Benjamin Lovitz

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Employment

Fall 2022—   **Department of Mathematics, Northeastern University**
–NSF postdoctoral fellow
–Zelevinsky postdoctoral fellow
–Mentor: Harm Derksen

Education

Spring 2018   **Institute for Quantum Computing, University of Waterloo**
—Winter 2022 –PhD in Applied Math (Quantum Information)
–Advisors: William Slofstra and John Watrous
–Comprehensive exam topics (April 2020): Algebraic geometry,
  linear algebraic groups, matrix product states
–Thesis: *Tensors: Entanglement, Geometry, and Combinatorics*

Fall 2015   **Institute for Quantum Computing, University of Waterloo**
—Fall 2018 –MSc in Physics (Quantum Information)
–Advisor: Norbert Lütkenhaus
–Thesis: *Practical quantum fingerprinting and appointment
  scheduling*

Fall 2011   **Bates College**
—Winter 2015 –BA double degree in Math and Physics (Honors)
–Magna Cum Laude
–Math advisor: Adriana Salerno
–Math capstone project: *The discrete log problem for elliptic curves*
–Physics advisor: Nathan Lundblad
–Physics honours thesis: *Optical frequency doubling*

Research Interests

Tensors, quantum information theory, applied algebraic geometry, combinatorics, entanglement theory, algebraic statistics.

Publications

Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond
Nathaniel Johnston, Benjamin Lovitz, and Aravindan Vijayaraghavan
To appear in FOCS 2023

A generalization of Kruskal's theorem on tensor decomposition
Benjamin Lovitz and Fedor Petrov
Forum of Mathematics, Sigma, 2023

A complete hierarchy of linear systems for certifying quantum entanglement of subspaces
Nathaniel Johnston, Benjamin Lovitz, and Aravindan Vijayaraghavan
Physical Review A, 2022

Entangled subspaces and generic local state discrimination with pre-shared entanglement
Benjamin Lovitz and Nathaniel Johnston
Quantum, 2022

New techniques for bounding stabilizer rank
Benjamin Lovitz and Vincent Steffan
Quantum, 2022

The non-m-positive dimension of a positive linear map
Nathaniel Johnston, Benjamin Lovitz, and Daniel Puzzuoli
Quantum, 2019

On decomposable correlation matrices
Benjamin Lovitz
Linear and Multilinear Algebra, 2019

Families of quantum fingerprinting protocols
Benjamin Lovitz and Norbert Lütkenhaus
Physical Review A, 2018

Practical quantum appointment scheduling
Dave Touchette, Benjamin Lovitz, and Norbert Lütkenhaus
Physical Review A, 2018

Perfect state transfer in Laplacian quantum walk
Rachael Alvir, Sophia Dever, Benjamin Lovitz, James Myer, Christino Tamon, Yan Xu, and Han-meng Zhan
Journal of Algebraic Combinatorics, 2016

Preprints
Toward a generalization of Kruskal's theorem on tensor decomposition
Benjamin Lovitz
arXiv preprint, 2020

Presentations
November 2023	FOCS 2023	
	Talk: *Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond*	
August 2023	IWOTA 2023	
	Talk: *A complete hierarchy of linear systems for certifying quantum entanglement of subspaces*	

July 2023	SIAM conference on applied algebraic geometry 2023 Talk: *Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond*
June 2023	ILAS 2023 Talk: *A complete hierarchy of linear systems for certifying quantum entanglement of subspaces*
June 2023	NESS 2023 Talk: *Algorithms and uniqueness of tensor decompositions*
March 2023	WACT 2023 Talk: *Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond*
February 2023	QIP 2023 Talk: *A complete hierarchy of linear systems for certifying quantum entanglement of subspaces*
December 2022	IPAM Tensor Methods Reunion Conference Talk: *Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond*
November 2022	University of Western Ontario mathematics seminar Talk: *Nullstellensatz-inspired algorithms for certifying entanglement of subspaces*
November 2022	Tensors: Quantum Information, Complexity and Combinatorics conference held at the Centre de Recherches Mathématiques in Montréal Talk: *Nullstellensatz-inspired algorithms for certifying entanglement of subspaces*
November 2022	Portland State University Computer Science seminar Talk: *New techniques for bounding stabilizer rank*
October 2022	Northeastern University GASC seminar Talk: *New techniques for bounding stabilizer rank*
September 2022	SIAM Conference on Mathematics of Data Science Talk: *Tensor Decompositions: Algorithms and Uniqueness*
September 2022	Kickoff workshop for AGATES, a semester-long program on algebraic geometry and tensors held at the Banach Center and the University of Warsaw Talk: *New techniques for bounding stabilizer rank*
May 2022	QLunch Seminar at QMATH, University of Copenhagen Talk: *A splitting theorem for product tensors*

