

# Simran Nerval — Curriculum Vitae

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## Education

### University of Toronto

*PhD in Astronomy and Astrophysics*

**Toronto, ON, Canada**

*2021 – 2026 (Expected)*

- Thesis: "Multi-pronged Approach to Characterize and Constrain the Early Universe" *Supervised by Renée Hložek*

### Queen's University

*MSc in Physics, Engineering Physics & Astronomy*

**Kingston, ON, Canada**

*2019 – 2021*

- Thesis: "Stochastic Gravitational Wave Backgrounds from Low-Scale Inflation" *Supervised by Joseph Bramante*

### University of Toronto

*Honours Bachelor of Science (Physics & Astronomy Specialist, Mathematics Minor)*

**Toronto, ON, Canada**

*2015 – 2019*

- Thesis: "Analysis of LiteBIRD Systematics and their Impact on Cosmology" *Supervised by Renée Hložek*

## Awards

### Queen Elizabeth II Graduate Scholarship in Science and Technology

*CAD\$15,000, Merit-based scholarship awarded to students in science and technology.*

**University of Toronto**

*2024 – 2025*

### Walter C. Sumner Memorial Fellowship

*CAD\$6,650 for 2023 – 2024, CAD\$7,400 for 2024 – 2025,*

**Walter C. Sumner Foundation**

*Awarded to 40 graduate students across Canada/year.*

*2023 – 2025*

### Dunlap Seed Funding

*CAD\$6,000 for Age of the Universe and CAD\$30,000 for Coding the Cosmos*

**Dunlap Institute**

*Awarded to run coding and astronomy camps for low socioeconomic high school students.*

*2023 – 2024*

### Lachlan Gilchrist Fellowship

*CAD\$4,000, Awarded to 3 graduate students in the physical sciences/year.*

**University of Toronto**

*2022 – 2023*

### Natural Sciences and Engineering Research Council of Canada (NSERC) Scholarships

*PGS D - CAD\$21,000/year for the first 2 years, CGS D - CAD\$35,000/year for the final year.*

**NSERC**

*2021 – 2024*

### David A. Dunlap Department of Astronomy & Astrophysics Entrance Scholarship

*CAD\$5,000*

**Uni. of Toronto**

*2021*

### Arts '49 Principal Wallace Fellowship

*CAD\$20,000, Awarded to 1 graduate student/year.*

**Queen's University**

*2020 – 2021*

## Supervision, Teaching, and Mentorship Experience

### Supervision

- Emma Xu (2024 – Present): Co-supervising Astronomy and Physics undergraduate who is utilizing numerical simulations to determine gravitational wave signatures from preheating and modifying the code to also simulate the signals during inflation.
- Ezra Msolla (2024 – 2025): Co-supervised Astronomy and Physics undergraduate who was developing an emulator to enable more efficient sampling of inflationary particle burst models.

- Zeling Zhang (2023 – 2025): Co-supervised Computer Science undergraduate who developed the back-end and a more efficient labelling system for our glitch classification project on Zooniverse enabled by active learning.

## Teaching

### Teaching Assistant

*Department of Astronomy & Astrophysics, University of Toronto*

**Toronto, ON, Canada**

*2021 – Present*

- AST222: Ran and made materials for tutorials, held office hours, marked, created coding based problem set questions, and final exam questions for a second year galaxies and cosmology course for astronomy and physics students (January – April 2023, January – April 2024, January – April 2025, and January – April 2026).
- AST325: Ran and made materials for astronomy and Python based tutorials, held office hours, ran labs sessions, and marked for a third year practical astronomy course for astronomy and physics students (September – December 2023 and September – December 2024).
- AST101: Ran tutorials, marked, and ran observing nights for a first year course for non-science students about the Sun, planets, comets, and the formation of the solar system (September – December 2021 and September – December 2022).

### Teaching Assistant

*Department of Physics, Engineering Physics & Astronomy, Queen's University*

**Kingston, ON, Canada**

*2019 – 2020*

- APSC111 (September – December 2019) and APSC112 (January – April 2020): Conducted tutorials and marked for a first year classical mechanics/electricity and magnetism course for engineering students.

## Mentorship

### STEM Leaders: Launch Program

*Mentor, Visions of Science*

**Toronto, ON, Canada**

*2025*

- Co-supervised high school student on a research project where they used ACT and SDSS data to determine the Hubble constant with Python.
- Mentored the undergraduate co-supervisor on how to supervise students, develop a project plan, and develop materials that help teach the student while still allowing them to have freedom to make their own research choices.

