Mark Bishop

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Education

- **PhD** 2022-2026
  Victoria University of Wellington Wellington, New Zealand
  - PhD in physics
  - Thesis title: "Systematic and Scale-Dependent Biases in Spectral Power Estimations of Astrophysical Plasma Observations: Implications for the Intracluster Medium"
  - Supervisors: Dr. Yvette Perrott, Dr. Tulasi Parashar
- **MSc (Research)** 2021 – 2022
  University of Waikato Hamilton, New Zealand
  - First Class Honours, Grade A (86%)
  - Master of Science (Research), main subject in Mathematics
  - Thesis title: "Transport of Turbulence in the Solar Wind"
  - Supervisor: Prof. Sean Oughton
- **BCMS (HONS)** 2015 – 2019
  University of Waikato Hamilton, New Zealand
  - First Class Honours
  - Bachelor of Computing and Mathematical Sciences with Honours
  - Major in Computer Science, major in Mathematics
  - Thesis title: "Fault-tolerant Faucet Software Defined Network Controller"

Professional & Research Appointments

- **Victoria University of Wellington** Wellington, New Zealand
  Research Assistant 2026
- **(NASA) Jet Propulsion Laboratory, Caltech** Pasadena, California
  Visiting Researcher, (JVSRP) 2025
- **University of Waikato** Hamilton, New Zealand
  Research Programmer 2017-2020

Publications

- Mark A. Bishop, Brandon S. Hensley, Krzysztof Gorski, Charles Lawrence, Graça Rocha; "Simulating and Characterizing Non-Gaussian Small-Scale Polarized Emission". *in prep.*
- Mark A. Bishop; "Real-space Computations and their Applications for Power Spectral Estimation". *in prep - adapted from thesis chapter.*
- Mark A. Bishop, Sean Oughton, Tulasi N. Parashar, Yvette C. Perrott; "Accuracy of Spectral Estimation on Gapped and Noisy Observations: Turbulence in the Intracluster Medium". *in prep - adapted from thesis chapter.*
- Mark A. Bishop, Sean Oughton, Tulasi N. Parashar, Yvette C. Perrott; "kea: A Python package for consistent power spectral analysis of data on arbitrary dimensions". *submitted to JOSS - adapted from thesis chapter.* Public Link.
- Mark A. Bishop, Sean Oughton, Tulasi N. Parashar, Yvette C. Perrott; "Direct power spectral density estimation from structure functions without Fourier transforms". *Physics of Fluids* 1 February 2026; 38 (2): 025107. /10.1063/5.0310561.
- Mark A. Bishop, Sean Oughton, Tulasi N. Parashar, Yvette C. Perrott; "Constraining solar wind transport model parameters using Bayesian analysis", *The Astrophysical Journal* 28 January 2025; 979 211. 10.3847/1538-4357/ad9f2f.
- Mark A. Bishop, Yvette C. Perrott, Tulasi N. Parashar, Sean Oughton; "Power spectrum estimation methods on intracluster medium surface brightness fluctuations", *European Physical Journal Web of Conferences*, 10.1051/epjconf/202429300007.
- S. Oughton, M. Bishop, "Transport of MHD turbulence in the Solar Wind: Analytic Solutions", *submitted to Solar Wind 16.*

Awards

New Zealand Space Scholarship 2025
Awarded a national scholarship to represent New Zealand at (NASA) Jet Propulsion Laboratory. Vetted via a nationwide selection process based on academic excellence, research merit, and strategic value to the New Zealand aerospace sector.
Marsden Grant for PhD Scholarship . . . . . 2022 – 2025
The A. Zulauf Trust Scholarship 2021
Awarded to high-achieving postgraduate researchers in mathematics or statistics based on academic excellence and a demonstrated commitment to the advancement of the field.
University of Waikato Research Masters Scholarship 2021
University of Waikato FCMS Dean's Award for Excellence 2018
University of Waikato Leibniz Prize in Mathematics 2018
University of Waikato Euler Prize in Mathematics 2017
University of Waikato FCMS Dean's Award for Excellence 2017
University of Waikato FCMS Summer Project Scholarships 2017
University of Waikato Academic Merit School Leaver Scholarship 2016
University of Waikato Computer Science Proficiency Award 2015

