Dr. Mawson W. Sammons

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https://github.com/MWSammons

Research Interests

Transient Radio Astronomy: Fast Radio Bursts, Pulsars, Interferometry
Propagation Effects: Gravitational lensing, multipath scattering, scintillation
Cosmology: Dark matter, Feedback processes, cosmological expansion

Employment

Trottier Fellow, Trottier Space Institute, McGill University, Montreal, Quebec — Since 2023
Supervisors: Prof. Victoria Kaspi, Prof. Matt Dobbs, Prof. Jonathan Sievers

Education

Ph.D. Physics, Curtin University, Perth, Western Australia — 2023
Thesis Title: "*Exploring the Lensing of Cosmological Transients on Nanosecond Timescales*"
Thesis Supervisors: Prof. Cathryn Trott, Dr. Clancy James, Dr. Mark Walker, Prof. Jean-Pierre Macquart.

B.Sc. First Class Honours in Physics Curtin University, Perth, Western Australia
2019
Thesis Title: *"Fast Radio Burst Temporal Microstructure as a Tool for Hunting Compact Objects"*
Thesis Supervisors: Prof. Jean-Pierre Macquart, Dr. Clancy James

Additional Experience

Student Internship, Pawsey Supercomputing Centre / International Centre for Radio Astronomy Research — 2019
"Optimising Semi-analytic halo evolution models on High Performance Compute Clusters"
Supervised by Dr. Claudia Lagos and Rodrigo Tobar (software engineer)

- Demonstrated the viability of particle swarm optimisation techniques for searching highly dimensional parameter spaces in the context of semi-analytic halo evolution models.
- Contributed to parallelised implementation of semi-analytic halo evolution model *SHARK* on high performance computing clusters.

Undergraduate Researcher, Curtin Institute of Radio Astronomy — 2018
"Investigating the Sensitivity of Fast Radio Burst Search Algorithms"
Supervised by Dr. Clancy James

- Using developed simulation evaluated the response of fast radio burst search algorithms to changes in burst width and dispersion. Results included included in Nature publication.
- Developed a weighted search algorithm to improve detection sensitivity

Student Internship, Curtin University — 2017
"Simulating Fast Radio Burst Search Algorithms"
Supervised by Dr. Clancy James

- Developed a simulation to test the response of Fast Radio Burst detection algorithms

Awards

Trottier Fellowship – International, $60,000, Research, — Since 2023
Research Training Program – National, $90,000, Research, — 2020-2023
First Class Honours – Institutional, GPA > 85%, Academic — 2019
Curtin Honours Scholarship – Institutional, $5000, Research — 2019
Curtin Excellence Scholarship – Institutional, $15000, Academic — 2016-2018
Rotary Tertiary Scholarship – Institutional, $3750, Academic — 2016-2018
Student Internship Stipend, Pawsey Supercomputing Centre/International Centre for Radio Astronomy Research – National, $6000, Research — 2019

Student Internship Stipend, Curtin Institute of Radio Astronomy – National, $3000, Research 2017

FIRST AUTHOR PUBLICATIONS

[1] **Sammons, Mawson W.**, Dobbs, Matt, Kaspi, Vicky, Sievers Jonathan "Forecasting the FRB Population Observed Through Strong Lensing Galaxy Clusters." **Submitted to CHIME/CHORD Collaborations.**

[2] **Sammons, Mawson W.**, Adam T Deller, Marcin Glowacki, Kelly Gourdji, C W James, J Xavier Prochaska, Hao Qiu, Danica R Scott, R M Shannon, and C M Trott. "Two-Screen Scattering in CRAFT FRBs." Monthly Notices of the Royal Astronomical Society 525, no. 4 (November 11, 2023): 5653–68. https://doi.org/10.1093/mnras/stad2631.

[3] **Sammons, Mawson W.**, C W James, C M Trott, and M Walker. "The Effect of Gravitational Lensing on Fast Transient Event Rates." Monthly Notices of the Royal Astronomical Society, October 22, 2022, stac3013. https://doi.org/10.1093/mnras/stac3013.

[4] **Sammons, Mawson W.**, Jean-Pierre Macquart, Ron D. Ekers, Ryan M. Shannon, Hyerin Cho, J. Xavier Prochaska, Adam T. Deller, and Cherie K. Day. "First Constraints on Compact Dark Matter from Fast Radio Burst Microstructure." The Astrophysical Journal 900, no. 2 (September 8, 2020): 122. https://doi.org/10.3847/1538-4357/aba7bb.

CO-AUTHORED PUBLICATIONS

[5] Anderson, G E, T D Russell, H M Fausey, A J van der Horst, P J Hancock, A Bahramian, M E Bell, et al. (19 co-authors including **M. W. Sammons**) "Rapid Radio Brightening of GRB 210702A." Monthly Notices of the Royal Astronomical Society 523, no. 4 (August 21, 2023): 4992–5005. https://doi.org/10.1093/mnras/stad1635.

