

# Joshua Joseph George

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## EDUCATION

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### Masters in Applied Mathematics

Expected August 2026

University of Waterloo, Waterloo, Ontario.

*Supervisors: Dr. Kirsten Morris and Dr. David Del Rey Fernández*

*Research Area: Generalized Hamiltonian systems and Machine Learning*

### BSc Honors Applied Mathematics

May 2024

University of Alberta, Edmonton, Alberta. *First Class Honors with Distinction*

*Supervisor: Dr. Bin Han*

*Honors Thesis: Linear Independence and Stability of Integer Shifts of Compactly Supported Distributions*

## RESEARCH EXPERIENCE

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### Graduate Student

Sept 2024 - present

Department of Applied Math, University of Waterloo.

#### Topic: Generalized Hamiltonian systems and Machine Learning

**Research:** My current research lies at the intersection of machine learning and dynamical systems, where I use dynamical-systems concepts to design learning algorithms. I am working with the port-Hamiltonian systems, a generalization of Hamiltonian systems that incorporates dissipation and forcing terms. Currently, I am exploring optimization algorithms for neural networks from a dynamical systems perspective.

### Undergraduate Research Assistant

May 2024 - August 2024

Department of Mathematics and Statistics, University of Alberta.

**Topic:** A new recursive algorithm accurately to compute tail probability distributions.

**Work:** Came up with a recursive algorithm that uses differentiation and the  $G$ -transformation to compute tail probability distributions, effectively reducing the time complexity from  $\mathcal{O}(n^4)$  to  $\mathcal{O}(n)$ . *Paper in Progress*

**Supervisor:** Dr. Hassan Safouhi

### Undergraduate Research Assistant

May 2023 - August 2023

Max Planck Institute for Dynamics of Complex Technical Systems

**Topic:** Visualizing Evolutions of Feature Maps in Flow Simulations

**Work:** Extracting, Visualising and Analysing feature weights and maps from Convolutional Autoencoders. Using Grad-CAM to infer useful information from the models on the spatially discretized Navier-Stokes Equation in a cylinder.

**Supervisor:** Mr. Yongho Kim & Dr. Jan Heiland

### Undergraduate Research Assistant

May 2023 - August 2023

Department of Mathematics and Statistics, University of Alberta.

**Topic:** Determinantal Point Processes for Image Processing

**Work:** Studied the theory behind Determinantal Point Processes from an image processing point of view.

Worked on the generalization of the theorem of the moments formula for DPixPs.

**Supervisor:** Dr. Yaozhong Hu

### Undergraduate Research Assistant

January 2023 - April 2023

Department of Mathematics and Statistics, University of Alberta.

**Topic:** Linear Independence and Stability of Integer Shifts of Compactly Supported Distributions

**Work:** We explore the Linear independence of compactly supported distributions and prove results for the same, relate the Kernel of the space of semi-discrete convolutions of a distribution to the Fourier transform of the distribution and provide some correlation between Stability and Linear Independence.

**Supervisor:** Dr. Bin Han

### Undergraduate Research Assistant

May 2022- September 2022

Department of Mathematics and Statistics, University of Alberta.

**Topic:** Prove the existence of periodic solutions of second-order differential equations.

**Work:** We start by studying the properties of the Dirac Delta and Green's Function and provide a specific solution to the second-order non-autonomous differential equation. Later on, we study topics in Topological Degree Theory and prove the Brouwer fixed point theorem.

**Supervisor:** Dr. Mohammad Ali Niksirat

### Undergraduate Research Assistant

May 2022- June 2022

Department of Physics, University of Alberta.

**Work:** Part of the undergraduate research cohort group. Determine the properties of the gas using data from the Gaia satellite to measure the motions of stars in young clusters.

**Supervisor:** Dr. Erik Rosolowsky

**Undergraduate Research Assistant**

May 2021- September 2021

Department of Mathematics and Statistics, University of Alberta.

**Topic:** Moments of Quadratic Dirichlet  $L$ - Functions.

**Work:** We studied the properties of Non-Holomorphic Eisenstein Series, Modular Forms and Dirichlet  $L$ - Functions and it's functional equation. During this time, encountered and reproved some results like the Prime Number Theorem, Riemann-Roch Theorem and also proved other results in Analytic Number Theory, Function field Theory and Multiple Dirichlet Series Theory.

**Supervisor:** Dr. Manish Patnaik

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TEACHING EXPERIENCE

**Graduate Teaching Assistant**

January 2025- April 2025

Department of Applied Mathematics, University of Waterloo.

Teaching Assistant under Dr. Michael Waite and Dr. Henry Shum (*Applied Real Analysis and Partial Differential Equations I*)

**Tasks:** Grading Assignments, run tutorials and office hours

**Graduate Teaching Assistant**

September 2024- December 2024

Department of Applied Mathematics, University of Waterloo.

Teaching Assistant under Dr. Eric Bembenek and Dr. Sean Speziale (*Honors Calculus I*)

**Tasks:** Grading Assignments and run tutorials

**Undergraduate Teaching Assistant**

January 2023- May 2024

Department of Mathematics and Statistics, University of Alberta.

