, June 7-10, 2019.

- *Quantum majorization via operator space duality*, 47th Canadian Operator Symposium, University of Regina, Regina, SK, June 3-7, 2019.

- *Finding the "closest" diagonal state to an arbitrary quantum state*, Special Session on Combinatorial Matrix Theory, American Mathematical Society Sectional Meeting, Auburn University, Auburn, AL, Mar. 15-17, 2019.

- *Switching the hypercube while maintaining perfect state transfer*, Optimization Techniques in Quantum Information Theory Session, CMS Summer Meeting, Fredericton, NB, Jun. 1-4, 2018.

- *Hadamard diagonalizable graphs, cubelike graphs, and perfect state transfer*, Algebraic Graph Theory and Quantum Walks Workshop, Waterloo, ON, Apr. 23–27, 2018.

- *Perfect quantum state transfer on weighted paths*, Mathematical Aspects of Quantum Information Session, CMS Winter Meeting, Waterloo, ON, Dec. 8–11, 2017.

- *Achieving perfect state transfer using Hadamard diagonalizable graphs*, Matrix Analysis and its Applications Special Session, 3rd Pacific Rim Mathematical Association (PRIMA2017) Congress, Oaxaca, Mexico, Aug. 14–18, 2017.

- *Clean quantum measurements via operator systems*, Workshop on Operator Systems in Quantum Information, Guelph, ON, Aug. 14–17, 2017.

- *Quantum state transfer via Hadamard diagonalizable graphs*, Invited Minisymposium: Linear Algebra and Quantum Information Science, 21st Meeting of the International Linear Algebra Society (ILAS) Ames, IA, USA, July 24–28, 2017.

- *Hadamard diagonalizability and cubelike graphs*, Special Western Canada Linear Algebra Meeting, BIRS, Banff, AB, July 7–9, 2017.

- *Hadamard diagonalizable graphs with perfect state transfer*, Prairie Discrete Math Workshop, Lumsden, SK, June 2–5, 2017.

- *Optimal bounds on fidelity of quantum state transfer with respect to errors*, Optimization Techniques in Quantum Information Theory Session, CMS Winter Meeting, Niagara Falls, ON, Dec. 2–5, 2016.

- *Applications of matrix theory to quantum coherence*, 2016 Workshop on Matrices and Operators (MAO), Jeju Island, South Korea, July 3–6, 2016.

- *The probability of quantum state transfer: a matrix analysis approach*, The Thirteenth Workshop on Numerical Ranges and Numerical Radii, Taipei, Taiwan, June 28–30, 2016.

- *Some matrix theory questions arising from quantum coherence*, Special Session on Matrix and Operator Theory, AMS Sectional Meeting, Fargo, ND, USA, April 16–17, 2016.

- *The probability of quantum state transfer: a matrix analysis approach*, 5th International Conference on Matrix Analysis and Applications (ICMAA), Fort Lauderdale, FL, USA, Dec 17–20, 2015.

- *Spectra and variance of quantum random variables*, Workshop on Quantum Marginals and Numerical Ranges, Guelph, ON, Aug. 17–21, 2015.

- *Spectra and variance of quantum random variables*, Workshop on Matrices and Operators (MAO), Shaanxi Normal University, Xian, China Jul. 19–21, 2015.

- *Some geometric interpretations of quantum fidelity*, Summer Research Workshop on Quantum Information Science, Sanya, Hainan, China Jul. 13–17, 2015.

- *On the problem of entanglement transformations: characterizing trumping*, Invited Minisymposium on Quantum Information and Computing, 19th Conference of the International Linear Algebra Society (ILAS), Seoul, South Korea, Aug. 6–9, 2014.

- *Quantum expectations: a matricial range perspective*, The Twelveth Workshop on Numerical Ranges and Numerical Radii, Sanya, Hainan, China, Jul. 28 – Aug. 1, 2014.

- *Using vector spaces of matrices to study quantum measurements*, Workshop on Matrices and Operators, Haikou, Hainan, China, Jul. 24–27, 2014.

- *Trumping and power majorization*, Minisymposium on Linear Algebra Problems in Quantum Computation, 18th Conference of the International Linear Algebra Society (ILAS), Providence, RI, USA, June 3–7, 2013.

