

# SIMON CHEN

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## Education

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### M.Sc. Physics (Perimeter Scholars International)

Perimeter Institute for Theoretical Physics & University of Waterloo

Sep 2024 - Jun 2025

Waterloo, Canada

↔ Advisor: –

Thesis: –

### B.Sc. Honours Mathematics and Physics

McGill University

Aug 2021 - May 2024

Montreal, Canada

↔ Advisor: Prof. Alexander Maloney

Thesis: Euclidean Wormholes in AdS/CFT

## Publications

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1. Herman, L., Barbarie, C., Agrawal, M., ..., **Chen, S.**, et al. [18 authors] (2024), *Drone-Based Antenna Beam Calibration in the High Arctic*, submitted to IEEE OJAP, [arXiv: 2407.00856](https://arxiv.org/abs/2407.00856).

## Research Experience

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### Undergraduate Researcher in Geometric Analysis

May 2023 - Aug 2024

↔ Prof. Jérôme Vétois

McGill University

[\[2023 Report\]](#) ([Google Drive](#))

- Conducted independent research that focused on improving the values of constants in specific trace-type Sobolev inequalities on Riemannian manifolds with boundary, subject to certain moment constraints.
- Obtained partial results by successfully extending some Euclidean theorems and concentration-compactness principles to compact manifolds with boundary.

### Undergraduate Honours Thesis in Quantum Gravity

Aug 2023 - May 2024

↔ Prof. Alexander Maloney

McGill University

[\[Thesis\]](#) ([Google Drive](#))

- Investigated the AdS/CFT factorization problem by constructing and analyzing asymptotically AdS, Euclidean wormhole solutions to Einstein's field equations. In particular, studied toroidal wormhole solutions coupled to massless, scalar fields in  $(2 + 1)$  dimensions.
- Examined relationships between the deformation of the torus and the evolution of the scalar fields in the bulk in higher-dimensional tori. Determined an exact relationship between the  $(2 + 1)$ -torus wormhole and the BTZ black hole.

### Undergraduate Researcher in Observational Cosmology

May 2022 - Aug 2022

↔ Prof. Cynthia Chiang

McGill University

- Worked on ALBATROS, a project focused on mapping the low-frequency sky via autonomous antenna stations.
- Built and modified drones for precise radio antenna calibration, assembled backend electronic components for 21-cm cosmology instrumentation, and authored documentation that streamlined both processes.

## Independent Projects

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### Expository Paper on the Resolution of the Yamabe Problem

Jan 2023 - Aug 2023

[https://www.math.mcgill.ca/gams/drppapers/2023Winter\\_Chen.pdf](https://www.math.mcgill.ca/gams/drppapers/2023Winter_Chen.pdf)

- Authored a detailed and self-contained paper on the proof of the Yamabe problem, referencing and expanding upon Lee and Parker's seminal article.
- Self-studied differential geometry and geometric analysis to understand and better articulate the original proof, which was later enhanced with supplementary steps to clarify complex segments for readers with a foundational background in analysis.

### Computational Lichtenberg Figures

Apr 2022 - Aug 2023

<https://github.com/epa058/Lichtenberg-Figures>

- In collaboration, developed an algorithm based on diffusion-limited aggregation and the dielectric breakdown model that faithfully emulates electric current behaviour in an insulator following dielectric breakdown.

- Extended the algorithm presented by Niemeyer et al. in their paper entitled "Fractal Dimensions of Dielectric Breakdown" (1984) to model two electrical discharge patterns, mirroring Lichtenberg burns.

## Numerical Simulations of Charged Particles in the Van Allen Radiation Belts

Nov 2022 - Dec 2022

<https://github.com/zebssfian/Van-Allen-Belt-Particle-Simulations>

- In collaboration, numerically simulated the 2D and 3D trajectories of charged particles in the Van Allen radiation belts, accounting for the influence of Earth's magnetic field and the principles of special relativity.
- Utilized the Runge-Kutta 4 method for integration and produced visual representations of the results, culminating in an educational video on the subject.

## Work Experience

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### Undergraduate Course Assistant

Aug 2022 - Dec 2023

McGill University

Montreal, Canada

- **Honours Vector Calculus (MATH 248):** Prepared and conducted weekly tutorials, held office hours, and graded assignments. [\[Tutorial Notes\]](#)
- **Modern Physics and Relativity (PHYS 260):** Held weekly office hours and interactive problem-solving sessions.

### Alumni Tutor

Aug 2020 - Dec 2022

Marianopolis College

Montreal, Canada

- Delivered weekly one-on-one tutoring sessions adapted to every tutee's specific learning style and needs. Frequently requested by returning students due to my ability to understand and resolve their misconceptions, my approachable teaching style, and my success with making studying less unpleasant.
- Courses tutored:
  - **Mathematics:** Calculus I, II, III; Linear Algebra
  - **Physics:** Astrophysics; Electricity & Magnetism; Classical Mechanics; Waves, Light & Modern Physics

### Private Tutor

May 2019 - Present

Self-Employed

Montreal, Canada

- Tutoring a diverse range of students, from elementary to undergraduate levels, adjusting my teaching strategies to meet distinct age-specific needs and their academic goals. Maintained long-term tutoring relationships with dozens of students, aiding in their transition across different academic levels.
- Subjects covered:
  - **Mathematics:** Calculus I, II, III, Vector Calculus; Abstract & Linear Algebra; Ordinary Differential Equations
  - **Physics:** Astrophysics; Electricity & Magnetism; Classical Mechanics; Waves, Light & Modern Physics

## Funding & Awards

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### Perimeter Scholars International Award (CAD 30,000)

2024

Scholarship provided to students selected for the Perimeter Scholars International Program.

University of Waterloo

### NSERC CGS-M (CAD 27,000)

2024

Competitive Canadian graduate scholarship to support my master's studies at Perimeter.

University of Waterloo

### President's Graduate Scholarship (CAD 5,000)

2024

Awarded to outstanding graduate students who hold major federally and provincially-funded competition-based scholarships.

University of Waterloo

### NSERC Undergraduate Research Award & FRQNT Scholarship Supplement

2023, 2024

(CAD 10,000+10,000)

McGill University

Awarded twice as funding for two summer research projects in mathematics supervised by Professor Jérôme Vétois.

### McGill Undergraduate Research Fellowship (CAD 7,000)

2022

Awarded as funding for a summer research project in physics supervised by Professor Cynthia Chiang.

McGill University

### George and Lidia Petras Scholarship in Science

2023

Awarded on the basis of academic merit to students who have completed at least one year of an undergraduate degree program in the Faculty of Science.

McGill University