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 – 2025): Co-supervised an Astronomy and Physics undergraduate who utilized numerical simulations to determine gravitational wave signatures from preheating.
- Ezra Msolla (2024 – 2025): Co-supervised an 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 a 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

Guest Lecturer **Toronto, ON, Canada**
Department of Astronomy & Astrophysics, University of Toronto *2026*

- AST222: Developed and presented a guest lecture on inflation, including exercises on how the universe expanded during this time period and how it solves the flatness, horizon, and monopole problem for a second year course for major and specialist students.

Teaching Assistant **Toronto, ON, Canada**
Department of Astronomy & Astrophysics, University of Toronto *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 **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 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 **Toronto, ON, Canada**
Mentor, Department of Astronomy & Astrophysics, University of Toronto *2021 – 2025*

- Mentoring upper year Physics and Astronomy undergraduates Dan Morrone (2021 – 2022), Kaitlin Cranston (2023 – 2024), Camille Paule (2024 – 2025), and Maëlle Magnan (2024 – 2025).
- 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 Quals 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 over 200 high school/CÉGEP students from all provinces, the Yukon, and Nunavut 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, 2021 – Present*

- **Led demonstrations** for the public at a variety of department outreach events.

Presentations

Academic

Searching for Primordial Wiggles: Testing Inflationary Particle Production with ACT DR6, Planck, and DESI DR2 **Montréal, QC, Canada**
Canadian Astronomical Society (CASCA) Annual General Meeting, Talk *June 2026*

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**
Cardiff University, 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 — **Toronto, ON, Canada**
CITA Cosmology Lunch, Talk — *December 2023*

Constraining Inflation Beyond the Standard Picture — **Penticton, BC, Canada**
CASCA Annual General Meeting, Talk — *June 2023*

Multi-pronged Approach to Characterize and Constrain Inflation — **Oslo, Norway**
University of Oslo Cosmoglobe Workshop, Talk — *January 2023*

LiteBIRD and Future CMB Telescopes — **Oslo, Norway**
University of Oslo Component Separation Course, Talk — *September 2022*

Constraining Inflation Beyond the Standard Picture — **Oslo, Norway**
University of Oslo Astronomy Lunch, Talk — *August 2022*

Stochastic Gravitational Wave Backgrounds from Low-Scale Inflation — **Virtual**
International HPC Summer School, Poster — *July 2021*

Gravitational Wave Backgrounds from Low-Scale Inflation — **Virtual**
Canadian Association of Physicists (CAP) Congress, Talk — *June 2021*

- **Awarded second place** in oral competition for the Division of Theoretical Physics

Gravitational Wave Backgrounds from Low-Scale Inflation — **Virtual, Pittsburgh, PA, USA**
Phenomenology Symposium, Talk — *May 2021*

Gravitational Wave Backgrounds from Low-Scale Inflation — **Virtual, Penticton, BC, Canada**
CASCA Annual General Meeting, Talk — *May 2021*

Gravitational Wave Backgrounds from E- and T-Model Inflation — **Virtual, Kingston, ON, Canada**
MI Annual Meeting, Talk — *August 2020*

- **Awarded best** student presentation

LiteBIRD's Projected Constraints of Inflationary Models — **Rochester, NY, USA**
Great Lakes Cosmology Workshop, Talk — *August 2019*

LiteBIRD's Projected Constraints of Inflationary Models — **Montréal, QC, Canada**
CASCA Annual General Meeting, Poster — *June 2019*

Invited Outreach Presentations

Toronto Public Library, Invited Public Talk — **Toronto, ON, Canada, March 2026**

March Break Lecture Series, Invited Public Talk — **Toronto, ON, Canada, March 2026**

Astronomy on Tap T.O., Invited Public Talk — **Toronto, ON, Canada, November 2025**

Abbey Park High School, Invited Speaker — **Toronto, ON, Canada, November 2025**

University of Toronto AstroTours, Invited Public Talk — **Toronto, ON, Canada, February 2025**
Great Lakes Science Boot Camp For Librarians, Invited Speaker — **Toronto, ON, Canada, July 2024**
Visions of Science, Invited STEM Academy Speaker — **Brampton, ON, Canada, April 2023**
Visions of Science, Invited STEM Sparks Presentation — **Toronto, ON, Canada, January 2022**
Queen's QUO Fast Radio Bursts, Invited Podcast Guest — **Kingston, ON, Canada, August 2021**
TELUS Spark Science Centre, Invited Speaker — **Virtual, Calgary, AB, Canada, August 2021**
Royal Astronomical Society of Canada, Invited Public Talk — **Virtual, BC, Canada, February 2021**
Astronomy on Tap: Kingston, Invited Public Talk — **Virtual, Kingston, ON, Canada January 2021**
Queen's Observatory Open House, Invited Public Talk — **Kingston, ON, Canada, 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 — **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_2 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 ΛCDM 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)