

Simran Nerval — Curriculum Vitae

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Education

- University of Toronto** **Toronto, ON, Canada**
PhD in Astronomy and Astrophysics *2021 – 2026 (Expected)*
- Thesis: "Multi-pronged Approach to Characterize and Constrain the Early Universe" *Supervised by Renée Hložek*
- Queen's University** **Kingston, ON, Canada**
MSc in Physics, Engineering Physics & Astronomy *2019 – 2021*
- Thesis: "Stochastic Gravitational Wave Backgrounds from Low-Scale Inflation" *Supervised by Joseph Bramante*
- University of Toronto** **Toronto, ON, Canada**
Honours Bachelor of Science (Physics & Astronomy Specialist, Mathematics Minor) *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** **University of Toronto**
CAD\$15,000, Merit-based scholarship awarded to students in science and technology. *2024 – 2025*
- Walter C. Sumner Memorial Fellowship** **Walter C. Sumner Foundation**
CAD\$6,650 for 2023 – 2024, CAD\$7,400 for 2024 – 2025,
Awarded to 40 graduate students across Canada/year. *2023 – 2025*
- Dunlap Seed Funding** **Dunlap Institute**
CAD\$6,000 for Age of the Universe and CAD\$30,000 for Coding the Cosmos
Awarded to run coding and astronomy camps for low socioeconomic high school students. *2023 – 2024*
- Lachlan Gilchrist Fellowship** **University of Toronto**
CAD\$4,000, Awarded to 3 graduate students in the physical sciences/year. *2022 – 2023*
- Natural Sciences and Engineering Research Council of Canada (NSERC) Scholarships** **NSERC**
PGS D - CAD\$21,000/year for the first 2 years, CGS D - CAD\$35,000/year for the final year. *2021 – 2024*
- David A. Dunlap Department of Astronomy & Astrophysics Entrance Scholarship** **Uni. of Toronto**
CAD\$5,000 *2021*
- Arts '49 Principal Wallace Fellowship** **Queen's University**
CAD\$20,000, Awarded to 1 graduate student/year. *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

Toronto, ON, Canada

Department of Astronomy & Astrophysics, University of Toronto

2021 – 2025

- 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, and January – April 2025).
- 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

Kingston, ON, Canada

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

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

Toronto, ON, Canada

Mentor, Visions of Science

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 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

Toronto, ON, Canada

Mentor, Department of Astronomy & Astrophysics, University of Toronto

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

Toronto, ON, Canada

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

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 Quads Committee

Toronto, ON, Canada

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

2022 – 2023

Canadian Astronomical Society (CASCA)

Virtual, Canada

Graduate Student Representative

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

Toronto, ON, Canada

AstroTours Co-Director

2021 – 2023

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

- Innovation, Diversity, Exploration, & Advancement in STEM Initiative** Kingston, ON, Canada
IDEAS Initiative Director of External Affairs 2020 – 2023
- **Workshop Coordinator** for GIRLS Camp, organized and ran *STEM Stories*, and organized a joint **national symposium** with Let's Talk Science for high school students called *Let's Talk Astrophysics* on dark matter and galactic dynamics.
- Gender MINorities In Physics (GEMINI-P)** Kingston, ON, Canada
Mentorship Program Coordinator 2020 – 2021
- Organized and ran a pilot **mentorship program** for upper year undergraduates with diverse mentors.
- Let's Talk Science** Kingston, ON, Canada
Coordinator (2020 – 2021), Volunteer (2019 – 2020) 2019 – 2021
- As a coordinator I **managed volunteers** and connected them with outreach opportunities, organized **virtual outreach** for K-12 classes and **developed** new kits on topics such as physics, astronomy, and computer science.
 - As a volunteer I ran **classroom visits** at elementary schools involving **leading demonstrations**, giving quick lectures on the science behind the activities, and supporting students in conducting their own experiments.
- Queen's University Association for Queer Employees (QUAQE)** Kingston, ON, Canada
QUAQE Organizing Committee Member 2020 – 2021
- Department of Physics, Engineering Physics & Astronomy** Kingston, ON, Canada
Volunteer, Queen's University 2019 – 2021
- **Co-led** a team from the physics department to make videos and design physics games for the virtual *Science Rendezvous Kingston 2021*, **operated a 14-inch telescope** for the general public, and volunteered at a variety of department outreach events.
- Departments of Physics and Astronomy & Astrophysics** Toronto, ON, Canada
Volunteer, University of Toronto 2018 – 2019
- **Led demonstrations** for the public at a variety of department outreach events.

