

Sarah J. Plosker

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Department of Mathematics & Computer Science
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Research Interests

Quantum information theory, operator theory, and matrix analysis, with current focus on quantum fidelity (probability of state transfer), positive operator-valued measures (POVMs), applications of majorization, and measures of entanglement and coherence.

Academic Positions

- **Associate Professor**, Department of Mathematics & Computer Science, Brandon University, January 2016 – present
- **Tier 2 Canada Research Chair (CRC) in Quantum Information Theory**, Department of Mathematics & Computer Science, Brandon University, July 2017 – June 2022
- Adjunct Professor, Department of Mathematics & Statistics, University of Guelph, January 2016 – present
- Adjunct Professor, Department of Mathematics, University of Manitoba, September 2014 – present
- Adjunct Professor, Department of Mathematics & Statistics, University of Regina, September 2014 – present
- Member, Winnipeg Institute for Theoretical Physics, August 2013 – present
- Assistant Professor, Department of Mathematics & Computer Science, Brandon University, August 2013 – January 2016

Education

- Ph.D. Applied Mathematics, University of Guelph, Guelph, ON, Advisor: David Kribs, July 2013
Included a Quantum Computing course at the Institute for Quantum Computing (Waterloo) and a Quantum Information course through Université de Sherbrooke
- M.Sc. Mathematics, University of Regina, Regina, SK, 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) with Dr. Don Stanley on commutative algebras

Awards, Grants & Honours

- “Operator theory and matrix analysis methods in quantum information theory”, **NSERC Discovery Grant**, Spring 2019 – Spring 2024, \$95,000
- “Expanding knowledge-sharing of cybersecurity through an Indigenous lens”, co-Principal Investigator with Gautam Srivastava, **Canadian Internet Registration Authority (CIRA) Community Investment Program Grant**, Spring 2019 – Fall 2020, \$20,659
- Outstanding Woman in Science recognition, International Women’s Day, Faculty of Science, Brandon University, Mar. 8, 2019
- Senate Award for Excellence in Research, Brandon University, Spring 2018, \$0
- **Tier 2 Canada Research Chair (CRC)** in Quantum Information Theory, Summer 2017 – Summer 2022, \$500,000
- CFI Infrastructure Operating Fund (IOF) allocation, for the ongoing operating and maintenance costs of the infrastructure of the Quantum Computing Lab, Spring 2017 – Spring 2022, up to \$19,889
- “Operator theory with applications to quantum information theory”, **NSERC Discovery Grant & Early Career Researcher Supplement**, Spring 2014 – Spring 2019, \$75,000
- “Quantum Random Walks”, Brandon University Research Committee (BURC) Research Award, Summer 2018–Winter 2020, \$2,354.67
- “Quantum Information Theory”, the **Canada Foundation for Innovation (CFI) John R. Evans Leaders Fund (JELF)**, funding for a Quantum Computing Lab at Brandon University, Spring 2017, \$66,295
- “Connections between geometric measures and orders of entanglement”, Brandon University Research Committee (BURC) Research Award, Spring/Summer 2014, \$7,500
- **Governor General’s Gold Medal**, University of Guelph, May 2014, \$0
- **Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship (NSERC PGS D)**, Sept. 2010 – Aug. 2013, \$63,000
- Ontario Graduate Scholarship (OGS), Sept. 2010 – Aug. 2011, Award Declined, \$15,000
- 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), Fall 2010–Summer 2013
- **Natural Sciences and Engineering Research Council of Canada Alexander Graham Bell Canada Graduate Scholarship (NSERC CGS M)**, Sept. 2009 – Aug. 2010, \$17,500
- Seven additional, university-wide awards totaling over \$26,000, University of Regina, Fall 2008–Summer 2010
- Natural Sciences and Engineering Research Council of Canada Undergraduate Student Research Award (NSERC USRA), Spring/Summer 2008, \$6,000
- University Prize in Science (awarded to the top student in the Faculty graduating with their first degree), June 2008 Convocation, \$0
- 15 additional, university-wide awards totaling over \$24,000, University of Regina, Fall 2004–Summer 2008

