

EDUCATION

- Ph.D. in Astrophysics** (Advisors: Dr. R. Smith, Prof. E. Thrane) Monash University
Thesis: “Astrophysical Inference in the Data Driven Era” 2019–2022
- B.A. in Computer Science and Physics** (GPA: 4.0/4.0, Valedictorian) The College of Wooster
Thesis: “Accelerating Granular Flow on GPUs with OpenCL & CUDA” 2014–2018

RELEVANT RESEARCH AND PUBLICATIONS

- Bayesian Search for IMBHs in LIGO data** Published in MNRAS
Implemented and ran a Bayesian search for IMBH in O2 data. arXiv:2107.12109
- Ran ~ 0.2 M Bayesian PE analyses, totaling 1.2M core-hours.
 - In addition to finding previously detected GW events, we discovered a few new GW candidates.
 - git.ligo.org/avi.vajpeyi/bcr_pipeline
- Measuring properties of AGN disks with gravitational waves** Published in ApJ
Constructed a stellar mass BH population model for BH merging in AGN disks. arXiv:2111.03992
- Simulated two AGN black hole populations.
 - Demonstrated O(200) events required before AGN parameters can be measured.
 - github.com/avivajpeyi/agn_phenomenological_model
- Bayesian Parameter Estimation Deep-followup for GW Events** Under review, ApJ
Devising and utilising a “deep-followup” Bayesian analysis method on GW candidates. arXiv:2203.13406
- Demonstrate the mathematical path to constrain a few dependent priors.
 - Analysing GW events with ambiguous PE results.
 - github.com/avivajpeyi/deep_gw_pe_followup
- TESS-Atlas** In prep
Obtaining Bayesian PE fits and cataloging all TESS Objects of interest with a transit model. dfm/tess-atlas
- First Bayesian PE catalog for all TESS objects of interest.
 - Fitting for systems with data for multiple-transits, single-transits, and multiple-planets.
 - github.com/dfm/tess-atlas
- Postdoctoral Research Fellow** University of Auckland, 2023–present
Bayesian noise modeling and evidence estimation for LISA and LVK. Google Scholar
- Bayesian power spectral density estimation for LISA noise based on P-splines with a parametric boost
 - MorphZ: Enhancing evidence estimation through the Morph approximation

A full list of short-author paper that I have contributed to can be found [here](#).

INDUSTRY EXPERIENCE

Software Consultant

Consulted on simulation-based inference and scientific-computing applications.

Quair

2022 - 2023

Software Engineer

Built NLP speech models and generated word content for educational Alexa skills.

Bamboo Learning Inc

July 2018 - March 2019

Machine Learning Consultant

Deployed CNN image classifiers and delivered ML training.

MOAD

July - Aug 2018

Software Engineering Practicum

Engineered an automated grading system for programming courses.