- *Private quantum codes*, Operator Theory and Operator Algebras Session, CMS Winter Meeting, Montreal, PQ, Dec. 7–10, 2012.

- *Private quantum channels, conditional expectations, and trace vectors*, 8th Canadian Student Conference on Quantum Information, Jouvence, PQ, June 16–17, 2011.

Invited Talks at Departmental Seminar Series

- *Centrosymmetric Stochastic Matrices*, Waterloo Algebraic Graph Theory Seminar Series (virtual), Mar. 22, 2021.

- *Centrosymmetric Stochastic Matrices*, Matrix Seminar Series, University of Nevada, Reno (virtual), Mar. 1, 2021.

- *How superpositioned is my quantum state?*, Science Seminar Series, Brandon University, Oct. 31, 2019.

- *On operator-valued measures*, Math dept. research seminar, Texas A&M University, Feb. 2, 2019.

- *Some matrix theory questions arising from quantum coherence*, Math Colloquium, University of Manitoba, Mar. 11, 2016.

- *Private quantum subsystems and error correction*, Operator Algebra Seminar Series, University of Regina, Sept. 26, 2014.

- *The majorization and trumping orders in quantum information*, Math Colloquium, University of Regina, Sept. 26, 2014.

- *On majorization and trumping*, Winnipeg Institute for Theoretical Physics (WITP), University of Manitoba, Mar. 20, 2014.

- *Private Quantum Channels*, Science Seminar Series, Brandon University, Jan. 17, 2014.

- *On complementarity in quantum error correction and quantum cryptography*, Operator Algebra Seminar Series, University of Regina, Regina, SK, Apr. 18, 2012.

- *Private quantum channels, conditional expectations, and trace vectors*, Nipissing University, North Bay, ON, June 30, 2011.

Contributed Talks

- *Universality of Weyl Unitaries*, Great Plains Operator Theory Symposium (GPOTS) (virtual), May 10-14, 2021

- *Operator-valued Lyapunov theorem*, Canadian Operator Symposium, University of Manitoba, Winnipeg, MB, June 4–8, 2018

- *The role of majorization and trumping in quantum information theory*, 2014 Program for Women and Mathematics: Random Matrix Theory, Institute for Advanced Study and Princeton University, Princeton, New Jersey, May 12–23, 2014

- *Using vector spaces of matrices to study quantum measurements*, 12th Western Canada Linear Algebra Meeting, University of Regina, Regina, SK, May 10–11, 2014.

- *Quantum information theory and the additivity conjecture*, Fourth Annual Meeting of the Prairie Network for Research in Mathematical Sciences, University of Manitoba, Winnipeg, MB, May 1, 2010.

- *Quantum information theory: the future of communication*, Creating Community Consciousness: Putting Theory into Practice, University of Regina, Regina, SK, Mar. 13, 2010.

- *Checksum algorithms and your credit card*, Graduate/Undergrad Student Seminars, University of Regina, Regina, SK, Feb. 2, 2009.

Teaching Experience

Course Instructor

Responsible for all aspects of the course, including creating lesson plans, creating lecture notes, delivering lectures, creating assignments and exams, providing office hours, marking exams, responding to student emails, etc.

- Brandon University
  - 62:171 Introduction to Statistics, Fall 2022, Winter 2017, Winter 2016, Winter 2015, Winter 2014
  - 62:181 Calculus I, Winter 2016, Winter 2015, Winter 2014
  - 62:261 Introduction to Set Theory and Logic, Fall 2017, Fall 2016, Fall 2015, Fall 2014, Fall 2013
  - 62:252 Applied Linear Algebra, Winter 2017, Winter 2016, Winter 2015, Winter 2014
  - 62:272 Applied Statistics, Winter 2017
  - 62:292 Linear Algebra II, Fall 2021, Fall 2019
  - 62:486 Topology, Fall 2018, Fall 2013
  - 62:498 Advanced Topics in Mathematics, Fall 2017, Fall 2015, Fall 2014

- University of Guelph
  - Math 2000 Set Theory, Fall 2012

- University of Regina
  - Math 111 Calculus II, Spring/Summer 2009

Summer School Mentor & Lecturer/Project Leader

- *Project Leader and group mentor*, week-long research and learning project with students and postdocs, Project title: The f-divergence, entropy, and related measures of two operator-valued measures, Women in Operator Algebras (WOA) II Workshop, Banff International Research Station (BIRS), Banff, AB, Dec. 5-10, 2021 (hybrid in-person/virtual format), Project title: Quantum majorization in infinite dimensional Hilbert spaces, WOA I, BIRS, Nov. 5–9, 2018.