Teaching Assistant under Dr. Alexander Litvak for Multivariate Calculus (*Intermediate Calculus I*)

**Tasks:** Grading Assignments

**Undergraduate Teaching Assistant**

January 2023- May 2024

Department of Mathematics and Statistics, University of Alberta.

Teaching Assistant under Dr. Alexander Litvak for Multivariate Calculus (*Intermediate Calculus I*)

**Tasks:** Grading Assignments

**Undergraduate Teaching Assistant**

January 2023- May 2024

Department of Computing Science, University of Alberta.

Teaching Assistant under Dr. Mohammad Reza Salavatipour and Dr. Carrie Demmans for Formal Logic and Systems in Computing Science

**Tasks:** Grading Assignments and Run Seminar Sessions

**Undergraduate Teaching Assistant**

September 2022- December 2022

Department of Mathematics and Statistics, University of Alberta.

Teaching Assistant under Dr. Volker Runde for Multivariate Real Analysis I (*Honors Advanced Calculus I*)

**Tasks:** Grading Assignments

**Undergraduate Teaching Assistant**

September 2021- April 2022

Department of Mathematics and Statistics, University of Alberta.

Teaching Assistant in Decima Robinson Center.

**Tasks:** Helped first and second years with introductory Honors Calculus and Linear Algebra courses.

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HONORS AND AWARDS

**Women in Math - Directed Reading program**

*Issued : August 2025*

University of Waterloo.

Mentoring undergraduate students in Modern Probability Theory

**University of Waterloo Senate Graduate Scholarship**

*Issued : June 2025*

**Graduate Research Scholarship**

*Issued : September 2024*

University of Waterloo.

**First Class with Distinction in Honors Applied Math**

*Issued : June 2024*

University of Alberta.

**Yahya Scholarship in Honors Pure Mathematics**

*Issued : September 2023*

University of Alberta.

Awarded to a student with superior academic achievement entering the fourth year of study for a Bachelor of Science with Honors in Mathematics. Selection based on academic standing.

**An Education Abroad Individual Award***Issued : June 2023*

University of Alberta.

The Education Abroad Individual Award is to help fund the international learning experience.

**Mathematical and Statistical Sciences Undergraduate Student Research Award***Issued : May 2023***University of Alberta Undergraduate International Scholarship***Issued : January 2023*

University of Alberta.

Awarded to students with superior academic achievement who have completed at least one year of studies.

Selection based on academic standing.

**Dr Clement W Bowman Scholarship in Honors Applied Mathematics***Issued : August 2022*

Department of Mathematics and Statistics, University of Alberta.

Awarded to students with superior academic achievement enrolled in the third year of the Applied Honors Mathematics Program.

**The Cyril G Wates Memorial Scholarship in Honors Pure Mathematics***Issued : August 2022*

University of Alberta.

To be awarded annually to a student of outstanding academic merit completing second year in Honors Mathematics

**The Mathematical Contest in Modeling (Successful Participant Award)***Issued: February 2022***International student scholarship***Issued : August 2020*

University of Alberta.

Students with superior academics who will be entering their first year of an undergraduate degree studying.

**Dean's List** *Fall 2021, Winter 2022, Fall 2022, Winter 2023 Fall, 2024, Winter 2025*

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**CONFERENCES AND SUMMER PROGRAMS**

NSF-FRG Collaboration: Singularities in Incompressible Flows: Computer Assisted Proofs and Physics-Informed Neural Networks. Princeton University. August 2025.

Emerging Research Trends in Computer Science. The Cornell, Maryland, Max Planck Pre-doctoral Research School in Computer Science (CMMRS). Max Planck SWS. July 2025.

Principled Scientific Discovery with Formal Methods. IBM J Watson Research Center, Yorktown Heights. NY. July 2025.

Ontario Graduate Math and Statistics Conference. University of Toronto. May 2025.

Alberta Graduate Math and Statistics Conference. University of Alberta. July 2024.

New Directions in Compressible and Incompressible Flows: A Conference in Honor of Alexis Vasseur's 50th Birthday Conference, Max Planck Institute for Mathematics in the Sciences, June 2023

Alberta Number Theory Days conference, Banff International Research Station, November 2021

Mathematical Association of America Virtual MATHFEST, August 2021

The International Undergraduate Summer Enrichment Program, July – August 2021

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**EXTRACURRICULARS****President**

May 2023 - May 2024

Mathematical Sciences Society, University of Alberta

**Work:** Plan and organize social activities and host math contests. Act as a liaison between the Society and the Faculty of Science, its various departments, and associate student groups as delegated by the President**Treasurer**

September 2023 - May 2024

Catholic Student Association, University of Alberta

**Social Executive**

September 2021 - May 2022

Google Developer Student Club, University of Alberta

**Google cloud higher education summer challenge**

June – September 2021

**Track:** Data analyst**Tasks:** Perform foundational data tasks in Google Cloud using Python and SQL