

# Benjamin Lovitz

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## Employment

Fall 2022—

**Department of Mathematics, Northeastern University**

–NSF 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, applied algebraic geometry, combinatorics, quantum information theory, entanglement theory, algebraic statistics.

## Publications

*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 Hanmeng Zhan

Journal of Algebraic Combinatorics, 2016

## Preprints

*Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond*

Nathaniel Johnston, Benjamin Lovitz, and Aravindan Vijayaraghavan

arXiv preprint, 2022

*A generalization of Kruskal's theorem on tensor decomposition*

Benjamin Lovitz and Fedor Petrov

arXiv preprint, 2021

*Toward a generalization of Kruskal's theorem on tensor decomposition*

Benjamin Lovitz

arXiv preprint, 2020

## Presentations

*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 Autònoma 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 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* 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*

### **Awards and achievements**

- 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
- September 2021*    President’s Graduate Scholarship  
—*April 2022*    *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*            Rawlings grant for summer mathematics research  
—*July 2014*    *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**

- Reviewer, *Mathematical Reviews* - American Mathematical Society  
Referee, *Journal of Physics A: Mathematical and Theoretical* - IOP Publishing  
Referee, *Machine Learning: Science and Technology* - IOP Publishing  
Referee, *Quantum Information and Computation* - Rinton Press  
Referee, *Linear and Multilinear Algebra* - Taylor and Francis

## References

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Nathaniel Johnston  
*Mount Allison University*  
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Owen Woody (teaching reference)  
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