Technical & Computational Skills

- **Statistical & Data Science**: Bayesian inference, Markov Chain Monte Carlo (MCMC) and Nested Sampling, parameter estimation, model selection
- **Signal & Image Processing**: Spectral analysis, spectral density estimation (Fourier & real-space methods), structure functions, spherical harmonics, spatial and time-series data analysis in noisy/data-limited regimes
- **Modelling & Simulations**: Magnetohydrodynamic turbulence (MHD), turbulence transport modelling, stochastic & fractal modelling, numerical differential equation solvers
- **Software & Tools**: Linux/UNIX environments, Git/GitHub, Docker, distributed cluster and high-performance computing (Slurm and MPI), FITS and HDF5 data formats
- **Languages**: Python (*Astropy*, *NumPy*, *SymPy*, *SciPy*, *Pandas*, *Healpy*), Bash, Java, C, Fortran, C#

Research Experience & Skills

- **Teaching & Mentoring**
  - *Supervision*:
    Co-supervised undergraduate and graduate research projects focusing on: PLUTO code simulations, solar wind data analysis, and optical telescope image processing.
  - *Lectures*:
    Have conducted lectures to postgraduate and undergraduate students on fluid turbulence.
  - *Workshops*:
    Co-designed and assisted departmental workshops on good Python coding practices as well Git/GitHub version control workflows for incoming postgraduate students.
- **Academic Service, Leadership, & Outreach**
  - *Conference Organization*:
    - Co-managed logistics, abstract reviews, scheduling, and funding coordination for a nationwide (New Zealand) student-led conference for postgraduate mathematics and statistics (NZMASP2023).
    - Helped organize a workshop for gravity and relativity researchers (NZ Gravity workshop 2024).
  - *Journal Club*:
    Organizer for the Space & Astrophysics Journal Club at Victoria University of Wellington; curated weekly schedules and invited internal and external speakers.
  - *University Outreach*:
    Frequently helped out at University open days; engaged with prospective students and families showcasing space science, physics, and astronomy.

Conference Presentations & Other Written Work

- "Bayesian Turbulence Transport and Spectral Estimation in the Solar Wind"
  Contributed Seminar, Space Sciences Laboratory, University of California, Berkeley (2025).
- "Synthesis of Homogeneous and Anisotropic Multifractal Fields"
  Invited Seminar, Panexperiment Galactic Science Group Journal Club (2025).
- "New methods and tools for simulation and analysis of low-frequency polarized microwave sky"
  Contributed Seminar, Jet Propulsion Laboratory (2025).
- "Turbulence in the ICM – Why do we care?"
  Contributed Seminar, Jet Propulsion Laboratory (2025).
- "Constraining solar wind transport model parameters using Bayesian analysis"
  Contributed e-Poster, American Geophysical Union Annual Meeting (2024).
- "My Journey into the Rabbit Hole of Turbulence"
  Contributed Talk, New Zealand Mathematics and Statistics Postgraduate Conference (2024).
- "Astrophysical Fluids: The Intracluster Medium"
  Contributed Talk, Fluids in New Zealand (2024).
- "Constraining solar wind transport model parameters using Bayesian analysis"
  Contributed Talk, New Zealand Mathematics and Statistics Postgraduate Conference (2023).
- "Effects of observed projections on turbulence statistics in the intracluster medium"
  Contributed Seminar, Department of Astronomy, University of Manchester, UK (2023).
- "Effects of observed projections on turbulence statistics in the intracluster medium"
  Contributed Seminar, The Cavendish Laboratory, University of Cambridge, UK (2023).
- "Effects of observed projections on turbulence statistics in the intracluster medium"
  Contributed Talk, mmUniverse (2023).
- "Understanding the large-scale structure of the universe"
  Co-authored Article, Royal Astronomical Society of New Zealand Newsletter (2023-03).
- "Turbulence in the Intracluster Medium"
  Contributed Talk, New Zealand Mathematics and Statistics Postgraduate Conference (2022).
- "Transport of Turbulence in the Solar Wind"
  Contributed Talk, New Zealand Mathematics and Statistics Postgraduate Conference (2021).

Personal Interests

- *Volunteering & Conservation:* Active participant in regional wildlife conservation efforts, including pest control monitoring and coastal cleanups.
- *Outdoors & Creative:* Hiking/backpacking and wildlife photography.