

Curriculum Vitae

MICHAEL NATHANSON

Department of Mathematics and Computer Science
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DOB: 8/25/72, US Citizen

Education:

- 2005 Ph.D. Mathematics, Northeastern University.
Advisor: Christopher King
Thesis: *Local Discrimination and Quantum Channel Capacities*
- 2002 M.S. Mathematics ($\Phi K \Phi$), Northeastern University.
Specialization: Combinatorics
- 1994 A.B. Mathematics (ΦBK , with Honors), Brown University.

Employment:

- 2017 – Professor, Department of Mathematics and Computer Science, Saint Mary's College of California.
- 2011 – 2017 Associate Professor, Department of Mathematics and Computer Science, Saint Mary's College of California.
- 2006 – 2011 Assistant Professor, Department of Mathematics and Computer Science, Saint Mary's College of California.
- 2005 – 2006 Visiting Assistant Professor, Department of Mathematics, Kenyon College.
- 2000 – 2005 Instructor, Department of Mathematics, Northeastern University.
- 1996 – 2000 Mathematics Teacher, Hopkins School, New Haven, CT (High School)
- 1994 – 1996 Mathematics Teacher, The Mercersburg Academy, Mercersburg, PA (High School)

Research Interests:

Quantum Information Theory, Matrix Analysis, Linear Algebra, Combinatorics

Teaching Interests:

Calculus, Linear Algebra, Discrete Math, Graph Theory;
Math anxiety and underprepared students

Academic Honors:

- 2017 Awarded promotion to Professor, Saint Mary's College.
- 2013 Fall Paper on *Three maximally entangled states* named an Editor's Selection by Physical Review A.
- 2013 Spring Granted Sabbatical from Saint Mary's College of California.
- 2011 Awarded tenure and promotion to Associate Professor, Saint Mary's College.
- 2009 Visiting researcher, Fields Institute, University of Toronto.
- 2005–2006 Project NExT Fellow, sponsored by MAA and R.L Moore Foundation.

- 2004, 2005 Mathematics Department TA Excellence in Teaching Award recognition, Northeastern University
- 2002 Phi Kappa Phi (national honor society, Northeastern University chapter)
- 2000 – 2002 GAANN Fellowship in Scientific Computing
- 1994 Phi Beta Kappa (national honor society, Brown University chapter)

Publications:

1. (with D. Kribs, C. Mintah, R. Pereira) *Operator structures and quantum one-way LOCC conditions*, J. Math Phys. 58, 092201 (2017).
2. (with S. Bandyopadhyay, S. Halder) *Entanglement as a resource for local state discrimination in multipartite systems*, Phys. Rev. A **94**, 022311 (2016).
3. (with X. Li, R. Phillips) *Minimum Vector Rank and Complement-Critical Graphs*, Electronic Journal of Linear Algebra **27**, 100-123 (2014).
4. *Three maximally entangled states can require two-way LOCC for local discrimination*, Phys. Rev. A 88, 062316 (2013). (Editor’s Selection)
5. (with S. Bandyopadhyay) *Tight bounds on the distinguishability of quantum states under separable measurements*, Phys. Rev. A 88, 052313 (2013).
6. *Review of Thomas and Cover “Elements of Information Theory”*, American Mathematical Monthly, Vol. 120, No. 2, February 2013.
7. *Testing for a particular pure state with LOCC*, J. Math Phys. 51, 042102 (2010), [quant-ph/0906.2382](#).
8. (with M.B. Ruskai) *Pauli Diagonal Channels Constant on Axes*, J. Phys. A: Math. Theor. 40 (2007), 8171-8204, [quant-ph/0611106](#).
9. *Quantum Guessing via Deutsch-Jozsa*, Quantum Information and Computation 10 (2010) 0837-0847, [quant-ph/0301025](#).
10. (with C. King, K. Matsumoto and M.B. Ruskai) *Properties of Conjugate Channels with Applications to Additivity and Multiplicativity*, Markov Processes and Related Fields 13 (2007), 391-424, [quant-ph/0509126](#).
11. *Distinguishing Bipartite Orthogonal States using LOCC: Best and Worst Cases*, J. Math Phys. 46, 062103 (2005), [quant-ph/0411110](#).
12. (with C. King and M.B. Ruskai) *Multiplicativity properties of entrywise positive maps*, Linear Algebra Appl. 404 (2005), 367-379, [quant-ph/0409181](#).
13. (with C. King) *On the existence of a common quadratic Lyapunov function for a rank one difference*, Linear Algebra Appl. 419 (2006), 400–416, [math.OA/0403467](#).
14. (with C. King) *New trace norm inequalities for 2 x 2 blocks of diagonal matrices*, Linear Algebra Appl. 389 (2004), 77–93, [math.CA/0312194](#).
15. (with C. King and M.B. Ruskai) *Qubit Channels Can Require More Than Two Inputs to Achieve Capacity*, Phys. Rev. Lett. 88, 057901 (2002), [quant-ph/0109079](#).
16. Undergraduate work on “The Pizza Theorem” cited in *Quantum*, March/April 1994.