- *Operator Algebras and Quantum Information Theory*, Culminating Workshop presentation, Groundwork for Operator Algebras Lecture Series (GOALS); GOALS aims to increase participation and retention in the field by persons from traditionally underrepresented groups, July 25, 2021.

- *The basics of quantum information theory Mini-Course*, Facilitator and Speaker for a half-day mini-course aimed at students and postdocs, Canadian Mathematical Society (CMS) Summer Meeting, Regina, SK, June 7-10, 2019.

- *Modelling a quantum spin network*, Project leader and group mentor for a week-long research and learning project with graduate students, Graduate Math Modelling in Industry Workshop (GMMIW 2017), Winnipeg, MB, Jul. 30 – Aug. 5, 2017.

- *The majorization and trumping orders in quantum information* (co-presenter Rajesh Pereira, three lectures in a week-long summer school for graduate students), 14th Canadian Summer School on Quantum Information, Guelph, ON, Jun. 16–20, 2014.

Course Material Development

- University of Guelph
  - Math 3160 - Linear Algebra II, Winter 2012 – Summer 2013 (the supplemental notes I developed were sold to students at cost from 2013 –2016, at which time the textbook officially used for the course went out of print)

Guest Lecturer

- *Quantum channels, Schur product, and factorizability*, informal afternoon of lecture and discussion directed at graduate students and postdoctoral fellows, Texas A&M University, Jan. 30, 2019.

- *Quantum fidelity*, three-part lecture series directed at undergraduate students, graduate students, and postdoctoral fellows, University of Regina, June 29–Jul. 3, 2015.

- Nano 3700 - Introduction to Quantum Computing, three lectures, University of Guelph, Winter 2013

- Math 3160 - Linear Algebra II, 11 lectures each semester, University of Guelph, Winter 2013, Winter 2012

- Math 111 - Calculus II, three lectures, University of Regina, Fall 2009

Lab Instructor

Tutorial-style labs. Responsible for creating lecture notes, delivering lectures, providing one-on-one help, invigilating exams, and marking assignments.

- University of Guelph
  - Math 2000 - Set Theory, Fall 2011
  - Math 2130 - Numerical Methods, Winter 2011

- University of Regina
  - Math 110 - Calculus I, Fall 2009
  - Math 111 - Calculus II, Winter 2009, Fall 2008, Fall 2007, Winter 2007, Fall 2006

Professional Development

- Participant, *Women and Gender Minorities in Math Summit Meeting*, Canadian Mathematical Society, virtual, May 30, 2023

- Participant, *Mentoring Workshop*, Operator Algebras Mentor Network, virtual, Mar. 29, 2023

- Participant, *Teaching Enhancement Conference 2021 A Wider Welcome: Fostering greater equity, diversity and inclusion in our classes*, Brandon University, Sept. 1, 2021

- Participant, Women in Mathematics during the time of COVID, Le Centre de recherches mathématiques (CRM), Mar. 8, 2021

- Participant, Inspiring Leadership Forum, University of Regina, "Finding the Courage Within", Mar. 3, 2021; "Defying the Odds", Mar. 5, 2019

- Participant, Project Management Fundamentals, full-day workshop, Brandon University, Oct. 18, 2019

- Certificate of Completion, *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE)*, Sept. 3, 2019

- Participant, *Teaching Enhancement Conference: Small Steps Often: Indigenous Learning and Teaching*, Centre for Teaching, Learning, & Technology, Brandon University, Aug. 28, 2019

- Verified Certificate, *Reconciliation Through Indigenous Education*, 6-week Massive Open Online Course (MOOC), the University of British Columbia, Oct. 23–Dec. 4, 2018

