

CURRICULUM VITAE

Vincent MacKay, PhD
Citizenship: Canadian | Languages: French, English
vimackay@mit.edu | vincentmackay.github.io

Research interests

I am a cosmologist and radio astronomer specializing in 21 cm experiments and transient detection. I design arrays and antenna hardware, and develop analysis methods addressing challenges such as mutual coupling mitigation and foreground suppression. My research sits at the intersection of physics, engineering, and data science.

I am part of the HERA and CHORD collaborations; previously, CHIME and HIRAX.

Positions

Postdoctoral Scholar	2023–present
MIT Kavli Institute for Astrophysics and Space Research	Cambridge, MA, USA

Education

<i>PhD</i> , Physics	2018–2023
University of Toronto; Supervisor: Keith Vanderlinde	Toronto, ON, Canada
<i>BSc</i> , <i>First-Class Honours</i> , Mathematics and Physics	2015–2018
McGill University	Montréal, QC, Canada
<i>BMus</i> , Piano performance	2012–2015
Conservatoire de musique de Québec	Québec City, QC, Canada

Fellowships, scholarships, awards

Trottier Space Institute Fellowship (declined)	2022–2025
CAD \$65,000.00/year	
Ontario Graduate Scholarship	2020–2021
CAD \$15,000.00	
University of Alberta Undergraduate Summer Research Award	Summer 2017
CAD \$8,000.00	
NSERC Undergraduate Summer Research Award	Summer 2016
CAD \$4,500.00	
FRQNT Supplement to NSERC	Summer 2016
CAD \$2,000.00	

Publications

- [1] **MacKay, Vincent** et al. **Feb. 2026**. “Complete Sampling of the uv Plane with Realistic Radio Arrays: Introducing the RULES Algorithm, with Application to 21 cm Foreground Wedge Removal”. In: *The Astrophysical Journal* 999.1, p. 96.
- [2] Kim, Honggeun, [...], **MacKay, Vincent**, et al. **Nov. 2025**. “Exploring One-point Statistics in HERA Phase I Data: Effects of Foregrounds and Systematics on Measuring One-point Statistics”. In: 993.2, 189, p. 189.
- [3] Berger, Sabrina, [...], **MacKay, Vincent**, et al. **Nov. 2024**. “First Use of GPS Satellites for Beam Calibration of Radio Dish Telescopes”. In: Accepted for publication in PASA.
- [4] Lai, Mark **MacKay, Vincent** et al. **Jan. 2023**. “0.3-1.5-GHz LNA With Wideband Noise and Power Matching for Radio Astronomy”. In: *IEEE Microwave and Wireless Technology Letters* 33.8, pp. 1163–1166.
- [5] **MacKay, Vincent** et al. **Jan. 2023**. “Low-Cost, Low-Loss, Ultra-Wideband Compact Feed for Interferometric Radio Telescopes”. In: *Journal of Astronomical Instrumentation* 12.4, 2350008, p. 2350008.
- [6] Crichton, Devin, [...], **MacKay, Vincent**, et al. **Jan. 2022**. “Hydrogen Intensity and Real-Time Analysis Experiment: 256-element array status and overview”. In: *Journal of Astronomical Telescopes, Instruments, and Systems* 8, 011019, p. 011019.
- [7] Saliwanchik, Benjamin R. B., [...], **MacKay, Vincent**, et al. **Dec. 2020**. “Mechanical and optical design of the HIRAX radio telescope”. In: *Ground-based and Airborne Telescopes VIII*. Ed. by Heather K. Marshall, Jason Spy-

romilio, and Tomonori Usuda. Vol. 11445. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 114455O, 114455O.

- [8] Cytrynbaum, Eric N. **MacKay, Vincent** et al. **July 2019**. “Double-wave reentry in excitable media”. In: *Chaos: An Interdisciplinary Journal of Nonlinear Science* 29.7, p. 073103.