[6] Arcus, W. R., J. -P. Macquart, **M. W. Sammons**, C. W. James, and R. D. Ekers. "The Fast Radio Burst Dispersion Measure Distribution." Monthly Notices of the Royal Astronomical Society 501 (March 1, 2021): 5319–29. https://doi.org/10.1093/mnras/staa3948.

[7] Cho, Hyerin, Jean-Pierre Macquart, Ryan M. Shannon, Adam T. Deller, Ian S. Morrison, Ron D. Ekers, Keith W. Bannister, et al. (17 co-authors including **M. W. Sammons**) "Spectropolarimetric Analysis of FRB 181112 at Microsecond Resolution: Implications for Fast Radio Burst Emission Mechanism." The Astrophysical Journal 891, no. 2 (March 12, 2020): L38. https://doi.org/10.3847/2041-8213/ab7824.

[8] Cook, Amanda M., Paul Scholz, Aaron B. Pearlman, Thomas C. Abbott, Marilyn Cruces, B. M. Gaensler, Fengqiu, et al. (25 co-authors including **M. W. Sammons**) "Contemporaneous X-Ray Observations of 30 Bright Radio Bursts from the Prolific Fast Radio Burst Source FRB 20220912A," August 21, 2024. https://doi.org/10.3847/1538-4357/ad6a13.

[9] Kader, Zarif, Matt Dobbs, Calvin Leung, Kiyoshi W. Masui, and **Mawson W. Sammons**. "Simulating FRB Morphologies and Coherent Phase Correlation Signatures from Multi-Plane Astrophysical Lensing." arXiv, July 4, 2024. https://doi.org/10.48550/arXiv.2407.04097.

[10] Marnoch, Lachlan, Stuart D. Ryder, Clancy W. James, Alexa C. Gordon, **Mawson W. Sammons**, J. Xavier Prochaska, Nicolas Tejos, et al. "The Unseen Host Galaxy and High Dispersion Measure of a Precisely Localized Fast Radio Burst Suggests a High-Redshift Origin." Monthly Notices of the Royal Astronomical Society 525, no. 1 (October 2023): 994–1007. https://doi.org/10.1093/mnras/stad2353.

[11] Nimmo, Kenzie, Ziggy Pleunis, Paz Beniamini, Pawan Kumar, Adam E. Lanman, D. Z. Li, Robert Main, et al. (29 co-authors including **M. W. Sammons**) "Magnetospheric Origin of a Fast Radio Burst Constrained Using Scintillation." arXiv, June 16, 2024. https://doi.org/10.48550/arXiv.2406.11053.

[12] Ryder, S. D., K. W. Bannister, S. Bhandari, A. T. Deller, R. D. Ekers, M. Glowacki, A. C. Gordon,

et al. (21 co-authors including **M. W. Sammons**) "A Luminous Fast Radio Burst That Probes the Universe at Redshift 1." Science 382, no. 6668 (October 20, 2023): 294–99. https://doi.org/10.1126/science.adf2678.

[13] Sand, Ketan R., Alice P. Curtin, Daniele Michilli, Victoria M. Kaspi, Emmanuel Fonseca, Kenzie Nimmo, Ziggy Pleunis, et al. (24 co-authors including **M. W. Sammons**) "Morphology of 137 Fast Radio Bursts down to Microseconds Timescales from The First CHIME/FRB Baseband Catalog." arXiv E-Prints, August 1, 2024. https://doi.org/10.48550/arXiv.2408.13215.

[14] Shannon, R. M., J.-P. Macquart, K. W. Bannister, R. D. Ekers, C. W. James, S. Osłowski, H. Qiu, et al. (31 co-authors including **M. W. Sammons**) "The Dispersion–Brightness Relation for Fast Radio Bursts from a Wide-Field Survey." Nature 562, no. 7727 (October 1, 2018): 386–90. https://doi.org/10.1038/s41586-018-0588-y.

[15] Stevens, Adam R. H., Manodeep Sinha, Alexander Rohl, **Mawson W. Sammons**, Boryana Hadzhiyska, César Hernández-Aguayo, and Lars Hernquist. "Dark Sage: Next-Generation Semi-Analytic Galaxy Evolution with Multidimensional Structure and Minimal Free Parameters." Publications of the Astronomical Society of Australia 41 (January 2024): e053. https://doi.org/10.1017/pasa.2024.14.

PRESENTATIONS [16] "Two-Screen Scattering in CRAFT FRBs", FRB 2023 International Conference, Bhopal, India, Nov 2023, Contributed talk (12+3 minutes) (recording: https://drive.google.com/file/d/1JvVA48EDM-ncc3Twi90qmfciSI6qQZJ2/view, beginning timestamp 30:20)

[17] "Two-Screen Scattering in CRAFT FRBs", Scintillometry 2023 International Conference, Taipei, Taiwan, Nov 2023, Contributed talk (15+5 minutes) (slides: https://drive.google.com/file/d/1qAReylbCBh_x6zcjWz86-hMhs_Duvyj3/view)

[18] "Exploring the Lensing of Cosmological Transients on Nano-second timescales", Curtin University, June 2023, 3rd Ph.D. milestone seminar (30+10 minutes).