Gitkeeper

Aug 2016 - Feb 2017

SHORT AUTHOR PUBLICATION LIST

- [1] N. Aimen, P. Maturana-Russel, **A. Vajpeyi**, N. Christensen, and R. Meyer, “Bayesian power spectral density estimation for LISA noise based on penalized splines with a parametric boost”, *Phys. Rev. D*, Jan. 2026. arXiv: 2510.00533 [gr-qc].
- [2] A. Boumerdassi, M. C. Edwards, **A. Vajpeyi**, and O. Burke, “First-time assessment of glitch-induced bias and uncertainty in inference of extreme mass ratio inspirals”, *Phys. Rev. D*, 2026. arXiv: 2512.16322 [gr-qc].
- [3] **A. Vajpeyi**, G. Mentasti, Q. Baghi, O. Burke, and L. Speri, “An explicit and differentiable Wilson-Daubechies-Meyer transform for gravitational-wave data analysis”, *arXiv e-prints*, Jun. 2026. arXiv: 2606.20269 [gr-qc].
- [4] **A. Vajpeyi**, R. Meyer, P. Maturana-Russell, and J. Liu, “Multivariate Bayesian P-spline estimation of spectral density matrices, with application to LISA TDI noise”, *arXiv e-prints*, Jul. 2026. arXiv: 2607.04833 [stat.ME].
- [5] E. M. Zahraoui, P. Maturana-Russel, **A. Vajpeyi**, W. van Straten, R. Meyer, and S. Gulyaev, “Enhancing evidence estimation through informed probability density approximation”, *Phys. Rev. D*, Apr. 2026, Also known as “MorphZ”. arXiv: 2512.10283 [stat.ME].
- [6] T. Islam, **A. Vajpeyi**, F. H. Shaik, C.-J. Haster, V. Varma, S. E. Field, J. Lange, R. O’Shaughnessy, and R. Smith, “Analysis of GWTC-3 with fully precessing numerical relativity surrogate models”, *Phys. Rev. D*, vol. 112, no. 4, Aug. 2025.
- [7] LIGO Scientific Collaboration, Virgo Collaboration, and KAGRA Collaboration, “Search for Continuous Gravitational Waves from Known Pulsars in the First Part of the Fourth LIGO-Virgo-KAGRA Observing Run”, *Astrophys. J.*, vol. 983, no. 2, p. 99, 2025, Art. no. 99.
- [8] LIGO Scientific Collaboration, Virgo Collaboration, and KAGRA Collaboration, “Search for Gravitational Waves Emitted from SN 2023ixf”, *Astrophys. J.*, vol. 985, no. 2, p. 183, 2025, Art. no. 183.
- [9] J. Liu, **A. Vajpeyi**, R. Meyer, K. Janssens, J. E. Lee, P. Maturana-Russel, N. Christensen, and Y. Liu, “Variational inference for correlated gravitational wave detector network noise”, *Phys. Rev. D*, vol. 111, no. 6, p. 062003, Mar. 2025, Art. no. 062003.
- [10] LIGO Scientific Collaboration and Virgo Collaboration, “GWTC-2.1: Deep Extended Catalog of Compact Binary Coalescences Observed by LIGO and Virgo during the First Half of the Third Observing Run”, *Phys. Rev. D*, vol. 109, no. 2, p. 022001, 2024, Art. no. 022001.
- [11] LIGO Scientific Collaboration, Virgo Collaboration, and KAGRA Collaboration, “Observation of Gravitational Waves from the Coalescence of a 2.5-4.5 M_{\odot} Compact Object and a Neutron Star”, *Astrophys. J. Lett.*, vol. 970, no. 2, p. L34, 2024, Art. no. L34.
- [12] LIGO Scientific Collaboration, Virgo Collaboration, and KAGRA Collaboration, “Constraints on the Cosmic Expansion History from GWTC-3”, *Astrophys. J.*, vol. 949, no. 2, p. 76, 2023, Art. no. 76.
- [13] LIGO Scientific Collaboration, Virgo Collaboration, and KAGRA Collaboration, “GWTC-3: Compact Binary Coalescences Observed by LIGO and Virgo during the Second Part of the Third Observing Run”, *Phys. Rev. X*, vol. 13, p. 041039, 2023, Art. no. 041039.
- [14] **A. Vajpeyi**, R. Smith, and E. Thrane, “Deep Follow-up for Gravitational-wave Inference: A Case Study with GW151226”, *Astrophys. J.*, vol. 947, no. 1, p. 10, Apr. 2023, Art. no. 10. arXiv: 2203.13406 [gr-qc].
- [15] D. Williams, J. Veitch, M. L. Chiofalo, P. Schmidt, R. P. Udall, **A. Vajpeyi**, and C. Hoy, “Asimov: A framework for coordinating parameter estimation workflows”, *Journal of Open Source Software*, vol. 8, no. 84, p. 4170, Apr. 2023.