Lectures and Presentations:

- 2017 Aug. Fields Institute Workshop on Operator Systems in Quantum Information, Guelph, Ontario.
Invited Talk: *Connections between operator systems and the problem of local quantum state discrimination*
- 2017 Jul. Meeting of the International Linear Algebra Society, Ames, Iowa. Minisymposium on Linear Algebra and Quantum Information Science.
Invited Talk: *An equivalence between local state discrimination and state transformation in multipartite systems*
- 2016 Jul. 20th Conference of the International Linear Algebra Society, Leuven, Belgium. Minisymposium on Linear Algebra and Quantum Computation.
Invited Talk: *Local discrimination of maximally-entangled states*
- 2015 Feb. Sonoma State University, Computer Science Colloquium: *From Bit to Qubit: Quantum Information for Everyone*
- 2014 Aug. MAA Mathfest, Portland, OR.
Contributed Talk: *Mathematics without the Math: Using group worksheets to circumvent math anxiety*
General Contributed Talk: *Interesting matrix problems from Quantum Information Theory: Locally Distinguishing Quantum States*
- 2014 Apr. Saint Mary's College. Sabbatical report on *Hiding Information in Quantum States*
- 2013 Aug. MAA Mathfest, Hartford, CT.
Contributed Talk: *Pizzas, Calzones, and Crusts: Using Symmetry to Slice up a Circle*
- 2012 Aug. MAA Mathfest, Madison, WI.
Contributed Talk: *The Pizza Theorem and the Joy of Discovery*
- 2010 Aug. MAA Mathfest, Pittsburgh, PA.
Contributed Talk: *Conjugating matrices to get uniform diagonals*
- 2010 Mar. Northeastern University Alumni Conference, Boston, MA:
Invited Lecture: *Mathematics as a Second Language*
- 2010 Feb. USF Mathematics Colloquium: *Finding a Classical Needle in a Quantum Haystack: An Introduction to Quantum Algorithms*
- 2008 Aug. MAA Mathfest, Madison, WI.
Lecture: *Guessing Secrets with Classical and Quantum Algorithms*
- 2008 Jan. Joint Meetings, San Diego, CA. Assisted at Project NExT booth.
Poster: *Distinguishing Quantum States with LOCC (Young Mathematicians Network)*
- 2007 Nov. UC Davis Seminar on Mathematical Physics and Probability: *Distinguishing quantum states using LOCC*
- 2007 Aug. First Joint Meeting of the American Mathematical Society and the Polish Mathematical Society, Warsaw:
Invited Lecture: *Testing for a Particular Pure State with LOCC*
- 2006 Oct. St. Mary's College Math Mondays: *Finding a Classical Needle in a Quantum Haystack: An Introduction to Quantum Algorithms*