### Graduate and Undergraduate Mentorship Programs

*Mentor, Department of Astronomy & Astrophysics, University of Toronto*

**Toronto, ON, Canada**

*2021 – Present*

- Mentoring upper year Physics and Astronomy undergraduates Dan Morrone (2021 – 2022), Kaitlin Cranston (2023 – 2024), Camille Paule (2024 – 2025), and Maëlle Magnan (2024 – Present).
- Mentored first year Astronomy and Astrophysics graduate student Anika Slizewski (2022 – 2023).

## Outreach, Volunteering, and Service

### Coding the Cosmos

*Director, Dunlap Institute for Astronomy & Astrophysics, University of Toronto*

**Toronto, ON, Canada**

*2023 – 2025*

- In this role I was the **PI** for our seed funding grants totalling CAD\$36,000, wrote curriculum, developed materials, recruited volunteers and executives, ran trainings for volunteers, oversaw and managed all working groups totalling over 35 volunteers, and led organization logistics.
- **Developed** and **organized** multiple 3-day **workshops** for over 50 grade 9 – 11 students across Southern Ontario where they were introduced to coding, data analysis, and completed coding based astronomy projects as well as a day long workshop for 29 grade 11 and 12 students called **Age of the Universe**.

### Course and Quals Committee

*Committee Member, Department of Astronomy & Astrophysics, University of Toronto*

**Toronto, ON, Canada**

*2022 – 2023*

### Canadian Astronomical Society (CASCA)

*Graduate Student Representative*

**Virtual, Canada**

*2020 – Present*

- Queen's University Graduate Student Representative (2020 – 2021), Graduate Student Committee (2020 – 2024), Education and Public Outreach Committee (2021 – 2022), Equity and Inclusivity Committee (2021 – Present).

### University of Toronto AstroTours

*AstroTours Co-Director*

**Toronto, ON, Canada**

*2021 – 2023*

- Organized and ran monthly **astronomy public talks**, telescope tours, and astronomy demonstrations.

<b>Innovation, Diversity, Exploration, &amp; Advancement in STEM Initiative IDEAS Initiative Director of External Affairs</b>	<b>Kingston, ON, Canada</b>
	<i>2020 – 2023</i>
- Workshop Coordinator for GIRLS Camp, organized and ran <i>STEM Stories</i> , and organized a joint <b>national symposium</b> with Let's Talk Science for over 200 high school/CÉGEP students from all provinces, the Yukon, and Nunavut called <i>Let's Talk Astrophysics</i> on dark matter and galactic dynamics.	
<b>GEnder MINorities In Physics (GEMINI-P)</b> <i>Mentorship Program Coordinator</i>	<b>Kingston, ON, Canada</b>
- Organized and ran a pilot <b>mentorship program</b> for upper year undergraduates with diverse mentors.	<i>2020 – 2021</i>
<b>Let's Talk Science</b> <i>Coordinator (2020 – 2021), Volunteer (2019 – 2020)</i>	<b>Kingston, ON, Canada</b>
- As a coordinator I <b>managed volunteers</b> and connected them with outreach opportunities, organized <b>virtual outreach</b> for K-12 classes and <b>developed</b> new kits on topics such as physics, astronomy, and computer science.	<i>2019 – 2021</i>
- As a volunteer I ran <b>classroom visits</b> at elementary schools involving <b>leading demonstrations</b> , giving quick lectures on the science behind the activities, and supporting students in conducting their own experiments.	
<b>Queen's University Association for Queer Employees (QUAQE)</b> <i>QUAQE Organizing Committee Member</i>	<b>Kingston, ON, Canada</b>
	<i>2020 – 2021</i>
<b>Department of Physics, Engineering Physics &amp; Astronomy</b> <i>Volunteer, Queen's University</i>	<b>Kingston, ON, Canada</b>
- <b>Co-led</b> a team from the physics department to make videos and design physics games for the virtual <i>Science Rendezvous Kingston 2021</i> , <b>operated a 14-inch telescope</b> for the general public, and volunteered at a variety of department outreach events.	<i>2019 – 2021</i>
<b>Departments of Physics and Astronomy &amp; Astrophysics</b> <i>Volunteer, University of Toronto</i>	<b>Toronto, ON, Canada</b>
- <b>Led demonstrations</b> for the public at a variety of department outreach events.	<i>2018 – 2019</i>
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<b>Presentations</b>	
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<b>Academic</b>	
<b>Constraining the Early Universe with CMB Data and Gravitational Wave Backgrounds and Probing Millimeter Transients</b> <i>University of Nottingham, Talk</i>	<b>Nottingham, England</b>
	<i>July 2025</i>
<b>Probing Millimeter Transients and Constraining the Early Universe with CMB Data and Gravitational Wave Backgrounds</b> <i>Cardiff University, Talk</i>	<b>Cardiff, Wales</b>
	<i>July 2025</i>
<b>Constraining the Primordial Power Spectrum with the ACT</b> <i>Cosmology from Home, Talk</i>	<b>Virtual</b>
	<i>June 2025</i>
<b>Constraining the Primordial Power Spectrum with the ACT</b> <i>Canadian Astronomical Society (CASCA) Annual General Meeting, Talk</i>	<b>Halifax, NS, Canada</b>
	<i>June 2025</i>
<b>The Development of Machine Learning Tools for Detecting Millimeter Sources in CMB Timestream Pre-processing</b> <i>UofT TASTY Talk Series, Talk, S. K. Nerval and E. Hornecker</i>	<b>Toronto, ON, Canada</b>
	<i>April 2025</i>
<b>Millimeter Transient Detection During Timestream Preprocessing with the Atacama Cosmology Telescope</b> <i>CASCA Annual General Meeting, Poster</i>	<b>Toronto, ON, Canada</b>
	<i>June 2024</i>