- [16] S. Y. Lehman, L. E. Christman, D. T. Jacobs, N. S. D. E. F. Johnson, P. Palchoudhuri, C. E. Tieman, **A. Vajpeyi**, E. R. Wainwright, J. E. Walker, I. S. Wilson, M. LeBlanc, L. W. McFaul, J. T. Uhl, and K. A. Dahmen, “Universal aspects of cohesion”, *Granular Matter*, vol. 24, no. 1, p. 35, 2022, Art. no. 35.
- [17] LIGO Scientific Collaboration, Virgo Collaboration, and KAGRA Collaboration, “All-sky search for continuous gravitational waves from isolated neutron stars using Advanced LIGO and Advanced Virgo O3 data”, *Phys. Rev. D*, vol. 106, no. 10, p. 102008, 2022, Art. no. 102008.
- [18] B. McKernan, K. E. S. Ford, T. Callister, W. M. Farr, R. O’Shaughnessy, R. Smith, E. Thrane, and **A. Vajpeyi**, “LIGO–Virgo correlations between mass ratio and effective inspiral spin: testing the active galactic nuclei channel”, *Mon. Not. R. Astron. Soc.*, vol. 514, no. 3, pp. 3886–3893, Jun. 2022. arXiv: 2107.07551 [astro-ph.HE].
- [19] **A. Vajpeyi**, R. Smith, E. Thrane, G. Ashton, T. Alford, S. Garza, M. Isi, J. Kanner, T. J. Massinger, and L. Xiao, “A follow-up on intermediate-mass black hole candidates in the second LIGO–Virgo observing run with the Bayes Coherence Ratio”, *Mon. Not. R. Astron. Soc.*, vol. 516, no. 4, pp. 5309–5317, Nov. 2022. arXiv: 2107.12109 [gr-qc].
- [20] **A. Vajpeyi**, E. Thrane, R. Smith, B. McKernan, and K. E. S. Ford, “Measuring the Properties of Active Galactic Nuclei Disks with Gravitational Waves”, *Astrophys. J.*, vol. 931, no. 2, p. 82, May 2022, Art. no. 82. arXiv: 2111.03992 [gr-qc].
- [21] J. C. Bustillo, N. Sanchis-Gual, A. Torres-Forné, J. A. Font, **A. Vajpeyi**, R. Smith, C. Herdeiro, E. Radu, and S. H. W. Leong, “GW190521 as a Merger of Proca Stars: A Potential New Vector Boson of 8.7×10^{-13} eV”, *Phys. Rev. Lett.*, vol. 126, no. 8, p. 081101, Feb. 2021, Art. no. 081101. arXiv: 2009.05376 [gr-qc].
- [22] LIGO Scientific Collaboration and Virgo Collaboration, “GWTC-2: Compact Binary Coalescences Observed by LIGO and Virgo during the First Half of the Third Observing Run”, *Phys. Rev. X*, vol. 11, no. 2, p. 021053, 2021, Art. no. 021053.
- [23] LIGO Scientific Collaboration and Virgo Collaboration, “Population Properties of Compact Objects from the Second LIGO-Virgo Gravitational-Wave Transient Catalog”, *Astrophys. J. Lett.*, vol. 913, no. 1, p. L7, 2021, Art. no. L7.
- [24] LIGO Scientific Collaboration, Virgo Collaboration, and KAGRA Collaboration, “Observation of Gravitational Waves from Two Neutron Star-Black Hole Coalescences”, *Astrophys. J. Lett.*, vol. 915, no. 1, p. L5, 2021, Art. no. L5.
- [25] D. Williams, D. Macleod, **A. Vajpeyi**, and J. Clark, *transientlunatic/asimov: v0.3.2*, version v0.3.2, Jul. 2021.
- [26] I. M. Romero-Shaw, et al., and **A. Vajpeyi**, “Bayesian inference for compact binary coalescences with BILBY: validation and application to the first LIGO-Virgo gravitational-wave transient catalogue”, *Mon. Not. R. Astron. Soc.*, vol. 499, no. 3, pp. 3295–3319, Dec. 2020. arXiv: 2006.00714 [astro-ph.IM].
- [27] R. J. E. Smith, G. Ashton, **A. Vajpeyi**, and C. Talbot, “Massively parallel Bayesian inference for transient gravitational-wave astronomy”, *Mon. Not. R. Astron. Soc.*, vol. 498, no. 3, pp. 4492–4502, Nov. 2020. arXiv: 1909.11873 [gr-qc].
- [28] M. Isi, R. Smith, S. Vitale, T. J. Massinger, J. Kanner, and **A. Vajpeyi**, “Enhancing confidence in the detection of gravitational waves from compact binaries using signal coherence”, *Phys. Rev. D*, vol. 98, no. 4, p. 042007, Aug. 2018, Art. no. 042007. arXiv: 1803.09783 [gr-qc].

TALKS

- **BayesComp25 Invited Session** 2025
Bayesian computation in astrophysics
- **COMPAS** Nov '24
Active Machine Learning with Deep GPs for COMPAS Population Inference
- **Flatiron Institute** Jul '24
Mind the Gaps — Time-Frequency Approaches for analysing LISA data with gaps
- **LIGO Rates and Populations** Oct '21
Measuring properties of AGN disks from BBH GW
- **FIT3170 Guest Lecture** April '21
UI/UX Design for programmers
- **OzGrav Online** June '20
Understanding our universe with parallel computing
- **OzGrav Retreat** Nov '19
A High Mass BH Search
- **Mt B. Observatory** Feb '19
GPU Computing in Astro
- **Google I/O Extended Bronx** July '18
“Icebreakers” tech demo

OUTREACH

- Assist UoA, Monash, OzGrav with public demos (open days, outreach, talks).
- Coded games Moonshot, three-body, looper, polarity, for outreach.

Public Talks

- Auckland Astronomical Society Aug '25
“Celestial Songs: A Cosmic Spacetime Symphony” — guest lecture, Stardome Observatory; recording.
- MOTAT STEM Fair 2025
Public engagement event.
- Raising the Bar (Auckland) Aug '24
“Celestial Songs: A Cosmic Spacetime Symphony” — Auckland Fish Market; traced cosmic ripples from Einstein’s 1916 theories to modern gravitational-wave discoveries and New Zealand’s role. Event / podcast.
- Future Me (Auckland) Jun '24
“Thump in the night — Statistics and the hunt for black holes”.
- Pint of Science (Melbourne) 2019–22
“Black Holes: The Ultimate Snitches” — how gravitational waves from colliding black holes let us study the dust-veiled centres of galaxies; delivered while a PhD candidate at Monash University.

