

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
–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

Research Interests

Tensors, quantum information theory, entanglement theory, optimization, applied algebraic geometry, representation theory, combinatorics, matroid theory.

Publications and preprints

Nearly tight bounds for testing tree tensor network states

Benjamin Lovitz and Angus Lowe
Submitted, 2024

X-arability of mixed quantum states

Harm Derksen, Nathaniel Johnston, and Benjamin Lovitz
Submitted, 2024

Linear preservers of secant varieties and other varieties of tensors

Fulvio Gesmundo, Young In Han, and Benjamin Lovitz
Submitted, 2024

A hierarchy of eigencomputations for polynomial optimization on the sphere
Benjamin Lovitz and Nathaniel Johnston
Submitted, 2023

Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond
Nathaniel Johnston, Benjamin Lovitz, and Aravindan Vijayaraghavan
64th IEEE Symposium on Foundations of Computer Science (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 and *Quantum Information Processing (QIP)* 2023

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 and *Quantum Information Processing (QIP)* 2022

On decomposable correlation matrices
Benjamin Lovitz
Linear and Multilinear Algebra, 2021

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

The non-m-positive dimension of a positive linear map
Nathaniel Johnston, Benjamin Lovitz, and Daniel Puzzuoli
Quantum, 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 Hanmeng Zhan
Journal of Algebraic Combinatorics, 2016

Awards

- September 2022*— NSF Mathematical Sciences Postdoctoral Research Fellowship (MSPRF)
National Science Foundation
150,000 USD
- September 2021* Ontario Graduate Scholarship (international competition)
—*April 2022* *Government of Ontario, Canada*
10,000 CAD

Talks

- August 2024* Effective methods in algebraic geometry (MEGA) 2024
A hierarchy of eigencomputations for polynomial optimization on the sphere
- May 2024* University of Toulouse geometry seminar
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond
- May 2024* SIAM conference on applied linear algebra
Algorithms and uniqueness of tensor decompositions
- April 2024* Georgia Tech algebra seminar
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond
- January 2024* Tel Aviv University applied math seminar
Old dog, new tricks: Tensor decompositions in quantum information and machine learning
- January 2024* Northwestern University TCS seminar
Old dog, new tricks: Tensor decompositions and applications
- November 2023* FOCS 2023
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond
- November 2023* UMASS Boston math seminar
Algorithms and uniqueness of tensor decompositions
- August 2023* IWOTA 2023
A complete hierarchy of linear systems for certifying quantum entanglement of subspaces
- July 2023* SIAM conference on applied algebraic geometry 2023
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond
- June 2023* ILAS 2023
A complete hierarchy of linear systems for certifying quantum entanglement of subspaces

<i>June 2023</i>	NESS 2023 <i>Algorithms and uniqueness of tensor decompositions</i>
<i>March 2023</i>	WACT 2023 <i>Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond</i>
<i>February 2023</i>	QIP 2023 <i>A complete hierarchy of linear systems for certifying quantum entanglement of subspaces</i>
<i>December 2022</i>	IPAM Tensor Methods Reunion Conference <i>Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond</i>
<i>November 2022</i>	University of Western Ontario mathematics seminar <i>Nullstellensatz-inspired algorithms for certifying entanglement of subspaces</i>
<i>November 2022</i>	Tensors: Quantum Information, Complexity and Combinatorics conference held at the Centre de Recherches Mathématiques in Montréal <i>Nullstellensatz-inspired algorithms for certifying entanglement of subspaces</i>
<i>November 2022</i>	Portland State University Computer Science seminar <i>New techniques for bounding stabilizer rank</i>
<i>October 2022</i>	Northeastern University GASC seminar <i>New techniques for bounding stabilizer rank</i>
<i>September 2022</i>	Algebraic Geometry with Applications to Tensors and Secants (AGATES) Plenary talk: <i>New techniques for bounding stabilizer rank</i>
<i>September 2022</i>	SIAM Conference on Mathematics of Data Science <i>Tensor Decompositions: Algorithms and Uniqueness</i>
<i>May 2022</i>	QLunch Seminar at QMATH, University of Copenhagen <i>A splitting theorem for product tensors</i>
<i>March 2022</i>	QIP 2022 <i>New techniques for bounding stabilizer rank</i>
<i>March 2022</i>	AMS Special Session on Nonlinear Algebra with Applications to Statistics <i>A generalization of Kruskal's theorem</i>
<i>March 2022</i>	Random Tensors at CIRM <i>New techniques for bounding stabilizer rank</i>

- January 2022* GIC seminar at the Universitat Autònoma de Barcelona
Entangled subspaces and generic local state discrimination with pre-shared entanglement
- December 2021* Theory Lunch Seminar at Northeastern University
A generalization of Kruskal's theorem
- November 2021* IDEAL Seminar at Northwestern University
A generalization of Kruskal's theorem
- November 2021* Algebra Seminar at Auburn University
A generalization of Kruskal's theorem
- April 2021* IPAM Tensor Methods weekly seminar
A generalization of Kruskal's theorem
- March 2021* Copenhagen QIT group meeting
Entangled subspaces and generic local state discrimination with pre-shared entanglement
- February 2021* IQST seminar at the University of Calgary
Entangled subspaces and generic local state discrimination with pre-shared entanglement
- January 2021* Quantum information seminar at the Perimeter Institute
Entangled subspaces and generic local state discrimination with pre-shared entanglement
- October 2014* Bates College
Laplacian quantum walk on graphs
- August 2014* Mathematical Association of America (MAA) Mathfest
Laplacian quantum walk on graphs

Teaching

- Winter 2024* Graduate course: Geometry and Applications of Tensors
Instructor, Northeastern University
- Fall 2023* MATH 2331: Linear Algebra (two sections)
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

Service

- Co-organized JMM 2023 special session “Applications of tensors in computer science” with Harm Derksen and Neriman Tokcan
- 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
 - *Machine Learning: Science and Technology*, IOP Publishing
 - *Quantum Information and Computation*, Rinton Press
 - *Linear and Multilinear Algebra*, Taylor and Francis
 - *Linear Algebra and its Applications*, Elsevier
 - *Foundations of Computer Science (FOCS)*, IEEE
 - *Symposium on the Theory of Computing (STOC)*, ACM
 - *SIAM Journal on Computing (SICOMP)*, SIAM
 - *Asian Quantum Information Science Conference (AQIS)*

Further education

March 2021 Tensor Methods and Emerging Applications to the Physical and Data
—*June 2021* Sciences
Industry for Pure and Applied Mathematics, UCLA

2018—2020 Fundamentals of University Teaching Program
Centre for Teaching Excellence, University of Waterloo

References

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