Training of Highly Qualified Personnel

Undergraduate Student Supervision

1. Darian McLaren, “Tridiagonal doubly stochastic matrices”, Research Assistant, Fall 2019 – Summer 2020; “Centrosymmetric matrices”, Undergrad Research Assistant, Summer – Fall 2019; “Quantum random walks”, Natural Sciences and Engineering Research Council of Canada Undergraduate Student Research Award (NSERC USRA), Summer 2018; “Quantum probability measures”, advanced topics in mathematics research supervisor, Fall 2017; “Quantum state transfer: a linear algebraic approach”, NSERC USRA, Summer 2017
2. Candace Richard (co-supervised with Gautam Srivastava), “Expanding knowledge-sharing of cybersecurity through an Indigenous lens”, CIRA Community Engagement project, Fall 2019 – Summer 2020
3. Farrah Huntinghawk, “Random spin channels and irreducibility”, NSERC USRA, Summer 2020; “Expanding knowledge-sharing of cybersecurity through an Indigenous lens” (co-supervised with Gautam Srivastava), CIRA Community Engagement project, Fall 2019 – Summer 2020; “Positive operator-valued measures”, NSERC USRA, Summer 2019; “Fun math events at the Indigenous People’s Centre”, series of 10 events on campus funded by the Brandon University Students’ Union Work Study Program, Fall 2016 – Winter 2017 (sudoku tournament, logic puzzles, Buffon’s needle and other π -day activities, etc.)
4. Rebecca Storey, “On the probability of quantum state transfer”, NSERC USRA, Summer 2016
5. Bailey Kacsmar, “Topics in cryptography”, advanced topics in mathematics research supervisor, Fall 2015
6. Ryan Bergen, “Quantum probability measures”, NSERC USRA, Summer 2015
7. Whitney Gordon, “The geometric measure of entanglement”, NSERC USRA, Summer 2015
8. Jin Li, “Quantum fidelity”, advanced topics in mathematics research supervisor, Fall 2014
9. Amie Teetaert, “Some applications of doubly stochastic matrices”, advanced topics in mathematics research supervisor, Fall 2014
10. Jarrad Perron, “Connections between geometric measures and orders of entanglement”, supported by the Brandon University Research Committee (BURC) Research Award, Summer 2014

Graduate Student Supervision

1. Hermie Monerde, MSc co-advisor (with Steve Kirkland), University of Manitoba, Fall 2019 – present
2. Oluwatobi Ruth Ojo, MSc co-advisor (with Doug Farenick), University of Regina, Fall 2019 – present
3. Julius Adili Masanika, “Complete Order Equivalence of Spin Unitaries”, MSc co-advisor (with Doug Farenick), University of Regina, Winter 2019 – Summer 2020
4. Xiaohong Zhang, “Combinatorial and algebraic aspects of quantum state transfer”, PhD co-advisor (with Steve Kirkland), University of Manitoba, Fall 2014 – Summer 2019
5. 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 – present
2. Chris Ramsey, Brandon University, Fall 2017 – Spring 2018

Graduate Student Committee Member

1. Sarobidy Razafimahatratra, PhD in Math, advisory committee member and thesis examination committee member, University of Regina, Fall 2019 – present
2. Kyle Monkman, PhD in Physics, advisory committee member, University of Manitoba, Spring 2019 – present
3. Ryan Tessier, PhD in Math, advisory committee member and thesis examination committee member, University of Regina, Fall 2015 – Fall 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, Summer 2014

Publications

Peer-Reviewed Journal Articles¹

31. S. Plosker and C. Mattes, *Traditional Beadwork as a Method of Teaching Linear Algebra*, submitted.
30. L. Cao, D. McLaren*, S. Plosker, *The Complete Positivity of Symmetric Tridiagonal and Pentadiagonal Matrices*, submitted.
29. S. Plosker and C. Ramsey*. *Bistochastic operators and quantum random variables*, submitted.
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. Nasserar, 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. Nasserar, 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.

¹**N. B.** An asterisk is used to identify highly qualified personnel (HQP: students and postdocs) who were under my direct supervision. For all mathematics journal articles, authors are listed in alphabetical order. This is the standard in mathematics. Item 31 is a mathematics education paper and authors are listed in decreasing order of contribution.

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, pp. 1-19, 2018.
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 Proceedings²

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,

Theses

- Ph.D. Dissertation (2013): *Operator and matrix theory applications to quantum information*
- M.Sc. Thesis (2010): *Capacities of completely positive maps*

Newsletter Articles

- *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*), Winter 2011, vol. I.
- *Upcoming CMS Meeting*, The Student Mathematical Newsletter (former semiannual publication by the Student Committee of the Canadian Mathematical Society (CMS)), Fall 2010, vol. 13, p. 15.
- *Student event sponsorship*, The Student Mathematical Newsletter, Fall 2010, vol. 13, p. 10.
- *Math in Moscow program*, The Student Mathematical Newsletter, Winter 2010, vol. 12, p. 2.

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 item **2**, authors are listed in alphabetical order within these two categories.