Media

- 95bFM — Ready Steady Learn Aug '24
Radio interview.

GRANTS

- **ADACS Merit Allocation Program** (2 awards, ≈AUD \$20K in-kind) '21, '23
One semester of professional software-development support per project: parallel_bilby, tess-atlas.

HACKATHONS

- Completed projects in 20 hackathons; published 19 games totaling +60Hrs of play.
- itch.io 1-BIT JAM #4 Oct '24
Towerfall: 1st in Gameplay, 4th of 331 overall
- Facebook Community Challenge (\$2000) Oct '20
Best Oceania Region Award
- Google I/O Extended Bronx Hack: 1st Place (“Google Action”) July '18
- HackOH5: 1st Place (\$1000) April '17
TensorFlow embeddings of newspaper text (1856-2010) demonstrating semantic change.

TEACHING

Monash University: Teaching Assistant

- [FIT:3170] Software engineering practice Feb-Nov '21
Mentored two teams of 15 students to develop applications for a client using “Lean sAFE”.
- [FIT:9136] Algorithms and foundations Mar-June '20
Ran online python workshops, helped create assignments and an automated-grading system.
- [FIT:1048] Fundamentals of C++ July-Nov '19
Conducted tutorials to help give students practical experience with C++ programming.

Independent Tutoring

- AP Physics and Calculus Oct-Dec '18
Tutored 2 advanced-placement high school students on physics and calculus.

The College of Wooster: Teaching Assistant

- [PHYS:201] Modern Physics Lab Feb-June '18
Helped students with lab experiments, scientific writing, and presentation of data. Some expts: Millikan Oil-drop, Photoelectric Effect and Rutherford Scattering.
- [PHYS:112] Calculus Physics 2 Lab Aug-Dec '17
Help introductory physics students with lab experiments and data analysis.
- [IDPT:405] Entrepreneurship Aug-Dec '16
Facilitate activities to engage students in the “Social Change Model of Leadership Development”.
- [CS:200] Algo. Analysis Aug-Dec '16
Intro to computation complexity theory, Big-O notation, and algorithms (dynamic, greedy, etc.)
- [CS:120] Data Structures and Algos. Feb-June '16
Run labs focused on C++ OOP, testing and documentation.
- [IDPT:1991] Global Engagement Aug-Dec '15
Stimulate class discussions on social and cultural topics and helped with class management.

AWARDS

- RTP Stipend (AUD \$28K) 2019-22
- Monash Tuition Scholarship (AUD \$49K) 2019-22
- Wooster Commencement Speaker June '18
- The Jonas O. Notestein Prize
Awarded for highest GPA in the graduating class
- The Arthur H. Compton Prize in Physics
Awarded for the highest standing in physics
- The Endowed Faculty Scholarship
- NCAA Honor Roll Dec '17
- MCURCSM: Best Paper Presentation Oct '17
- Dean's List and Scholarship '14-18
- Honour Societies: ΦBK, ΠΙME June '17

REFERENCES

Daniel Foreman–Mackey, Ph.D.

Associate Research
Scientist, Flatiron
Institute
dforeman-mackey@flatironinstitute.org

Barry McKernan, Ph.D.

Professor, American
Museum of Natural
History
bmckernan@amnh.org

Rory Smith, Ph.D.

Research Fellow,
Monash University
rory.smith@monash.edu

STUDENT SUPERVISION

Postgraduate (supervisory assistance, not primary supervisor)

- Jianan Liu — PhD 2023–present
University of Auckland; fast Bayesian methods (variational inference) for GW detector noise.
- Nazeela Aimen — PhD 2023–present
University of Auckland; non-parametric Bayesian power spectral density estimation for LISA noise.
- Yukun Yang — MSc 2024
University of Auckland; “Learning from Black Holes with Neural-net Surrogates”.
- Jiaxuan (Steven) Zhou — MSc 2023
Monash University; fast eccentric waveforms via reduced-order models and neural networks.
- Eyleen Amanda Sánchez García — MSc 2025
Pontificia Universidad Católica de Valparaíso; CCSNe detection with normalising flows.
- Manfred Linton — Science Scholars 2023
University of Auckland.

Undergraduate Capstone Projects (Monash FIT)

- OwlEyes 2021
FIT3170 final-year project team supervision; Visual Testing for Android Apps.
- Automated grading tool 2021
FIT3170 final-year project team supervision; FIT3170-project4-2021.
- MLVet 2022
FIT3170 final-year project team supervision; video-editing app; MLVETDevelopers.
- RABIT 2022
FIT3170 final-year project team supervision; FIT3170-FY-Project-7.