<b>Millimeter Transient Detection During Timestream Preprocessing with the Atacama Cosmology Telescope</b> <i>Hotwiring the Transient Universe VII, Talk, S. K. Nerval and E. Hornecker</i>	<b>Toronto, ON, Canada</b> <i>May 2024</i>
<b>Glitch Classification with the Atacama Cosmology Telescope and the Simons Observatory</b> <i>CITA Cosmology Lunch, Talk</i>	<b>Toronto, ON, Canada</b> <i>December 2023</i>
<b>Constraining Inflation Beyond the Standard Picture</b> <i>CASCA Annual General Meeting, Talk</i>	<b>Penticton, BC, Canada</b> <i>June 2023</i>
<b>Multi-pronged Approach to Characterize and Constrain Inflation</b> <i>University of Oslo Cosmoglobe Workshop, Talk</i>	<b>Oslo, Norway</b> <i>January 2023</i>
<b>LiteBIRD and Future CMB Telescopes</b> <i>University of Oslo Component Separation Course, Talk</i>	<b>Oslo, Norway</b> <i>September 2022</i>
<b>Constraining Inflation Beyond the Standard Picture</b> <i>University of Oslo Astronomy Lunch, Talk</i>	<b>Oslo, Norway</b> <i>August 2022</i>
<b>Stochastic Gravitational Wave Backgrounds from Low-Scale Inflation</b> <i>International HPC Summer School, Poster</i>	<b>Virtual</b> <i>July 2021</i>
<b>Gravitational Wave Backgrounds from Low-Scale Inflation</b> <i>Canadian Association of Physicists (CAP) Congress, Talk</i>	<b>Virtual</b> <i>June 2021</i>
- Awarded second place in oral competition for the Division of Theoretical Physics	
<b>Gravitational Wave Backgrounds from Low-Scale Inflation</b> <i>Phenomenology Symposium, Talk</i>	<b>Virtual, Pittsburgh, PA, USA</b> <i>May 2021</i>
<b>Gravitational Wave Backgrounds from Low-Scale Inflation</b> <i>CASCA Annual General Meeting, Talk</i>	<b>Virtual, Penticton, BC, Canada</b> <i>May 2021</i>
<b>Gravitational Wave Backgrounds from E- and T-Model Inflation</b> <i>MI Annual Meeting, Talk</i>	<b>Virtual, Kingston, ON, Canada</b> <i>August 2020</i>
- Awarded best student presentation	
<b>LiteBIRD's Projected Constraints of Inflationary Models</b> <i>Great Lakes Cosmology Workshop, Talk</i>	<b>Rochester, NY, USA</b> <i>August 2019</i>
<b>LiteBIRD's Projected Constraints of Inflationary Models</b> <i>CASCA Annual General Meeting, Poster</i>	<b>Montréal, QC, Canada</b> <i>June 2019</i>
<b>Invited Outreach Presentations</b>	
<b>Astronomy on Tap T.O., Invited Public Talk</b>	<b>Toronto, ON, Canada, November 2025</b>
<b>Abbey Park High School, Invited Speaker</b>	<b>Toronto, ON, Canada, November 2025</b>
<b>University of Toronto AstroTours, Invited Public Talk</b>	<b>Toronto, ON, Canada, February 2025</b>
<b>Great Lakes Science Boot Camp For Librarians, Invited Speaker</b>	<b>Toronto, ON, Canada, July 2024</b>
<b>Visions of Science, Invited STEM Academy Speaker</b>	<b>Brampton, ON, Canada, April 2023</b>
<b>Visions of Science, Invited STEM Sparks Presentation</b>	<b>Toronto, ON, Canada, January 2022</b>
<b>Queen's QUO Fast Radio Bursts, Invited Podcast Guest</b>	<b>Kingston, ON, Canada, August 2021</b>
<b>TELUS Spark Science Centre, Invited Speaker</b>	<b>Virtual, Calgary, AB, Canada, August 2021</b>
<b>Royal Astronomical Society of Canada, Invited Public Talk</b>	<b>Virtual, BC, Canada, February 2021</b>
<b>Astronomy on Tap: Kingston, Invited Public Talk</b>	<b>Virtual, Kingston, ON, Canada January 2021</b>

