Patrick Horlaville

Astrophysics student, researcher & communicator

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Summary

I am a PhD student in Physics at McGill University working on novel statistics for upcoming telescopes that will map the large scale structure of the Universe at a time when the first stars and galaxies started to form. Aside from my research activities, I am invested in developing and practicing meaningful science communication, in particular in the context of outreach and education towards the youth in my community.

Education

2025– **PhD in Physics**, McGill University — GPA: 4.00/4.00
Supervisor: Prof. Adrian Liu

2023–2025 **MSc in Physics**, Bishop's University — GPA: 86.5/100
Supervisor: Prof. John Ruan
Thesis: Predicting the Host Galaxies of Supermassive Black Hole Binaries

2023–2025 Certificate in Knowledge Mobilization, Bishop's University — GPA: 96.2/100
Supervisors: Prof. Heather Lawford & Wade Lynch
Final project: How Can LLMs Help Sci-Comm Writers?

2019–2023 **BSc in Honours Physics**, McGill University — GPA: 3.92/4.00
Supervisors: Prof. Matt Dobbs & Dr. Dallas Wulf
Thesis: Blazar Monitoring with the CHIME Telescope
Distinctions: First Class Honours in Physics, Dean's Multidisciplinary Research List

Selected Awards *Listed amounts in Canadian dollars*

2025–2028	NSERC Postgraduate Scholarship – Doctoral	$120,000
Summer 2025	FRQNT Master's Scholarship	$6,667
	Declined $20,000 for the 2024/25 academic year in favor of NSERC CGS–M	
2024–2025	NSERC Canada Graduate Scholarship – Master's	$27,000
2023–2024	Bishop's Graduate Entrance Scholarship	$10,000

Publications

4. Carlson, N. J., Bond, J.R., Chung, D.T., **Horlaville, P.**, Morrison, T., "The WebSky [C II] Forecasts and the search for primordial intermittent non-Gaussianity", 2025, submitted to JCAP [arXiv.2510.18312].

3. **Horlaville, P.**, Ruan, J. J., Runnoe, J. C., Eracleous, M., Haggard, D., Bardati, J., "Predicting Potential Host Galaxies of Supermassive Black Hole Binaries Based on Stellar Kinematics in Archival IFU Surveys", 2025, submitted to ApJ [arXiv.2504.21145]

2. Bardati, J., Ruan, J. J., Haggard, D., Tremmel, M., **Horlaville, P.**, "Signatures of Massive Black Hole Merger Host Galaxies from Cosmological Simulations II: Unique Stellar Kinematics in Integral Field Unit Spectroscopy", 2024, ApJ, 977, 265 [DOI: 10.3847/1538-4357/ad9471]

1. **Horlaville, P.**, Chung, D. T., Bond, J. R., & Liang, L., "The informativeness of [C II] line intensity mapping as a probe of the H I content and metallicity of galaxies at the end of reionization", 2024, MNRAS, 531, 2958 [DOI: 10.1093/mnras/stae1333]

Research Projects *in Physics & Astronomy*

Bayesian Stacking of Galaxies for Line-Intensity Mapping Experiments 2025–present

Summary: For my PhD, I am developing a Bayesian formalism for stacking galaxy emission as traced by line-intensity mapping (LIM) telescopes in the context of cross-correlations with galaxy catalogs.
Supervisor: Prof. Adrian Liu @ McGill University

Predicting the Host Galaxies of Supermassive Black Hole Binaries 2023–2025

Summary: For my MSc, I developed a new method to identify candidate supermassive black hole binary host galaxies in archival galaxy surveys based on their stellar kinematics (cf. Publications #3). I also contributed to a related project, where I debugged some code in the analysis of cosmological simulations data, which resulted in my implication on the associated paper (cf. Publications #2).
Supervisor: Prof. John Ruan @ Bishop's University

Modelization and Statistics of [C II] Line Intensity Mapping 2022–2025

Summary: For my internship at the Canadian Institute for Theoretical Astrophysics (CITA) in Toronto in the summer of 2022, I revitalized a line intensity mock map program and used it to implement a new model for the parametrization of the cosmological [C II] signal, whose follow-up work and statistical analysis led to my first first-author publication (cf. Publications #1). Continued collaboration with CITA folks led to my participation in the analysis of the effects of early Universe's non-Gaussianities on line-intensity maps of galaxies billions of years later, at redshifts ~ 3 to 8 (cf. Publications #4).
Supervisors: Dr. (now Prof.) Dongwoo Chung & Prof. J. Richard Bond @ CITA

Blazar Radio Variability Monitoring with the CHIME Telescope 2021–2022

Summary: For my undergraduate honours thesis, I worked on quantifying the radio variability of northern hemisphere blazars observed daily by the CHIME telescope. To do so, I worked on the mitigation of instrument systematics and developed statistics to distinguish different classes of blazars.
Supervisors: Dr. Dallas Wulf & Prof. Matt Dobbs @ McGill University