March 2022	AMS Special Session on Nonlinear Algebra with Applications to Statistics Talk: *A generalization of Kruskal's theorem*
March 2022	Random Tensors at CIRM Talk: *New techniques for bounding stabilizer rank*
March 2022	QIP 2022 Talk: *New techniques for bounding stabilizer rank*
January 2022	GIC seminar at the Universitat Autonoma de Barcelona Talk: *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
December 2021	Theory Lunch Seminar at Northeastern University Talk: *A generalization of Kruskal's theorem*
November 2021	IDEAL Seminar at Northwestern University Talk: *A generalization of Kruskal's theorem*
November 2021	Algebra Seminar at Auburn University Talk: *A generalization of Kruskal's theorem*
April 2021	IPAM Tensor Methods weekly seminar Talk: *A generalization of Kruskal's theorem*
April 2021	IPAM Workshop: Tensor Methods and their Applications in the Physical and Data Sciences Poster: *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
March 2021	Copenhagen QIT group meeting Talk: *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
February 2021	IQST seminar at the University of Calgary Talk: *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
January 2021	24th Annual Conference on Quantum Information Processing (QIP) Poster: *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
January 2021	Quantum information seminar at the Perimeter Institute Talk: *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
April 2015	Mount David Summit, Bates College Poster: *The discrete log problem for elliptic curves*

October 2014	Bates College Talk: *Laplacian quantum walk on graphs*
August 2014	Mathematical Association of America (MAA) Mathfest Talk: *Laplacian quantum walk on graphs*

Teaching

Fall 2023	MATH 2331: Linear Algebra *Instructor, Northeastern University*
Fall 2021	QIC 820: Theory of Quantum Information *Teaching Assistant, University of Waterloo*
Fall 2019	Math 127: Calculus 1 for the sciences *Instructor, University of Waterloo*

Advising

Fall 2021	Mentor to undergraduate student Daniel Han, in collaboration with William Slofstra *Undergraduate Research Assistantship program, University of Waterloo*

Further education

March 2021 —June 2021	Tensor Methods and Emerging Applications to the Physical and Data Sciences *Industry for Pure and Applied Mathematics, UCLA*
2018—2020	Fundamentals of University Teaching Program *Centre for Teaching Excellence, University of Waterloo*

Awards and achievements

September 2022—	NSF Mathematical Sciences Postdoctoral Research Fellowship (MSPRF) *National Science Foundation* 150,000 USD
September 2021 —April 2022	Ontario Graduate Scholarship (international competition) *Government of Ontario, Canada* 10,000 CAD
September 2021 —April 2022	President's Graduate Scholarship *University of Waterloo* 3,332 CAD
April 2021	3rd place: "Cut to the Chase" video competition *Banff international research station* 50 CAD

September 2015	Entrance award for academic excellence and research potential
	Institute for Quantum Computing
	5000 CAD
May 2015	Percy D. Wilkins Award for highest mathematics GPA
	Bates College
	125 USD
June 2014 —July 2014	Rawlings grant for summer mathematics research
	Bates College
	3000 USD
August 2014	Travel grant for Mathfest 2014
	Mathematical Association of America
	500 USD
May 2011	Mathematics award
	Catlin Gabel School

Service

- Co-organized JMM 2023 special session "Applications of tensors in computer science" with Harm Derksen and Neriman Tockan

- Co-organized SIAM AG 2023 minisymposium "Geometric and algebraic structures in quantum information" with Eliana Duarte and Luke Oeding

- Reviewer for *Mathematical Reviews*, American Mathematical Society

- Referee for *Journal of Physics A: Mathematical and Theoretical*, IOP Publishing

- Referee for *Machine Learning: Science and Technology*, IOP Publishing

- Referee for *Quantum Information and Computation*, Rinton Press

- Referee for *Linear and Multilinear Algebra*, Taylor and Francis

- Referee for *Foundations of Computer Science (FOCS)*, IEEE

- Referee for *Asian Quantum Information Science Conference (AQIS)*

References

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