Talks

Conference talks

1. National Radio Science Meeting *Boulder, CO, USA, 2026*
“Complete Sampling of the *uv* Plane with Realistic Radio Arrays: Introducing the RULES Algorithm, with Application to 21 cm Foreground Wedge Removal”
2. Cosmology on Safari *Hluhluwe, South Africa, 2025*
“An algorithm to produce uv-complete arrays”
3. National Radio Science Meeting *Boulder, CO, USA, 2023*
“An Ultra-Wideband, Low-Loss, Low-Cost Feed Design for Large-N, Small-D Observatories, and Implementation on CHORD”
4. URSI Atlantic Radio Science Meeting *Gran Canaria, Spain, 2022*
“Hardware Design and Array Layout for CHORD: the Canadian Hydrogen Observatory and Radio-transient Detector”
5. National Radio Science Meeting *Boulder, CO, USA, 2022*
“Design Considerations for CHORD: the Canadian Hydrogen Observatory and Radio-transient Detector”
6. Science at Low Frequencies Conference *Fully online conference, 2020*
“The Canadian Hydrogen Observatory and Radio-transient Detector (CHORD): Feed and Dish Design and Trade-offs”
7. IEEE AP-S/URSI Conference *Montréal, QC, Canada, 2020*
“A Miniaturized Ultra-Wideband, Low-Loss, Low-Cost Feed for Astrophysics”
8. Society for Mathematical Biology Annual Meeting *Montréal, QC Canada, 2019*
“Double-wave reentry in excitable media”

Colloquium and seminar talks

9. Astronomy and Space Physics Seminar, Kansas University *Lawrence, KS, USA, 2021*
“Cosmology and Detection of Radio Transients with CHORD: Science Goals and Design Considerations”
10. Summer colloquium, Department of Physics, University of Toronto *Toronto, ON Canada, 2020*
“Development of CHORD: the Canadian Hydrogen Observatory and Radio-transient Detector”

Outreach talks

11. Astronomy on Tap NYC: Cosmic Happy Hour *New York, NY, USA, 2022*
“The Hubble Tension: A Crisis of Cosmic Proportions”
12. Cosmos From Your Couch *Toronto, ON, Canada, 2020*
“Peeking into the Invisible Universe with Radio Astronomy”

Teaching

Physics Directed Reading Program, University of Toronto

Directed reading program in observational cosmology *2022–2023*

Dunlap Instrumentation Summer School

Workshop: Radio signal detection and the properties of thermal radiation and noise *Summer 2021*

Teaching Assistant, University of Toronto

PHY293: Waves and Modern Physics *Fall 2020, Fall 2022*
PHY250: Electricity and Magnetism *Summer 2022*
PHY294: Quantum and Thermal Physics *Winter 2022*
PHY151: Foundations of Physics I *Fall 2018, Fall 2021*
PHY205: The Physics of Everyday Life *Summer 2021*
PHY491/1491: Current Interpretations of Quantum Mechanics *Winter 2021*
PHY207: The Physics of Music *Winter 2020, Winter 2021*
PHY100: The Magic of Physics *Fall 2019*
PHY132: Introduction to Physics II *Winter 2019*

Community involvement

Member of the organizing committee for the 2021 Dunlap Instrumentation Lectures

Helping organize a week-long virtual lecture series with invited speakers and visiting student researchers

Judge at young scientist competitions

2021 Canada-Wide Science Fair (CWSF)

2021 Canadian Undergraduate Physics Conference (CUPC)

President of the Physics Graduate Student Association 2019-2020

Organizing social activities for physics graduate students, representing them at the graduate student union

Other volunteering activities

Leading lab tours for University of Toronto's AstroTours

Representing the Dunlap Institute at the 2022 Black Excellence in STEM and Medicine (BE-STEMM) conference career fair

Discussing with grade school students on video calls as part of the *Skype a Scientist* program