Haggai Liu

Curriculum Vitae
PhD Mathematics | Homepage
Simon Fraser University, Canada

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GitHub
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Education

PhD Mathematics May 2021 - April 2026
Simon Fraser University (SFU)

- Thesis: Moduli spaces of weighted stable curves and their fundamental groups

MSc. Mathematics September 2018 - April 2021
Simon Fraser University (SFU)

- Thesis: On the cogrowth series of free products of finite groups

BSc. Computer Science and Mathematics September 2012 - December 2017
University of Victoria (UVic)

- GPA 8.51 (A+) Cumulative; 8.89 (A+) Upper-level on a 9-point grading scale

Research Interests

- **Algebraic Combinatorics**: Moduli of curves, hyperplane arrangements, cactus group, Coxeter groups, Posets and lattices
- **Algebraic Geometry**: Varieties, Schemes, Blow-ups and exceptional divisors
- **Algebraic Topology**: Fundamental Groups, Cell Complexes

Publications

H. Liu. "Poincare Polynomials of Heavy-Light Hassett Spaces" *preprint*. September 2026. 10 pages. ArXiv: https://arxiv.org/abs/2609.03268.

V. Blankers, E. Clader, I. Halacheva, H. Liu, and D. Ross. "Moduli Theory of the r-Braid Arrangement" *Forum of Mathematics, Sigma*. February 2026. 18 pages. ArXiv: https://arxiv.org/abs/2506.18205.

Extended Abstract: J. Levinson, and H. Liu. "Fundamental groups of moduli spaces of real weighted stable curves" *Séminaire Lotharingien de Combinatoire 93B: Proceedings of the 37th Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2025, Sapporo)*.
July 2025. 12 pages. (https://www.mat.univie.ac.at/ slc/wpapers/FPSAC2025/ Article **#143**).

J. Levinson, and H. Liu. "Moduli Spaces of Weighted Stable Curves and their Fundamental Groups" *Submitted to Advances in Mathematics*. 30 pages. ArXiv: https://arxiv.org/abs/2503.23253.

J. Bell, H. Liu, and M. Mishna. "Cogrowth Series for Free Products of Finite Groups" *International Journal of Algebra and Computation*. January 2023. 24 pages. ArXiv: https://arxiv.org/abs/2110.00089.

Research Experience

Combinatorics and Geometry of Moduli Spaces of Curves July - August 2024
Banff International Research Station (BIRS) Banff, Alberta, Canada
Project group members: Vance Blankers, Emily Clader, Iva Halacheva, and Dustin Ross

- Obtained descriptions for a family of hyperplane arrangements that generalize the braid arrangement. Such arrangements are parameterized by a positive integer related to primitive complex roots of unity. Proved that the wonderful compactifications of these arrangements can be interpreted as moduli spaces.

Research Assistant (PhD) May 2021 - April 2026
SFU (Department of Mathematics) Burnaby, BC, Canada
Combinatorics and Algebraic Geometry
Faculty Mentor: Jake Levinson

- Generalized an equivariant fundamental group on a symmetric weighted moduli space of pointed rational curves. Obtained presentations of such groups by examining a particular cell decomposition and relating the cells to rooted trees and permutahedra.

Research Assistant (MSc.) May 2020 - April 2021
SFU (Department of Mathematics) Burnaby, BC, Canada
Analytic and Enumerative Combinatorics
Faculty Mentor: Marni Mishna

- Analyzed the generating function describing walks on an infinite Cayley graph. Obtained degree bounds for this algebraic function by solving a system of polynomial equations derived from the theory of free probability.

Research Assistant (BSc. — Co-op term 2) May - August 2016
UVic (Department of Mathematics and Statistics) Victoria, BC, Canada
Combinatorics and Graph Theory
Faculty Mentor: Peter Dukes

- Investigated the structure of facets of cones generated by characteristic vectors of triangles. Wrote Sage code to obtain classifications of such facets.

USRA Research Assistant (BSc. — Co-op term 1) May - August 2015
UVic (Department of Mathematics and Statistics) Victoria, BC, Canada
Differential Equations
Faculty Mentor: Slim Ibrahim

- Studied Euler equations for the Earth's rotation and analyzed the linear estimates for the solutions to the equations, on flat Euclidean space and Spherical space.