[19] "Fast Radio Burst Gravitational Lensing and Scintillation", Max-Planck Institute for Radio Astronomy, Bonn, Germany, Invited Seminar, November 2022, (30+10 minutes).

[20] "Fast Radio Burst Gravitational Lensing and Scintillation", University of Amsterdam, Amsterdam, Netherlands, Invited Seminar, November 2022, (30+10 minutes).

[21] "Fast Radio Burst Gravitational Lensing and Scintillation", Heidelberg University, Heidelberg, Germany, Invited Seminar, November 2022, (45+15 minutes).

[22] "Effect of Gravitational Lensing on Fast Transient Event Rates", International Astronomical Union General Assemble, Busan, South Korea, August 2022, Contributed talk (8+2 minutes) (recording: https://www.youtube.com/watch?v=JFJl1jIrkOw, beginning timestamp 1:21:30)

[23] "Effect of Gravitational Lensing on Fast Transient Event Rates", Astronomical Society of Australia Annual Science Meeting 2021, National Conference, Online, July 2022, Contributed talk (8+2 minutes)

[24] "Exploring the Lensing of Cosmological Transients on Nano-second timescales", Curtin University, September 2021, 2nd Ph.D. milestone seminar (45+15 minutes).

[25] "Effect of Gravitational Lensing on Fast Transient Event Rates", Astronomical Society of Australia Annual Science Meeting 2021, National Conference, Online, July 2021, Contributed talk (8+2 minutes)

[26] "Effect of Gravitational Lensing on Fast Transient Event Rates", FRB 2021, International Conference, Online, July 2021, Contributed talk (8+2 minutes)

[27] "Exploring the Lensing of Cosmological Transients on Nano-second timescales", Curtin University, September 2020, 1st Ph.D. milestone seminar (30+10 minutes).

TEACHING **Lecturer**, McGill University 2025

- Co-taught graduate course in high energy astrophysics
- Set and graded coursework

Laboratory Demonstrator, Curtin University 2020-2022
- Updated and led weekly laboratory sessions
- Instructed and graded associated laboratory report writing
- Held office hours to assist with experimental and writing technique.

Grader, Graduate level general relativity, Curtin University 2020
- Supervised by Dr Sam Sweeny

SUPERVISING

Co-supervisor: Evan Davies-Velie, Master Student McGill University Since 2024
- Thesis: "*Improving the CHIME FRB Detection System with Coherent Dedispersion*"

SERVICE

Summer Undergraduate Selection Committee, Trottier Space Institute Since 2024
- Reviewed and selected applications for undergraduate summer research projects

Seminar Committee Member, Trottier Space Institute Since 2024
- Organised for an international range of experts to visit McGill University and give a seminar on their work.

Journal Review, Astrophysical Journal, Physical Review D 2024

Plaskett and Vibert-Douglas Nominations Selection Committee, McGill University 2024
- Read and reviewed 6 candidate thesis and ranked for nomination to the national prizes.

Public Outreach Volunteer Trottier Space Institute since 2023
- Guided public viewing of the 2024 total solar eclipse
- Supported outreach events such as public lectures

Collaboration Member, CHIME/FRB Since 2023
- Data Archiving Expert: maintenance and continued development of the bespoke `Datatrail` (`https://github.com/CHIMEFRB/datatrail-cli`) package which tracks and transfers all CHIME data between the core array, outrigger stations, local computing resources and long term data storage.
- Observing with the CHIME/FRB backend on the CHIME telescope (6 weeks per year)

Collaboration Member, CHORD Since 2023
- Beamforming pipeline developer: translation and continued development of beamforming code libraries from CHIME/FRB for use in CHORD (`https://github.com/chord-observatory`)
- Forecasting and planning for novel FRB detection and RFI mitigation stategies

Collaboration Member, CRAFT 2017-2023
- Developed fast radio burst morphology fitting routines as part of high time resolution analysis pipeline which operated on raw voltages.
- Performed morphological fitting for a substantial fraction of observed bursts

Development Committee, Curtin Institute of Radio Astronomy 2020-2022
- Assisted in organizing institutional celebrations for a variety of cultural holidays
- Solicited anonymous feedback on institutional practices and addressed reports of workplace misconduct
- Represented the student body on the advisory committee to department executives.
- Acted as liaison between between the diversity, equity and inclusion branches at each node of the International Centre for Radio Astronomy Research.
- Completed level 1 ALLY training course by Curtin University on 2SLGBTQIA+ awareness and inclusion.

Public Observatory Volunteer Perth Observatory 2016-2020
- Led weekly night sky tours at Perth Observatory, engaging the public about astronomy while guiding viewing of celestial objects such as planets star clusters.
- Represented the observatory and led public viewing at Astro-Fest, the largest astronomy festival in Western Australia

COMPETENCES **Languages** Python, R, LaTeX, Bash, Git, SQL, SLURM, YAML