**Contributed Outreach Presentations**University of Toronto AstroTours, **Public Talk**

Toronto, ON, Canada, November 2022

IAU Communicating Astronomy with the Public, **Poster**

Sydney, NSW, Australia, September 2022

**Research Experience****Dunlap Institute for Astronomy & Astrophysics, University of Toronto**

Toronto, ON, Canada

Supervised by Renée Hložek

September 2021 – Present

- Using a multi-pronged approach to **characterize and constrain inflation** using the cosmic microwave background and gravitational wave backgrounds.

**Arthur B. McDonald Institute (MI), Queen's University**

Kingston, ON, Canada

Supervised by Joseph Bramante

September 2019 – August 2021

- Used detailed modelling and numerical simulations to **determine gravitational wave signatures** (stochastic gravitational wave backgrounds) of low scale inflationary sectors.

**Dunlap Institute for Astronomy & Astrophysics, University of Toronto**

Toronto, ON, Canada

Supervised by Renée Hložek

September 2018 – August 2019

- **Modelled**  $1/f$  noise for LiteBIRD using Fisher forecasts in order to **constrain cosmological parameters**.

**Department of Physics, University of Toronto**

Toronto, ON, Canada

Supervised by Kaley Walker

May 2018 – August 2018

- Executed **satellite validation** between the ACE satellite and ground based instruments in Eureka, Nunavut, Canada that measured NO<sub>2</sub> between 2004 and 2017.

**Technical Skills**

Proficient in **Python** and have experience with **Fortran**, **Mathematica**, and **high-performance computing**. Comfortable using **LATEX** and the **Linux** command line.

**Publications****Leading and Major Contribution**

1. E. Calabrese, et al. (including **S. K. Nerval**), *The Atacama Cosmology Telescope: DR6 Constraints on Extended Cosmological Models*, JCAP, Vol. 2025, Issue 11, 63 (2025, 2503.14454)
2. **S. K. Nerval**, E. Hornecker, Y. Guan, et al., *The Atacama Cosmology Telescope: Machine Learning Driven Tools for Detecting Millimeter Sources in Timestream Pre-processing*, ApJ, Vol. 990, Issue 2, 139 (2025, 2503.10798)
3. A. Bhoonah, J. Bramante, **S. Nerval** and N. Song (alphabetical order), *Gravitational Waves From Dark Sectors, Oscillating Inflatons, and Mass Boosted Dark Matter*, JCAP, Vol. 2021, Issue 4, 43 (2021, 2008.12306)