- 2006 Apr. MAA Ohio Section Meeting, Dayton, OH.
Lecture: *Zeros on the Diagonal*
- 2005 Nov. OCCAM Conference on Computational Modeling, Oberlin College, OH.
- 2005 Nov. Oberlin College, Ohio: *Finding a Classical Needle in a Quantum Haystack*
Poster: *Two problems in Quantum Computing and Information*
- 2005 Jan. QIP 2005 (International Quantum Information Processing Conference), MIT, Cambridge, MA.
Poster: *Distinguishing Bipartite Orthogonal States with LOCC*
- 2004 May Fields Institute Workshop on Quantum Information Geometry, McMaster University.
Invited Lecture: *Trace Norm Inequalities*
- 2004 Apr. Haitian Scientific Society, Boston: *Entanglement and Locality in Quantum Protocols*
- 2003 June PIMS-MITACS Summer School on Quantum Information Science, University of Calgary.
Poster: *Quantum Guessing Via Deutsch-Josza*
- 2002 Oct. AMS Fall Eastern Section Meeting, Boston:
Lecture: *Quantum Guessing Via Deutsch-Josza*
- 2002 May Experiential Education Exposition, Northeastern University:
Poster: *Qubit Channels Can Require More Than Two Inputs to Achieve Capacity*

Professional Conferences and Programs:

- 2017 Aug. Fields Institute Workshop on Operator Systems in Quantum Information, Guelph, Ontario.
- 2017 Jul. Meeting of the International Linear Algebra Society, Ames, Iowa. Minisymposium on Linear Algebra and Quantum Information Science.
- 2016 Jul. 20th Conference of the International Linear Algebra Society, Leuven, Belgium. Minisymposium on Linear Algebra and Quantum Computation.
- 2016 Feb. MAA Golden Section Meeting, Davis, CA.
- 2014 Aug. MAA Mathfest, Portland, OR.
Moderator/Judge: Undergraduate research presentations in Geometric Group Theory
Moderator: General Contributed Talk session on Assorted Mathematics Research Topics
- 2013 Aug. MAA Mathfest, Hartford, CT.
- 2013 Feb. MAA Northern California/Nevada/Hawaii Section Meeting, Stockton, CA.
- 2013 Jan. Joint Meetings, San Diego, CA. (Took mini-course on random matrices)
Moderator/Judge: Undergraduate research poster session
- 2012 Nov. Bay Area Discrete Math Day, Moraga, CA.
- 2012 Aug. MAA Mathfest, Madison, WI.
Moderator/Judge: Undergraduate research presentations in Applied Math
- 2012 Mar. Bay Area Discrete Math Day, Berkeley, CA.
- 2012 Feb. MAA Northern California/Nevada/Hawaii Section Meeting, MSRI, Berkeley, CA.

- 2011 Jan. Joint Meetings, New Orleans, LA. (Interviewed tenure-track candidates)
- 2010 Aug. MAA Mathfest, Pittsburgh, PA.
Moderator/Judge: Undergraduate research presentations in Applied Math
- 2010 Mar. Northeastern University Alumni Conference, Boston, MA:
- 2010 Feb. MAA Northern California/Nevada/Hawaii Section Meeting, San Francisco, CA.
- 2010 Jan. Joint Meetings, San Francisco, CA. (Attended with my JanTerm students)
- 2009 July “Operator Structures in Quantum Information Workshop,” Fields Institute, Toronto.
- 2009 Mar. “Entropy and the Quantum”, workshop at University of Arizona, Tuscon, AZ.
- 2009 Feb. MAA Northern California/Nevada/Hawaii Section Meeting, Berkeley, CA.
- 2008 Aug. MAA Mathfest, Madison, WI.
Moderator/Judge: Undergraduate research presentations in Combinatorics
- 2008 Mar. MAA Northern California/Nevada/Hawaii Section Meeting, Sacramento, CA.
- 2008 Jan. Joint Meetings, San Diego, CA. Assisted at Project NExT booth.
- 2007 Aug. First Joint Meeting of the American Mathematical Society and the Polish Mathematical Society, Warsaw:
- 2007 Apr. Legacy of R. L. Moore Conference on Inquiry-Based Learning, Austin, TX.
- 2006 June XXXVIII Symposium on Mathematical Physics: “Quantum Entanglement and Geometry”, Nicolaus Copernicus University, Torun, Poland.
- 2006 Aug. MAA Mathfest/Project NExT, Knoxville, TN.
- 2006 Apr. MAA Ohio Section Meeting, Dayton, OH.
- 2006 Jan. Joint Meetings/Project NExT, San Antonio, TX.
- 2005 Nov. OCCAM Conference on Computational Modeling, Oberlin College, OH.
- 2005 Aug. MAA Mathfest/Project NExT, Albuquerque, NM.
- 2005 Jan. Quantum Information Processing Conference, MIT.
- 2004 May Fields Institute Workshop on Quantum Information Geometry, McMaster University.
- 2003 Summer SIMS Introduction to Bioinformatics, Northeastern University.
- 2003 June PIMS-MITACS Summer School on Quantum Information Science, University of Calgary.
- 2002 Oct. AMS Fall Eastern Section Meeting, Boston:
- 2002 Aug. MSRI Quantum Computation Semester: Introductory Workshop, Berkeley.
- 2002 May Experiential Education Exposition, Northeastern University:

Journals Refereed: *Physical Review A* *Physical Review Letters* *Journal of Physics A*
Quantum Information and Communication *New Journal of Physics*
Communications in Mathematical Physics *Scientific Reports*
Quantum Information Processing

Service at Saint Mary’s College:

- 2006 – Departmental Service, including organizing Math Monday (2006-2012, 2013, 2014) and Math Tea (2010-2011); participating in tenure-track hires (2009, 2011, 2014, 2015, 2016) and screening of lecturer candidates; calculus coordination (2007) and development of placement model for incoming students (2007); periodic staffing evening math center; development of course coordinator model (2011); Math 27 course coordinator (2012–2014); writer and grader of annual scholarship exam (2013-present).

- 2015 – Coordinator of Mathematics Placement: overseeing online placement exam and placement process; advising students on math courses; administering Add/Drop for lower division mathematics courses
- 2006 – Supervision of at least 13 senior essay projects
- 2016 Taught 3-student independent study in Computational Complexity (MA/CS 197)
- 2014 School of Science Summer Research: Collaborated and supervised project with Sofia Burille.
- 2011 School of Science Summer Research: Collaborated and supervised project with Xiaowei Li and Rachel Phillips.
- 2017 – School of Science representative on Academic Probation Review Board
- 2015 – 2017 Admissions and Academic Regulations Committee (AARC) [Elected position]
- 2014 – 2016 Core Curriculum Committee [Elected position] and Chair of Theological Understanding Working Group
- 2013 – 2014 Core Curriculum Committee [Elected position] and Chair of Mathematical and Scientific Understanding Working Group
- 2011 – 2012 Member, Mathematical and Scientific Understanding Working Group for the Core Curriculum Committee
- 2010 Member, Artistic Understanding Working Group for the Core Curriculum Implementation Committee
- 2016 Search Committee: Assistant Professor of Music and Choral Director
- 2008 – 2012 Member, Faculty Technology Group
- 2009 – 2012 Member, Academic Honor Council
- 2012 – Technology Planning and Policy Committee. Member of the Administrative Technology Subcommittee.
- 2011 – 2013 Moodle Advisory Committee
- 2011 – 2012 Equal Employment Opportunity Compliance Committee [Elected position]
- 2010 Search Committee: Dean of Academic Advising and Achievement
- 2009 AARC Subcommittee on Academic Advising

Nonscientific Awards and Achievements:

- * Pianist and singer
- * Member and bass section leader of the Oakland Symphony Chorus
- * Sang in Carnegie Hall, Lincoln Center, Symphony Hall (Boston), Paramount Theater (Oakland), Leshner Center (Walnut Creek) and Fenway Park (Boston).
- * Wrote mock press release on merger of Christmas and Chanukah, which was circulated on the Internet, read on CarTalk, thus introducing the word “Christmukah” into English.
- * Constructed numerous acrostic puzzles which were sold to *The Washington Post*
- * Twice awarded Hicks Prize for Debating Excellence at Brown University. Represented Brown at the World Debate Championships in Oxford.