- Certificate of Completion, *Unconscious bias training*, bias in peer review module from the Canada Research Chair website, Nov. 3, 2018

- Participant, *Developing Your Cultural Awareness* , Brandon University, Feb. 6, 2019; *Guide to Recruitment & Hiring (Academic)*, online training, Feb. 6, 2019; *Workshop on Dealing with Conflict Productively*, Nov. 14, 2018; *Workshop on Discrimination & Harassment Prevention Policy & Procedures*, Sept. 12, 2018

- Participant, *The Blanket Exercise (KAIROS)*, experiential workshop to develop awareness and understanding of the relationship between Indigenous and non-Indigenous peoples, Brandon University, Oct. 3, 2018

- Participant, *Teaching Enhancement Conference: Hands-on Theory*, Centre for Teaching, Learning, & Technology, Brandon University, Aug. 31, 2017

- Completion of Accessibility Training, three modules on the Accessibility for Manitobans Act (AMA) and the Customer Service Standard, Brandon University, Winter 2017

- Participant, *Teaching Enhancement Conference*, Centre for Teaching, Learning, & Technology, Brandon University, Sept. 3, 2015

- Letter of Participation, *Making a Difference: Inspiring Confidence in the Classroom*, Graduate Student University Teaching Conference, Centre for Open Learning and Educational Support, University of Guelph, Aug. 30, 2012

- UNIV 6800 - *University Teaching, Theory, and Practice (UTTP)* (full semester course, for credit), Centre for Open Learning and Educational Support, University of Guelph, Fall 2011

- Letter of Participation, *Teaching: It's Your Discipline*, Graduate Student University Teaching Conference, Centre for Open Learning and Educational Support, University of Guelph, Sept. 2, 2011

- Participant, *Taking Stock: Research on Teaching & Learning in Higher Education*, Teaching Support Services Special Event, University of Guelph, Feb. 14, 2011

- *Passport of Participation, Graduate Student Teaching Development Program*, Teaching Support Services, University of Guelph, Fall 2010 - Winter 2011

- Participant, *TAACtics: Graduate Student Pedagogy Discussion Group*, Teaching Assistant Advisory Committee (TAAC), University of Guelph, Fall 2010 - Winter 2011

- Completion of Accessible Service Provision eLearning course, Accessibility for Ontarians with Disability Act (AODA) Training, University of Guelph, Fall 2010

- Letter of Participation, *Empowering Future Educators & Leaders*, Graduate Student University Teaching Conference, Teaching Support Services, University of Guelph, Sept. 25, 2010

- Participant, *Practice Your Presentation Skills! Workshop*, Mathematics of Information Technology and Complex Systems (MITACS), University of Regina, Mar. 22, 2010

- Certificate, *Teaching Development Days for Teaching Assistants*, Teaching Development Centre, University of Regina, Fall 2009

Academic Service and Contributions

University Service

- *Adjudicator*, Department of Mathematics & Computer Science annual scholarships & awards, Brandon University, 2013–present

- *Science Representative*, Review Committee on the Status of Women, 2021–22

- *Member*, Mathematics Programming Committee, Department of Mathematics & Computer Science, Brandon University, 2021

- *Member*, Hiring Committee, Department of Mathematics and Computer Science, Brandon University, 2022, 2021, 2018, 2017, 2015, 2014

- *Success1 Coach*, personal coach for "at-risk" first-year students (one per year), including attendance at coaching workshops, Brandon University, 2016–2019

- *Science Representative*, Liberal Education Requirement Policy Revision Subcommittee of the Curriculum & Academic Planning (CAP) Committee, Brandon University, 2019

- *Member*, Canada Research Chairs Program Equity, Diversity, and Inclusion Committee (a small committee that worked quickly to help the university become EDI-compliant), Brandon University, Winter 2019

- *Member*, Faculty Canada Research Chair Letter of Intent (CRC LOI) adjudication committee, Brandon University, Fall 2018

- *Science Representative*, University Promotions Committee, Brandon University, 2018–19

- *Volunteer*, Orientation (various activities), Brandon University, 2018, 2016, 2013.

