Michael Radica | Curriculum Vitae

Ph.D. Candidate – Université de Montréal
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General Information

- Nationality: Canadian
- Languages: English (Native), French (Conversational, C1)
- Affiliations: Canadian Astronomical Society (CASCA), Centre de Recherche en Astrophysiqe du Québec (CRAQ), Trottier Institute for Research on Exoplanets (iREx)
- Research Interests:
  - Exoplanet atmosphere characterization at high and low resolution
  - Evolution of highly irradiated atmospheres
  - Exotic atmospheric chemistry
  - Development of astronomical data analysis tools

Education

- **Ph.D., Physics** 2024 (expected)
  Université de Montréal, Montréal, QC, Canada
  Advisor: Dr. David Lafrenière
  GPA: 4.3/4.3
- **M.Sc., Physics & Astronomy** 2019
  McMaster University, Hamilton, ON, Canada
  Advisor: Dr. Douglas Welch
  GPA: 11.7/12
  - Dissertation title: *A Search for Light Echoes from Core-Collapse Supernovae in NGC 6946*
- **B.Sc. Summa Cum Laude, Honours Physics Co-op** 2017
  McMaster University, Hamilton, ON, Canada
  Advisor: Dr. Laura Parker
  GPA: 11.3/12
  - Dissertation title: *On the Segregation of Dark Matter Substructure in the Bolshoi Simulation*

Awards & Honours

- CRAQ International Internship Scholarship **$7,500** 2022
- First Science Results from JWST conference travel support 2022
- Bourse J.A. DeSève (1yr; *declined*) **$8,000** 2021
- NSERC Canada Graduate Scholarship — Doctoral Program (3yr) **$105,000** 2021
- FRQNT Bourse de Doctorat en Recherche (3yr) **$70,000** 2021
- iREx Trottier Scholarship **$1,000** 2019, 2020, 2021
- Ontario Graduate Scholarship (1yr; *declined*) **$15,000** 2019
- McMaster University Symposium Day; 1^{st} Place Talk 2018
- NSERC Canada Graduate Scholarship — Master's Program (1yr) **$17,500** 2018
- Ontario Graduate Scholarship (1yr) **$15,000** 2017
- Ontario Graduate Fellowship (1yr; *declined*) **$12,500** 2017
- Canadian Undergraduate Physics Conference Research Presentations; 1^{st} Place 2015, 2016
- McMaster University Faculty of Science Dean's List 2013 – 2017
- McMaster University President's Award **$2,500** 2012

Refereed Publications

Summary: 4 first author, 250+ citations, hindex=8
Full library of publications available on the ADS.

First Author Publications

4. Awesome SOSS: Transmission Spectroscopy of WASP-96b with NIRISS/SOSS
Radica, M; Welbanks, L; Espinoza, N; Taylor, J; Coulombe, L-P; *et al.*
Monthly Notices of the Royal Astronomical Society, 524, 1 (2023).

3. Revisiting Radial Velocity Measurements of the K2-18 System with the Line-by-Line Framework
Radica, M; Artigau, E; Lafrenière, D; Cadieux, C; Cook, N; *et al.*
Monthly Notices of the Royal Astronomical Society, 517, 4 (2022).

2. APPLESOSS: A Producer of ProfiLEs for SOSS. Application to the NIRISS SOSS Mode
Radica, M; Albert, L; Taylor, J; Lafrenière, D; Coulombe, L-P; *et al.*
Publications of the Astronomical Society of the Pacific, 134, 104502 (2022).

1. A Search for Supernova Light Echoes in NGC 6946 with SITELLE
Radica, M; Welch, D; Rousseau-Nepton, L
Monthly Notices of the Royal Astronomical Society, 497, 3 (2020).

Second & Third Author Publications

3. Disentangling Planetary and Stellar Features in the Era of JWST: Near-Infrared Transmission Spectroscopy of HAT-P-18 b
Fournier-Tondreau, M; MacDonald, R; **Radica, M**; Lafrenière, D; Welbanks, L; *et al.*
Monthly Notices of the Royal Astronomical Society, submitted.

2. Awesome SOSS: Atmospheric Characterisation of the Early Release Observations of WASP-96b
Taylor, J; **Radica, M**; Welbanks, L; MacDonald, R; Blecic, J; *et al.*
Monthly Notices of the Royal Astronomical Society, 524, 1 (2023).

1. Early Release Science of the exoplanet WASP-39b with JWST NIRISS
Feinstein, A; **Radica, M**; Welbanks, L; Murray, C; Ohno, K; *et al.*
Nature, 614, 670–675 (2023).