**Collaboration**

1. Simons Observatory Collaboration (including **S. K. Nerval**), *The Simons Observatory: forecasted constraints on primordial gravitational waves with the expanded array of Small Aperture Telescopes*, submitted to JCAP (2025, 2512.15833)
2. J. Clancy, et al. (including **S. K. Nerval**), *The Simons Observatory: Development of a Pipeline to Detect Rapid Transients in Time-Ordered Data*, submitted to OJA (2025, 2512.11313)
3. T. Louis, et al. (including **S. K. Nerval**), *The Atacama Cosmology Telescope: DR6 Power Spectra, Likelihoods and  $\Lambda$ CDM Parameters*, JCAP, Vol. 2025, Issue 11, 62 (2025, 2503.14452)

4. S. Naess, et al. (including **S. K. Nerval**), *The Atacama Cosmology Telescope: DR6 Maps*, JCAP, Vol. 2025, Issue 11, 61 (2025, 2503.14451)
5. M. Abitbol, et al. (including **S. K. Nerval**), *The Simons Observatory: Science Goals and Forecasts for the Enhanced Large Aperture Telescope*, JCAP, Vol. 2025, Issue 8, 34 (2025, 2503.00636)
6. D. J. Watts, et al. (including **S. K. Nerval**), *Cosmoglobe DR1. III. First full-sky model of polarized synchrotron emission from all WMAP and Planck LFI data*, A&A, Vol. 686, A297 (2023, 2310.13740)
7. J. R. Eskilt, et al. (including **S. K. Nerval**), *Cosmoglobe: Towards end-to-end CMB cosmological parameter estimation without likelihood approximations*, A&A, Vol. 678, A169 (2023, 2306.15511)
8. T. Hasebe, et al. (including **S. Nerval**), *Sensitivity modeling for LiteBIRD*, J. Low Temp. Phys., Vol. 211, Issue 5-6, 384-397 (2023)
9. J. R. Eskilt, et al. (including **S. K. Nerval**), *Cosmoglobe DR1 results. II. Constraints on isotropic cosmic birefringence from reprocessed WMAP and Planck LFI data*, A&A, Vol. 679, A144 (2023, 2305.02268)
10. LiteBIRD Collaboration (including **S. Nerval**), *Probing cosmic inflation with the LiteBIRD cosmic microwave background polarization survey*, PTEP, Vol. 2023, Issue 4, 042F01 (2023, 2202.02773)
11. D. J. Watts, et al. (including **S. K. Nerval**), *Cosmoglobe DR1 results. I. Improved Wilkinson Microwave Anisotropy Probe maps through Bayesian end-to-end analysis*, A&A, Vol. 679, A143 (2023, 2303.08095)
12. U. Fuskeland, et al. (including **S. K. Nerval**), *Tensor-to-scalar ratio forecasts for extended LiteBIRD frequency configurations*, A&A, Vol. 676, A42 (2023, 2302.05228)
13. J. Hubmayr, et al. (including **S. Nerval**), *Optical Characterization of OMT-Coupled TES Bolometers for LiteBIRD*, J. Low Temp. Phys., Vol. 209, Issue 3-4, 396-408 (2022)
14. P. Vielva, et al. (including **S. Nerval**), *Polarization angle requirements for CMB B-mode experiments. Application to the LiteBIRD satellite*, JCAP, Vol. 2022, Issue 04, 029 (2022)
15. Y. Sekimoto, et al. (including **S. Nerval**), *Concept design of low frequency telescope for CMB B-mode polarization satellite LiteBIRD*, Proceedings of the SPIE, Vol. 11453, 1145310 (2020)
16. L. Montier, et al. (including **S. Nerval**), *Overview of the medium and high frequency telescopes of the LiteBIRD space mission*, Proceedings of the SPIE, Vol. 11443, 114432G (2020)
17. M. Hazumi, et al. (including **S. Nerval**), *LiteBIRD: JAXA's new strategic L-class mission for all-sky surveys of cosmic microwave background polarization*, Proceedings of the SPIE, Vol. 11443, 114432F (2020)
18. H. Sugai, et al. (including **S. Nerval**), *Updated Design of the CMB Polarization Experiment Satellite LiteBIRD*, J. Low Temp. Phys., Vol. 199, Issue 3-4, 1107-1117 (2020)
19. A. Lee, et al. (including **S. Nerval**), *LiteBIRD: an all-sky cosmic microwave background probe of inflation*, Astro2020: Decadal Survey on Astronomy and Astrophysics, APC white papers, no. 286; Bulletin of the American Astronomical Society, Vol. 51, Issue 7, 286 (2019)