- *Pi Your Profs*, Brandon University Mathematics Association, Mar. 14, 2018; Brandon University Biological Society, Mar. 14, 2014; funds donated to BUSU Food Bank and Relay for Life

- *Volunteer*, Science Booth at Brandon Career Symposium, Keystone Centre, Brandon, MB, Spring 2018, Spring 2014

- *Member*, NSERC USRA Oversight Committee, Brandon University, 2014–17

- *Science Representative*, Brandon University Faculty Association (BUFA), 2016–17

- *Faculty Advisor*, Math Student Club, Brandon University, 2015–18 (secured club room space and funding to send five club members to a regional conference, acted as mentor and advisor for social and educational events)

- *Science Representative*, Scholarship Committee, Brandon University, 2014–16

- *Member*, Bylaws Revision Committee, Brandon University, 2014–16

- *Senator*, Senate, Brandon University, 2014–16

- *Member*, Faculty of Science Graduate Studies Committee, Brandon University, 2014–16

- *Department Representative*, Declare Fair, Brandon University, Mar. 25, 2014

- *Math Contest Coach* (together with C.K. Li and D. Pickering), coaching & preparing a team of students to compete at the Mathematical Association of America (MAA) North Central Section, 2013–14

- *Senator*, Senate, University of Guelph, 2012–13

- *Member*, Board of Graduate Studies, University of Guelph, 2012–13

- *Member*, Committee on Student Petitions, University of Guelph, 2012–13

- *Member*, Senate Priorities and Planning Committee, University of Guelph, 2012-13

- *Member*, Student Senate Caucus (SSC), University of Guelph, 2012–13

- *Co-Organizer and Discussion Facilitator*, Matrix Analysis and its Applications to Quantum Information Theory Learning Seminar Series, Dept. Math & Statistics, University of Guelph, Guelph, ON, Summer 2012.

- *Adjudicator*, Student Life Recognition Awards Committee, University of Guelph, 2011–12

- *General Director, Math & Statistics*, Graduate Students' Association (GSA), University of Guelph, 2011–12

- *Volunteer*, Math & Statistics booth at various student recruitment events, University of Guelph, Guelph, ON, 2010–11

- *Conference Volunteer*, Creating Community Consciousness: Putting Theory into Practice, University of Regina, Regina, SK, Mar. 12–13, 2010

- *Co-Founder, Organizer, and Host*, The Math, Actuarial Science, and Statistics Students' Society π-Day (Rounded Up), University of Regina, Mar. 15, 2010.
  - included remarks from department head and three 14 minute talks
  - Over 500 pieces of free pie were given away
  - Became an annual event

- *Organizer and Host*, Graduate Students' Association Educational Seminars, University of Regina, Fall 2009 – Winter 2010.

- *Organizer and co-Host*, Graduate Students' Association Coffee Socials, University of Regina, Fall 2009 – Winter 2010.

- *Adjudicator*, Centre for Teaching and Learning (CTL) Graduate Teaching Awards Adjudication Committee, University of Regina, 2009–10

- *Member*, Strategic Research Planning Sub-Committee from the Council Committee on Research, University of Regina, 2009–10

- *Member*, Faculty Council of the Faculty of Graduate Studies and Research, University of Regina, 2009–10

- *Member*, Council Discipline Committee, University of Regina, 2009–10

- *VP Social and Educational Programming*, Graduate Students' Association (GSA), University of Regina, 2009–10

- *Grad Student Representative* (2009–10), *Vice President* (2008–09), *Math and Statistics Student Representative* (2007–08), Math, Actuarial Science, and Statistics Students' Society (MASS), University of Regina

- *Organizer*, Graduate Students' Association Welcome BBQ ($\sim$ 150 attendees), University of Regina, Sept. 17, 2009.

- *Member*, University of Regina Women in Science and Engineering (URWISE), University of Regina, 2008–10

- *Math and Statistics Graduate Student Representative* (2008–10), *Math and Statistics Undergraduate Student Representative* (2007–08), Department of Math and Statistics, University of Regina

- *Organizer and Host*, Graduate/Undergrad Student Seminars (new series), Dept. Math & Statistics, University of Regina, Winter 2008.