Co-Author Publications

13. Characterizing the Near-infrared Spectra of Flares from TRAPPIST-1 During JWST Transit Spectroscopy Observations
Howard, W; Kowalski, A; Flagg, L; MacGregor, M; Lim, O; *et al.* (including **Radica, M**)
ApJL, submitted.

12. Atmospheric Reconnaissance of TRAPPIST-1 b with JWST/NIRISS: Evidence for Strong Stellar Contamination in the Transmission Spectra
Lim, O; Benneke, B; Doyon, R; MacDonald, R; Piaulet, C; *et al.* (including **Radica, M**)
ApJL, in press.

11. CO or no CO? Narrowing the CO abundance constraint and recovering the H2O detection in the atmosphere of WASP-127 b using SPIRou
Boucher, A; Lafrenière, D; Pelletier, S; Darveau-Bernier, A; **Radica, M**; *et al.*
Monthly Notices of the Royal Astronomical Society, 522, 4, (2023).

10. A broadband thermal emission spectrum of the ultra-hot Jupiter WASP-18b
Coulombe, L-P; Benneke, B; Challener, R; Piette, A; Wiser, L; *et al.* (including **Radica, M**)
Nature, 620, 292–298 (2023)

9. Homogeneous search for helium in the atmosphere of 11 gas giant exoplanets with SPIRou
Allart, R; Lemée-Joliecoeur, P-B; Jaziri, Y; Lafrenière, D; Artigau, E; *et al.* (including **Radica, M**)
Astronomy & Astrophysics, accepted.

8. The Near Infrared Imager and Slitless Spectrograph for the James Webb Space Telescope - I Instrument Overview and in-Flight Performance
Doyon, R; Willott, C; Hutchings, J; Sivaramakrishnan, A; Albert, L; *et al.* (including **Radica, M**)
Publications of the Astronomical Society of the Pacific, 135, 098001 (2023).

7. The Near Infrared Imager and Slitless Spectrograph for the James Webb Space Telescope - III. Single Object Slitless Spectroscopy
Albert, L; Lafrenière, D; Doyon, R; Artigau, E; Volk, K; *et al.* (including **Radica, M**)
Publications of the Astronomical Society of the Pacific, 135, 075001 (2023).

6. The Near Infrared Imager and Slitless Spectrograph for JWST – V. Kernel Phase Imaging and Data Analysis
Kammerer, J; Cooper, A; Vandal, T; Deepashri, T; Martinache, F; *et al.* (including **Radica, M**)
Publications of the Astronomical Society of the Pacific, 134, 014502 (2023).

5. Early Release Science of the exoplanet WASP-39b with JWST NIRSpec PRISM
Rustamkulov, Z; Sing, D; Mukherjee, S; May, E; Kirk, J; *et al.* (including **Radica, M.**)
Nature, 614, 659–663 (2023).

4. Identification of carbon dioxide in an exoplanet atmosphere
The JWST Transiting Exoplanet Community Early Release Science Team, *et al.* (including **Radica, M**)
Nature, 614, 649–652 (2023).

3. ATOCA: an algorithm to treat order contamination. Application to the NIRISS SOSS mode
Darveau-Bernier, A; Albert, L; Talens, G; Lafrenière, D; **Radica, M**, *et al.*
Publications of the Astronomical Society of the Pacific, 134, 094502 (2022).

2. Characterizing exoplanetary atmospheres at high resolution with SPIRou: Detection of water on HD 189733 b
Boucher, A; Darveau-Bernier, A; Pelletier, S; Lafrenière, D; Artigau, E; *et al.* (including **Radica, M**)
The Astronomical Journal, 162, 233 (2021).

1. CHANG-ES XXI. Transport processes and the X-shaped magnetic field of NGC 4217: off-center superbubble structure
Stein, Y; Dettmar, R-J; Beck, R; Irwin, J; Wiegert, T; *et al.* (including **Radica, M**)
Astronomy & Astrophysics, 639, A111 (2020).

White Papers & Conference Proceedings

2. Quantifying Biases in Extracted NIRISS/SOSS Spectra
Radica, M; Taylor, J; Lafrenière, D; Albert, L; Darveau-Bernier, A
Bulletin of the American Astronomical Society, Vol. 54, No. 5 (2022).

1. Exoplanet instrumentation in the 2020s: Canada's pathway towards searching for life on potentially Earth-like exoplanets
Benneke, B; Cowan, N; Rowe, J; Marois, C; *et al.* (including **Radica, M**)
Canadian Long Range Plan 2020 (2020).