Invited Lectures

- *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.
- *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, Summer 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.
- *How superpositioned is my quantum state?*, Science Seminar Series, Brandon University, Oct. 31, 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.
- *On operator-valued measures*, Math dept. research seminar, Texas A&M University, Feb. 2, 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.
- *Some matrix theory questions arising from quantum coherence*, Math Colloquium, University of Manitoba, Mar. 11, 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, Xi'an, 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.
- *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 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.
- *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.
- *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.
- *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.
- *Private quantum channels, conditional expectations, and trace vectors*, [8th Canadian Student Conference on Quantum Information](#), Jouvence, PQ, June 16–17, 2011.
- *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.

Contributed Lectures

- *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.

Poster Presentations

- *Trumping and power majorization*, [CMS Student Poster Session](#), [CMS Winter Meeting](#), Montreal, PQ, Dec. 7–10, 2012.
- *Classical and nonclassical randomness in quantum measurements* (co-presented with J. Smith), [CMS Student Poster Session](#), [CMS Summer Meeting](#), University of Regina, Regina, SK, June 2–4, 2012.
- *Quantum capacities and the additivity conjecture*, [CMS Student Poster Session](#), [CMS Summer Meeting](#), University of New Brunswick, Fredericton, NB, June 4–6, 2010.
- *Capacities of completely positive maps*, [Connecting Women in Mathematics Across Canada \(CWIMAC 2008\)](#), University of Ottawa, Ottawa, ON, Dec. 4–5, 2008.

Teaching Experience

Teaching Experience: Course Instructor

- Brandon University
 - 62:171 Introduction to Statistics, 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 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

- *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.
- *Quantum majorization in infinite dimensional Hilbert spaces*, Project leader and group mentor for a week-long research and learning project with students and postdocs, Women in Operator Algebras Workshop, Banff International Research Station (BIRS), Banff, AB, Nov. 5–9, 2018.

- *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), [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

- 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 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
- *Member*, Hiring Committee, Department of Mathematics and Computer Science, Brandon University, 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 (CRCP) Equity, Diversity, and Inclusion Committee, 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
- *Science Scooper*, Survival Ice Cream Parlour, Brandon University, Sept. 7, 2018; Sept. 9, 2016; Sept. 6, 2013
- *Student Orientation Volunteer*, lunch service, Brandon University, Sept. 4, 2018
- *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)
- *Presenter*, Preparing your Dossier for Tenure/Promotion/Reclassification Spring Workshop, May 11, 2016
- *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
- *Participant*, External Review of the Department of Mathematics and Statistics, University of Regina, Mar. 6, 2009
- *Organizer*, Graduate Students' Association Welcome BBQ (~ 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

- *Senior Mentor and Member of Board of Directors*, Operator Algebras Mentor Network, August 2020–present (also Chaired the Board April–May, 2021)
- *Director – West*, Canadian Mathematical Society Board of Directors, Summer 2019–Spring 2023
- *Local Organizing Committee Member*, Western Canada Linear Algebra Meeting (WClam)(included successful application for ~\$11,000 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), Brandon University, originally planned for May 23–24, 2020 but postponed to May 29–30, 2021 due to COVID-19; University of Manitoba, May 15–16, 2016
- *Reviewer*, zbMATH (formerly Zentralblatt MATH), Summer 2019–present
- *Organizing Committee Member*, Western Canada Linear Algebra Meeting (WClam), 2017–present
- *Reviewer*, American Mathematical Society MathSciNet Mathematical Reviews, 2014–present
- *Mentor*, Association for Women in Mathematics, Spring 2019–present
- *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
- *Organizer*, Invited Minisymposium: Linear Algebra and Quantum Information Science, [International Linear Algebra Society \(ILAS\) Meeting](#) Rio, Brazil, July 8-12, 2019
- *Facilitator*, The basics of quantum information theory Mini-Course; *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)
- *Judge*, CMS Student Poster Session, CMS Summer Meeting: 2012, 2011; CMS Winter Meeting: 2017, 2010
- *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, 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-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
- *Co-Chair* (2010–12), *Western Provinces Representative* (2009–10), CMS Student Committee (StudC)
- *Organizer and Host*, The Hiring Process, CMS Student Committee Panel Discussion, CMS Winter Meeting, 2010, CMS Summer Meeting 2010
- *Registration Clerk*, 37th Canadian Operator Symposium, University of Regina, May 25, 2009

Community Service

- “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 through a Canadian Internet Registration Authority (CIRA) grant, Spring 2020

- *Judge and Demonstrator*, Meadows Elementary School Science Fair and Interactive Science Demonstrations, Feb. 26, 2020
- *Volunteer*, Let's Talk Science, 2018-2020; included the creation of a *Science Saturday* event at the Prairie Crocus Regional Library in Rivers, MB, and over 10 events in rural communities; named *volunteer of the month* for January 2020
- 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
- *Judge*, St. Augustine Elementary School Science Fair, Feb. 21, 2019; Meadows Elementary School Science Fair, Feb. 13, 2019
- 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