Service to the Discipline

- *Member*, Scientific Organizing Committee, Canadian Mathematical Society (CMS) Winter Meeting, Montreal, QC, Dec. 1-4, 2023

- *Senior Mentor*, Operator Algebras Mentor Network, Aug. 2020–present; *Member of Board of Directors*, Aug. 2020–Dec. 2021 (Chaired the Board April–May, 2021)

- *Director – West*, CMS Board of Directors, Summer 2019–Spring 2023

- *Co-organizer*, Contributed Minisymposium in honour of Stephen Kirkland's 60th Birthday, International Linear Algebra Society (ILAS) Meeting, Madrid, Spain, June 12-16, 2023

- *Co-organizer*, Women in Operator Algebras (WOA) III, Banff International Research Station (BIRS), June 26-30, 2023

- *Organizing Committee Member*, Western Canada Linear Algebra Meeting (WClam), 2017–present

- *External Reviewer*, NSERC Discovery Grant Mathematics and Statistics (EG 1508) competition, 2022-23

- *Co-organizer*, Quantum Information Theory Scientific Session, CMS Winter Meeting, Toronto, ON, Dec. 2-5, 2022

- *Reviewer*, zbMATH (formerly Zentralblatt MATH), 2019–2021

- *Reviewer*, American Mathematical Society MathSciNet Mathematical Reviews, 2014–2021

- *Research Mentor and Project Supervisor*, Athena Talaria Research Program (aimed at underprivileged female and non-binary high school students), Summer 2021

- *Reviewer*, book proposal for the Physics book program, Springer Nature, Summer 2021

- *Nomination reviewer*, Global Excellence Initiative, Universities Canada, Spring 2021

- *Local Organizing Committee Member*, Western Canada Linear Algebra Meeting (WCLAM), Brandon University (included successful application for ∼$11,000 from various external and internal sources), May 29–30, 2021; May 23–24, 2020 (postponed due to COVID-19); University of Manitoba, May 15–16, 2016

- *Judge*, CMS Student Poster Session, CMS Summer Meeting: 2021, 2012, 2011; CMS Winter Meeting: 2017, 2010

- *External Reviewer*, NSERC Discovery Grant Physics (EG 1505) competition, 2019-20, 2020-21

- *Adjudicator*, US National Science Foundation (NSF) Division of Mathematical Sciences, Alexandria, Virginia, USA, 2020 Grant Competition

- *Mentor*, Association for Women in Mathematics, 2019-20

- *Organizer*, Invited Minisymposium: Linear Algebra and Quantum Information Science, [International Linear Algebra Society (ILAS) Meeting](#) Rio, Brazil, July 8-12, 2019

- *Co-organizer*, Quantum Information Theory Scientific Session, Canadian Mathematical Society (CMS) Summer Meeting, Regina, SK, June 7-10, 2019

- *Grant Proposal Reviewer*, National Science Centre, Poland, Spring 2019

- *Special Guest*, Mentoring Lunch for women in math, American Women in Mathematics Student Chapter, Texas A&M University, January 30, 2019

- *Member*, International Linear Algebra Society (ILAS) Nomination Committee, 2017–2018

- *Organizing Committee Member*, Workshop on Numerical Ranges and Numerical Radii (WONRA), Munich, Germany, June 18-22, 2018

- *Organizer*, Summer Symposium, Winnipeg Institute for Theoretical Physics (WITP), Brandon University, August 27, 2018; August 29, 2014

- *Co-Organizer*, Prairie Discrete Mathematics Workshop (PDMW), Brandon University, June 12-15, 2018 (included successful application for ∼$12,000 from the Pacific Institute for the Mathematical Sciences (PIMS), Research Manitoba, the Fields Institute, the City of Brandon, Brandon University (Faculty of Science), and the Canadian Mathematical Society (CMS) Student Committee)

- *Co-Organizer*, Mathematical Aspects of Quantum Information Theory Scientific Session, Canadian Mathematical Society (CMS) Summer Meeting, Fredericton, NB, June 1–4, 2018 (including successful application for $2,000 funding from the Atlantic Association for Research in the Mathematical Sciences (AARMS) to support travel of researchers from Atlantic Canada)