Succesful Observing Proposals

Summary: 8 successful PI programs, 5 Co-I programs.

Space-Based Observatories

2. Putting it all Together: Dynamics and Chemistry Probed Through Transmission Spectroscopy of a Cloud-Free Exoplanet
   Radica, M; Taylor, J; Zamyatina, M; Tsai, S-M; Ahrer, E-M; *et al.*
   7 hours, JWST NIRSpec/G395H, Cycle 2, PID: 4082

1. Unravelling the Mysteries of LTT 9779b — Studying Clouds that Shouldn't Exist on a Planet that Shouldn't Exist
   Radica, M; Taylor, J; Lafrenière, D; Wakeford, H; Parmentier, V; *et al.*
   12 orbits, HST/UVIS, Cycle 29, PID: 2663

Ground-Based Observatories

6. Born Survivor: A SPIRou Study of a Hot-Neptune Orbiting a Red-Giant Star
   Radica, M; Allart, R
   16 hours, CFHT/SPIRou, Semester 2023B, PID: 23BC022

5. RV Characterization of the Keystone Triple Planet System TOI-1749
   Radica, M; Lafrenière, D; Mann, C; Benneke, B; Cadieux, C; *et al.*
   40 hours, Gemini/MAROON-X, Semester 2022A, PID: 2022AC021

4. An IGRINS Study of the First Hot-Neptune
   Radica, M; Lafrenière, D; Pelletier, S; Allart, R; Artigau, E; *et al.*.
   5.2 hours, Gemini/IGRINS, Semester 2022A, PID: 2022AC022

3. Photometric Followup of an M-Dwarf Trio of Planets Spanning the Radius Valley
   Radica, M; Mann, C; Lafrenière, D
   36 hours, OMM/PESTO, Semester 2021C, PID: OMM-21C-07

2. Do Exo-Neptunes Have Low-Metallicity Atmospheres? A Case Study of HAT-P-11b
   Radica, M; Pelletier, S; Lafrenière, D; Allart, R; Boucher, A; *et al.*
   8 hours, CFHT/SPIRou, Semester 2021B, PID: 21BC009

1. A SITELLE Survey for Highly Broadened H-alpha P-Cygni Profiles in NGC 6946 from Core-Collapse Supernova Light Echoes
   Radica, M; Welch, D; Rousseau-Nepton, L
   12 hours, CFHT/SITELLE, Semester 2018B, PID: 18BC017

Talks & Posters

Summary: 8 Talks, 3 Invited, 1 for general public; 6 Seminars; 7 posters.
Timeline: 2023 (7), 2022 (3), 2021 (2), 2020 (2), 2019 (1)

Invited Talks

2. *Awesome SOSS: Transmission Spectroscopy of WASP-96b with NIRISS/SOSS*
   OMM-NRC Astronomy Day, Montréal, Canada — Apr 2023

1. *Awesome SOSS: Transmission Spectroscopy of WASP-96b with NIRISS/SOSS*
   JWST Exoplanet Atmospheres Meeting, Oxford, UK — Mar 2023

Invited Colloquia & Seminars

6. AOPP Seminar, **University of Oxford** — Apr 2023
5. Astronomy Seminar, **University of Exeter** — Apr 2023
4. Astronomy Seminar, **University of Bristol** — Apr 2023
3. Astronomy Colloquium, **Canada-France-Hawaii Telescope** — Dec 2017
2. Summer Astrophysics Colloquium, **University of Manitoba** — Aug 2016

1. Undergraduate Physics Colloquium, **McMaster University** Feb 2013

Contributed Conference Talks & Posters

* Denotes a poster presentation.