Presentations

Invited Talks:

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups September 21, 2025
Workshop on Combinatorics and Geometry of Moduli of Curves: Urbana, USA.

Enumerative Properties of Cogrowth Series on Free Products of Finite Groups July 24, 2021
Applications of Computer Algebra (ACA) 2021: Online.

Seminar Talks:

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups February 25, 2025
University of British Columbia (UBC) Discrete Math Seminar: UBC Vancouver.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups February 29, 2024
Number Theory and Arithmetic Geometry (NTAG) Seminar: SFU.

Enumerative Properties of Cogrowth Series on Free Products of Finite Groups June 30, 2021
SFU Discrete Math Seminar: Online.

Contributed Conference Talks:

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups May 21, 2025
Canadian Discrete and Algorithmic Mathematics (CanaDAM) 2025: University of Ottawa.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups April 19, 2025
AMS New England Graduate Student Conference 2025: Brown University.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups November 30, 2024
Canadian Mathematical Society (CMS) Winter Meeting 2024: Vancouver.

- Session: Algebraic Geometry

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups June 3, 2024
Early-Career Conference in Combinatorics (ECCC) 2024: Urbana, USA.

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups June 1, 2024
CMS Summer Meeting 2024: Saskatoon.

- Session: Moduli Spaces in Complex and Algebraic Geometry: Recent Developments

Moduli Spaces of Weighted Stable Curves and their Fundamental Groups March 16, 2024
Graduate Student Combinatorics Conference 2024: Pittsburgh, USA.

Cone of Weighted Graphs Generated by Triangles August 18, 2016
Canadian Undergraduate Mathematics Conference 2016: UVic.

Poster Presentations:

Fundamental groups of moduli spaces of real weighted stable curves July 22, 2025
Formal Power Series and Algebraic Combinatorics (FPSAC) 2025: Sapporo, Japan.

Cone of Weighted Graphs Generated by Triangles 2017
Jamie Cassels Undergraduate Research Awards: UVic.

Mentoring Experience

Graduate Mentor for Directed Reading Program at SFU September - December 2025
Mathematics Department

- Undergraduate Mentee: *Talwinder Kaur*
- Reading Topic: *Algebraic matroid theory*
- Assign reading material to my mentee and have weekly meetings to discuss the reading.

Instructional Experience

Mathematics and Computer Science Teacher — On Call June 2026 - present
Forbest Academy: Vancouver and Richmond BC, Canada

- Courses Taught:
  - Mathematics 11 and 12
  - Introduction to Python Programming
  - AP Computer Science: Java Programming (trial lesson)

Sessional Instructor at SFU May - August 2025
Mathematics Department

- Math 251 (Multivariable Calculus) Surrey Campus

Graduate Teaching Assistant (TA) at SFU September 2018 - April 2026
Mathematics Department

- Teach tutorials, grade assignments, hold office hours and workshop hours

Private Tutoring 2013 - present
Self-employed

- Various topics in math, statistics, computer science, and physics
- High school (including AP and IB courses) and post secondary levels
- Number of clients vary, but usually around 7 per semester

Awards and Distinctions

Graduate Dean Entrance Scholarship (GDES) — SFU May 2021 - April 2025

- Intended for outstanding applicants to master's and PhD programs

Special Graduate Entrance Scholarship (SGES) — SFU September 2018
University of Victoria Alumni Undergraduate Scholarship — UVic November 2017
Department of Computer Science 10th Anniversary Scholarship — UVic September 2016
Jamie Cassels Undergraduate Research Awards — UVic September 2015 - April 2016

- Awarded to UVic undergraduate students who undertake research supervised by a faculty member

NSERC Undergraduate Student Research Awards (USRA) May - August 2015

Other Experience

Volunteer Marker for High School Math Challengers Competition 2025 - present

- SFU and UBC campuses on select Saturdays
- Graded multiple choice questions
- Solved some competition questions to verify correctness of answer keys
- Certificates available upon request