Occurrence Rates of Exoplanets around M stars Summer 2021

Summary: For my internship at the Exoplanets Research Institute (iREx) at the Université de Montréal, I explored the modeling statistics of generating populations of exoplanets and the retrieval of their transit signature with TESS lightcurves in order to investigate their occurrence rates around M stars.
Supervisor: Prof. Björn Benneke, Exoplanets Research Institute (iREx) @ Université de Montréal

Daily Validation with the CHIME Telescope Winter 2021

Summary: I was an undergraduate research apprentice in the Matt Dobbs cosmology radio lab for one semester, where I worked on the daily validation of the CHIME telescope data. I notably built template models for the spectrum of stable radio sources and investigated their day-to-day variations.
Supervisor: Dr. (now Prof.) Saurabh Singh, Prof. Matt Dobbs @ McGill University

Computer Skills

Programming: Python (`numpy`, `matplotlib`, `astropy`, `pandas`, `emcee`...), R, Bash scripting, git/GitHub
Computing Environments: Unix/Linux, macOS, Windows; experience with remote HPC servers
Document & Design Tools: LaTeX, Microsoft Office Suite, Canva

Academic References

Adrian C. Liu	Associate Professor in the Department of Physics @ McGill
John J. Ruan	Associate Professor in the Department of Physics & Astronomy @ Bishop's
Dongwoo T. Chung	Assistant Professor in the Department of Astronomy @ Cornell
J. Richard Bond	University Professor @ the Canadian Institute for Theoretical Astrophysics

Community Engagement & Outreach *Volunteer †Invited ‡Selected

2025–present	Outreach coordinator‡ @ the Trottier Space Institute
2018–present	Magazine columnist* @ the Montreal Planetarium Astronomy Society
Feb 17 2026	Speaker† @ Cégep du Vieux-Montréal: *Overview of Modern Cosmology*
Feb 3 2026	Speaker‡ @ Astronomy on Tap Montreal: *The Cosmic Dance of Giant Black Holes*
Summer 2025	Journal club organizer* @ Bishop's Physics & Astronomy Department
2024–2025	Tutor‡ @ Bishop's Physics Help Center
2023–2025	CASCA Graduate Students Commitee representative* @ Bishop's University
June 3–6 2024	Graduate student posters and talks grader* @ 2024 CASCA meeting
May 24–26 2024	Outreach facilitator‡ @ at the 2024 Eurêka! science festival for CRAQ
Winter 2024	Volunteer facilitator* in Sherbrooke elementary schools for eclipse viewing safety
Winter 2023	Elementary school mentor* @ Sinclair Laird elementary school, Montreal
Winter 2023	Contributing speaker‡ @ the 2023 ISLS meeting for Sinclair Laird mentorship project
Winter 2022	Speaker† @ Vanier College & Cégep du Vieux-Montréal
2019–2022	Outreach volunteer* @ McGill Space Institute for school activities & observatory visits
Summer 2021	Outreach volunteer* @ iREx for visiting high school students
2017–2019	Peer tutor‡ @ Cégep du Vieux-Montréal
Nov 24 2017	Speaker† @ the Montreal Planetarium Astronomy Society

Other Awards & Distinctions *Listed amounts in Canadian dollars*

Winter 2024	Research Week Award (2nd Prize) @ Bishop's University	$150
Fall 2023	GIS Day Award (3rd Prize) @ Bishop's University	$100
Summer 2022	NSERC Undergraduate Research Award + Fellowship @ CITA	$6,000+$3,500
Fall '21, Winter '22	Tomlinson Engagement Award for Mentoring (x2) @ McGill University	2 x $300
Summer 2021	NSERC Undergraduate Research Award + Top Up @ iREx	$6,000+$2,500
2020	Golden Key Society Fellowship @ McGill University	*Distinction*
2019	Cégep Senior Thesis Award (3rd Prize) @ Cégep du Vieux-Montréal	$100

Conferences & Specialized Schools Attended

June 26–28 2024	CRAQ Summer School: *Machine Learning for Astrophysics*	Montreal, CA
June 3–6 2024	CASCA Annual General Meeting (w/ poster presentation)	Toronto, CA
Aug 3–4 2023	Pan-Canadian Reionization Workshop ($1,000 travel fund from CITA)	Toronto, CA
July 18–22 2022	CMB+EoR Workshop	Montreal, CA
June 15–17 2022	CRAQ Summer School: *Probes of Cosmology*	Montreal, CA

Relevant Graduate Coursework

McGill: Galaxies & Cosmology, Observational Methods in Modern Astrophysics, Computational Physics
Bishop's: Theoretical Topics, Exoplanet Astrophysics, Stellar Astrophysics, Cosmology

Online Mentions

February 2025 CASCA Graduate Student Highlight

Memberships & Affiliations

CASCA – Canadian Astronomical Society
CRAQ – Centre de Recherche en Astrophysique du Québec
SAPM – Société d'Astronomie du Planétarium de Montréal

Last updated: March 17, 2026