- *Co-Organizer*, Optimization Techniques in Quantum Information Theory Scientific Session, Canadian Mathematical Society (CMS) Winter Meeting, Niagara Falls, ON, Dec. 2–5, 2016

- *Journal referee* for the following journals: Acta Mathematica Vietnamica, Electronic Journal of Linear Algebra, Journal of Mathematical Analysis and Applications, Journal of Physics A: Mathematical and Theoretical, Linear Algebra and its Applications, Linear and Multilinear Algebra, New Journal of Physics, Operators and Matrices, Physical Review Applied, Special Matrices, Quantum Information & Computation (QIC)

- *Co-Organizer*, Matrix Theory in Quantum Information Special Session, Canadian Mathematical Society (CMS) Winter Meeting, Ottawa, ON, Dec. 6–9, 2013

- *Co-Organizer*, Southwestern Ontario Graduate Mathematics Conference (SOGMC'13), University of Guelph, Guelph, ON, Jun. 4–5, 2013

- *Co-Chair* (2010–12), *Western Provinces Representative* (2009–10), CMS Student Committee (StudC).
  Duties included:
    - *Co-Organizer*, Student Poster Session, CMS Summer Meeting, 2012, *Organizer* 2011
    - *Organizer and co-Host*, CMS Student Committee Student Social, CMS Summer Meeting, 2012, 2011, CMS Winter Meeting 2010
    - *Organizer and Host*, The Hiring Process, CMS Student Committee Panel Discussion, CMS Winter Meeting, 2010, CMS Summer Meeting 2010

- *A mathematics graduate student aims to contribute to quantum information theory*, video interview and teaching featured on the Faculty of Science, University of Regina website.

- *My experience in the Math and Statistics Department*, Department of Math & Statistics showcase event, audience of ∼100 honour-roll undergraduate students, University of Regina, SK, Mar. 25, 2009.

Community Service/In the Media

- *Secretary*, Rivers and Area Game and Fish Association, January 2020–present

- Biography posted to the University of Regina home page, alumni website, and social media (in relation to the U of R Alumni Crowning Achievement Outstanding Young Alumni Award); interview featured in *Degrees* magazine, 2021

- "Everyday Encounter", interview for the Rivers Banner (a weekly regional rural newspaper), Vol. 113, No. 11, Oct. 2020

- *Workshop Facilitator*, "Expanding knowledge-sharing of cybersecurity through an Indigenous lens", facilitated community outreach workshops at Waywayseecappo Community School on cybersecurity, Spring 2020

- *Judge and Demonstrator*, Meadows Elementary School Science Fair and Interactive Science Demonstrations, Feb. 26, 2020; *Judge*, St. Augustine Elementary School Science Fair, Feb. 21,2019; Meadows Elementary School Science Fair, Feb. 13, 2019

- *Volunteer*, Let's Talk Science, 2018–present; included the creation of a *Science Saturday* event at the Prairie Crocus Regional Library in Rivers, MB in 2020; over 10 events in rural communities; named *volunteer of the month* for January 2020; created and wrote a weekly "Science Corner" article in the local newspaper the Rivers Banner (2021–2022; 45 articles)

- Wrote articles featuring my research projects ("Beadwork and Linear Algebra", Oct. 2020; "Quantum Measurements", Dec. 2018) aimed at a lay audience for *Research Connection*, a publication that provides information to the community at large on research and scholarly activities at Brandon University

- Profile/Bio featured on NSERC Women in Science and Engineering—Prairies, 2017–present

- Interview and profile featured on Mathematics with a Human Face, a resource page provided by Math Central primarily directed to elementary and high school students, teachers, and parents, 2016–present

- *Lab Tour Guide*, Western Manitoba Science Fair, Brandon University, Apr. 9, 2019; Apr. 10, 2018

- *Interactive research profile display*, International Day of the Girl, Manitoba Status of Women, Manitoba Legislative Building, Oct. 16, 2015

- *Volunteer*, Games Room, Mathematics Enrichment Camp, University of Regina, Sept. 26, 2009

- *Group Leader*, Mathematics Enrichment Camp, University of Regina, Sept. 27, 2008