- **Awesome SOSS: Transmission Spectroscopy of WASP-96b with NIRISS/SOSS*
  ExoClimes VI, Exeter, UK Jun 2023
- *Awesome SOSS: Transmission Spectroscopy of WASP-96b with NIRISS/SOSS*
  CASCA Annual General Meeting, Penticton, BC, Canada Jun 2023
- *A First Look Transmission Spectrum of WASP-96b with NIRISS/SOSS*
  First Science Results from JWST, Baltimore, MD, USA Dec 2022
- **A Validation of the Line-by-Line Framework for Precision Velocimetry with the K2-18 System*
  CASCA Annual General Meeting, Waterloo, ON, Canada (*virtual*) May 2022
- **How Assumptions in the Underlying Spatial Profile Impact Extracted NIRISS/SOSS Spectra*
  Exoplanets IV, Las Vegas, NV, USA May 2022
- **Towards a Robust Extraction Algorithm for NIRISS SOSS Spectra*
  CASCA Annual General Meeting, Penticton, BC, Canada (*virtual*) May 2021
- **Towards a Robust Extraction Algorithm for NIRISS SOSS Spectra*
  Exoplanets III, Heidelberg, Germany (*virtual*) Jul 2020
- **NEAT Exploration of Exoplanet Atmospheres*
  CASCA Annual General Meeting, York, ON, Canada (*virtual*) May 2020
- **A Search for Supernova Light Echoes in NGC 6946 with SITELLE*
  CASCA Annual General Meeting, Montréal, QC, Canada Jun 2019
- *The Search for Supernova Light Echoes in NGC 6946*
  McMaster University Symposium Day, Hamilton, ON, Canada Oct 2018
- *The Evolution of Dark Matter Substructure in Simulated Galaxy Clusters*
  Canadian Undergraduate Physics Conference, Halifax, NS, Canada Nov 2016
- *Studying Radio Haloes of Galaxies with CHANG-ES*
  Canadian Undergraduate Physics Conference, Peterborough, ON, Canada Nov 2014

Invited Public Talks

- *The Search for Earth 2.0*
  Villa Maria High School, Montréal, QC, Canada Oct 2021

Committee Membership & Community Service

- Reviewer for MNRAS 2023 – present
- CUPC 2021 Judge — Astrophysics Nov 2021
- CASCA 2021 AGM Online Organizing Committee 2020 – 2021
- UdeM Equity and Diversity Committee 2020 – 2022
- CASCA Graduate Student Committee 2020 – present

Media & Press

- *An exoplanet atmosphere as never seen before*, UdeMnouvelles (Nov 2022) [Link]
- *Exploration de la diversité atmospherique d'exoplanètes en transit*, Moteur de Recherche (Nov 2022) [Link]

Teaching & Mentorship

- **Co-op Program Alumni Mentor** 2020 – 2023
  McMaster University
  Mentor to one undergraduate student per year in the Physics & Astronomy co-op program.
- **Teaching Assistant** 2020 – 2022

Université de Montréal
Marking and presentation of tutorials (*en français*) for courses including:
- Astrobiologie (Winter 2020 – 2022; 7 hr/wk)
- Introduction à la Physique Numérique (Fall 2020; 10 hr/wk)

- **Graduate Student Mentor** 2018 – 2019
McMaster University
Mentor to incoming M.Sc student.

- **Teaching Assistant** 2017 – 2019
McMaster University
Marking and presentation of tutorials for courses including:
  - Introduction to Physics for Engineers (Winter 2017; 6 hr/wk)
  - Planetary Astronomy (Winter 2018, 2019; 6 hr/wk)
  - Introduction to Astronomy (Fall 2018; 6 hr/wk)
  - The Big Questions in Astronomy (Fall 2018; 6 hr/wk)
  - Stellar Structure (Winter 2019; 6 hr/wk)

- **Senior Undergraduate Mentor** 2016
University of Manitoba
Research mentor to two first year undergraduate students.

- **Certified Tutor** 2014 – Present
  - Private Tutor: Undergraduate/Secondary School Physics (2021 – 2023; 2 hr/wk)
  - Private Tutor: Undergraduate Physics (Fall/Winter 2019; 2 hr/wk)
  - McMaster Physics Help Center (Winter 2018; 3 hr/wk)
  - McMaster Physics Help Initiative (2014 – 2016; 2 hr/wk)

Other Research Experience

- Visiting Student. Supervisor: Dr. Hannah Wakeford 2023
University of Bristol, Britstol, UK
-Performed analysis of HST/UVIS eclipse observations of LTT 9779 b.
- Science Intern. Supervisor: Dr. Laurie Rousseau-Nepton 2017
Canada-France-Hawaii Telescope, Waimea, HI, USA
-Studied dust extinction in the Milky Way using the SITELLE instrument.
- Research Assistant. Supervisor: Dr. Chris O'Dea 2016
University of Manitoba, Winnipeg, MB, Canada
-Developed tools to quantify the X-ray morphology of AGNs.
- Research Assistant. Supervisor: Dr. Judith Irwin 2015
Queen's University, Kingston, ON, Canada
-Analyzed EVLA radio observations of galactic haloes as part of the CHANG-ES survey.

Other Science Outreach

- 24 Hours of Science — Astronomer in your Classroom (May 2021)
- Montréal Student Space Association iREx Liaison (2020 – 2022)
- William J. McCallion Planetarium Presenter (2017 – 2019)
- McMaster Sidewalk Astronomy Guide (2017 – 2019)
- McMaster University Fall Preview Lab Tour Guide (Oct 2013)