Presentations

- Academic**.....
- Constraining the Early Universe with CMB Data and Gravitational Wave Backgrounds and Probing Millimeter Transients** Nottingham, England
University of Nottingham, Talk July 2025
- Probing Millimeter Transients and Constraining the Early Universe with CMB Data and Gravitational Wave Backgrounds** Cardiff, Wales
University of Cardiff, Talk July 2025
- Constraining the Primordial Power Spectrum with the ACT** Virtual
Cosmology from Home, Talk June 2025
- Constraining the Primordial Power Spectrum with the ACT** Halifax, NS, Canada
Canadian Astronomical Society (CASCA) Annual General Meeting, Talk June 2025
- The Development of Machine Learning Tools for Detecting Millimeter Sources in CMB Timestream Pre-processing** Toronto, ON, Canada
UofT TASTY Talk Series, Talk, S. K. Nerval and E. Hornecker April 2025
- Millimeter Transient Detection During Timestream Preprocessing with the Atacama Cosmology Telescope** Toronto, ON, Canada
CASCA Annual General Meeting, Poster June 2024
- Millimeter Transient Detection During Timestream Preprocessing with the Atacama Cosmology Telescope** Toronto, ON, Canada
Hotwiring the Transient Universe VII, Talk, S. K. Nerval and E. Hornecker May 2024

Glitch Classification with the Atacama Cosmology Telescope and the Simons Observatory <i>CITA Cosmology Lunch, Talk</i>	Toronto, ON, Canada <i>December 2023</i>
Constraining Inflation Beyond the Standard Picture <i>CASCA Annual General Meeting, Talk</i>	Penticton, BC, Canada <i>June 2023</i>
Multi-pronged Approach to Characterize and Constrain Inflation <i>University of Oslo Cosmoglobe Workshop, Talk</i>	Oslo, Norway <i>January 2023</i>
LiteBIRD and Future CMB Telescopes <i>University of Oslo Component Separation Course, Talk</i>	Oslo, Norway <i>September 2022</i>
Constraining Inflation Beyond the Standard Picture <i>University of Oslo Astronomy Lunch, Talk</i>	Oslo, Norway <i>August 2022</i>
Stochastic Gravitational Wave Backgrounds from Low-Scale Inflation <i>International HPC Summer School, Poster</i>	Virtual <i>July 2021</i>
Gravitational Wave Backgrounds from Low-Scale Inflation <i>Canadian Association of Physicists (CAP) Congress, Talk</i>	Virtual <i>June 2021</i>
- Awarded second place in oral competition for the Division of Theoretical Physics	
Gravitational Wave Backgrounds from Low-Scale Inflation <i>Phenomenology Symposium, Talk</i>	Virtual, Pittsburgh, PA, USA <i>May 2021</i>
Gravitational Wave Backgrounds from Low-Scale Inflation <i>CASCA Annual General Meeting, Talk</i>	Virtual, Penticton, BC, Canada <i>May 2021</i>
Gravitational Wave Backgrounds from E- and T-Model Inflation <i>MI Annual Meeting, Talk</i>	Virtual, Kingston, ON, Canada <i>August 2020</i>
- Awarded best student presentation	
LiteBIRD's Projected Constraints of Inflationary Models <i>Great Lakes Cosmology Workshop, Talk</i>	Rochester, NY, USA <i>August 2019</i>
LiteBIRD's Projected Constraints of Inflationary Models <i>CASCA Annual General Meeting, Poster</i>	Montréal, QC, Canada <i>June 2019</i>

Invited Outreach Presentations.....

University of Toronto AstroTours, Public Talk	Toronto, ON, February 2025
Great Lakes Science Boot Camp For Librarians, Invited Speaker	Toronto, ON, July 2024
Visions of Science, Invited STEM Academy Speaker	Brampton, ON, April 2023
Visions of Science, Invited Pre-recorded STEM Sparks Presentation	Toronto, ON, January 2022
Queen's Observatory QUO Fast Radio Bursts, Invited Podcast Guest	Kingston, ON, August 2021
TELUS Spark Science Centre, Invited Camp Presentation	Virtual, Calgary, AB, August 2021
Royal Astronomical Society of Canada, Invited Public Talk	Virtual, BC, February 2021
Astronomy on Tap: Kingston, Invited Public Talk	Virtual, Kingston, ON, January 2021
Queen's University Observatory Open House, Invited Public Talk	Kingston, ON, January 2020

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

Supervised by Renée Hložek

Toronto, ON, Canada

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

Supervised by Joseph Bramante

Kingston, ON, Canada

September 2019 – August 2021

- Used detailed modeling 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

Supervised by Renée Hložek

Toronto, ON, Canada

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

Supervised by Kaley Walker

Toronto, ON, Canada

May 2018 – August 2018

- Executed **satellite validation** between the ACE satellite and ground based instruments in Eureka, Nunavut, Canada that measured NO_2 between 2004 and 2017.

Technical Skills

Proficient in **Python** and have experience with **Fortran** and **Mathematica**. Comfortable using **L^AT_EX** 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*, accepted in JCAP (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 Inflavons, and Mass Boosted Dark Matter*, JCAP, Vol. 2021, Issue 4, 43 (2021, 2008.12306)

Collaboration.....

1. T. Louis, et al. (including **S. K. Nerval**), *The Atacama Cosmology Telescope: DR6 Power Spectra, Likelihoods and Λ CDM Parameters*, accepted in JCAP (2025, 2503.14452)
2. S. Naess, et al. (including **S. K. Nerval**), *The Atacama Cosmology Telescope: DR6 Maps*, accepted in JCAP (2025, 2503.14451)
3. 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)
4. 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)
5. 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)
6. T. Hasebe, et al. (including **S. Nerval**), *Sensitivity Modeling for LiteBIRD*, J. Low Temp. Phys., Volume 211, Issue 5-6, 384-397 (2023)
7. 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)
8. 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)

9. 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)
10. 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)
11. 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)
12. 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)
13. 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)
14. 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)
15. 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)
16. 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)
17. 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)