Neco Kriel

Contact information

Nationality:	Australian • South African
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Accounts:	GitHub • Google Scholar • ResearchGate • OrcID
Affiliation:	Research School of Astronomy and Astrophysics (RSAA), Australian National University (ANU), ACT, 2611, Australia
Interests:	magnetohydrodynamics • turbulence • dynamos • galactic winds • plasma/fluid dynamics mathematical modelling • theoretical astrophysics • high performance computing

Education

Doctor of Philosophy at the Australian National University

2022 – Present (Exp. Aug. 2025) | *Specialisation:* Theoretical & Computational Astrophysics
Supervisors: Professor Mark Krumholz & Christoph Federrath

Honours in Science (First Class) at the Australian National University

2021 | *Major:* Astronomy & Astrophysics
Thesis: Fundamental scales in turbulent dynamo amplification of magnetic fields.

Bachelor & Honours (First Class) **in Engineering** at Queensland University of Technology (QUT)

2016 – 2020 | *Major:* Computer & Software Systems
Thesis: Improved modelling of turbulence in agrichemical spray simulations.

Bachelor of Mathematics at Queensland University of Technology

2016 – 2019 | *Major:* Applied & Computational Mathematics

Exchange programs

Sep. 2022	Summer school (online) at Kyoto, Japan *Program:* International School for Space Simulations
Jun. – Aug. 2019	Internship at the Institute of Mathematical Stochastics, Technische Universität Dresden *Program:* Research Experience Program
Nov. 2018 – Mar. 2019	Internship at the Optical Materials Photonics and Systems Laboratory, CentraleSupélec *Funded by:* Nicolas Baudin Research Travel Grant
Jul. 2018	Summer school at the Technical University of Turin *Program:* Photonics & Data Science Summer School

Scholarships & awards (selected)

2022 – 2025	Australian Government Research Training Scholarship
2022	Joan Duffield Research Award
2021	RSAA Bok Honours Year Scholarship
2017 – 2020	Admission to the Dean's List of Academic Excellence at QUT
2020	Best Student Talk at the Mount Stromlo Student Seminars
2019	Dresden University of Technology Research Scholarship
2018	Nicolas Baudin Research Travel Grant

Academic proceedings

Invited Talks

2023 | Growth or decay: universality of the turbulent dynamo saturation
[7th Feb.] Virtual Nordic Dynamo Seminar, Stockholm University

Conference Talks

2023 | Magnetised structures in highly supersonic, turbulent dynamos
[14th Apr.] IMAGINE meeting, Nordic Institute for Theoretical Physics

2021 | Fundamental scaling relations in subsonic, turbulent dynamos
[17th Sep.] The Australasian Conference of Undergraduate Research
[8th Oct.] Specialist Meeting on Galactic magnetic fields, The Royal Astronomical Society
[9th Dec.] The Australian Institute of Physics

Seminars (selected)

2021 | Rubik's Cube through the lens of mathematics
[5th Mar.] Seminar, RSAA at ANU

2020 | Improved computational modelling of turbulence in a particle simulation code
[11th Nov.] Thesis seminar, School of Mathematical Sciences at QUT

Professional service

Peer-review Contributions

2022 | One article in Monthly Notices of the Astronomical Society on the turbulent dynamo.

Community Involvement/Leadership at the RSAA, ANU (selected)

2023 – Present | • Organiser of RSAA journal club ('astro-coffee')
Weekly get-together between students, postdocs, and academics to discuss new and interesting papers.

Aug. 2022 – Aug. 2023 | • Chair of the Seminar Committee
Organised 80+ speakers' visits, scheduled team of 8 people's hosting duties, managed annual budget of $10,000 AUD, and hosted 20+ seminars.

2023 | • Organiser of student writing retreat

2022 | • Organiser of the Mount Stromlo Student Seminars
Successfully secured $4,000 AUD in grants (from ASTRO3D, SEEF, etc.) to support our national, student-driven seminar series hosted at the RSAA.

Community Involvement at QUT

2018 – 2020 | STIMULATE Peer Learning Facilitator

2016 – 2020 | **Committee member on four different student run organisations, including the QUT Engineers Without Borders.**

Public Outreach

2022 – Present | Outreach Ambassador at Mount Stromlo Observatory

2018 – 2020 | STEM Widening Participation Ambassador at QUT

Teaching experience

Invited Guest Lectures

2022 | [13th Oct.] Lecture on '*The turbulent dynamo*' for a graduate-level gas dynamics class at ANU

2020 | [7th Oct.] Lecture on '*Data reduction & the curse of dimensionality*' for a final year Bachelor of Mathematics class at QUT

Two lectures given to the year 12 Advanced Mathematics cohort at my former high school:
[14th Feb.] '*The Calculus of Infinitesimals*'
[27th Mar.] '*Modelling the World Around Us*'

Sessional Academic at QUT

2020 | Taught six undergraduate courses spanning final-year Partial Differential Equations through to first-year Introduction to Computer Systems.
Programming topics: *MATLAB, Python, R, Raspberry Pi*
Math topics: *Fourier Analysis, Matrices, ODEs & PDEs, Vector Calculus*

2019 | Taught three first-year, undergraduate courses in mathematics.

Software experience

Programming Languages / Tools

Advanced:	C++ (AMReX, CUDA), Excel, Git, LaTeX, MATLAB, Python, Visit	*Weapons of choice.*
Intermediate:	C, C++ (OpenMP, MPI), C#, Gnuplot, Java, R	*Experienced with.*
Basic:	Blender (data visualisation), FORTRAN, Mathematica, Maple	*Still learning.*

Simulation Codes

QUOKKA (developer), FLASH4.0

Publications

• **Citations:** 18 • **h-index:** 2

Peer Reviewed

1. **Kriel, N.**, Beattie, J. R., Seta, A., & Federrath, C. (2022). Fundamental scales in the kinematic phase of the turbulent dynamo. DOI: 10.1093/mnras/stac969. arXiv: 2204.00828.
2. Beattie, J. R., Krumholz, M., Skalidis, R., Federrath, C., Mocz, P., Crocker, R. M., Seta, A., & **Kriel, N.** (2022). Energy balance and Alfvén Mach numbers in compressible magnetohydrodynamic turbulence with a large-scale magnetic field. DOI: 10.1093/mnras/stac2099. arXiv: 2202.13020.
3. Beattie, J. R., Federrath, C., **Kriel, N.**, Mocz, P., & Seta, A. (2023). Growth or Decay – I: universality of the turbulent dynamo saturation. DOI: 10.1093/mnras/stad1863. arXiv: 2209.10749.

In Preparation

1. **Kriel, N.**, Beattie, J. R., Federrath, C., Krumholz, M. R., & Hew, J. (Expected September submission). Fundamental scales in the kinematic phase of the turbulent dynamo – II: the effect of compressibility in highly supersonic, isothermal plasmas.
2. Beattie, J. R., Federrath, C., **Kriel, N.**, Mocz, P., Hew, J., & Ripperda, B. (Expected September submission). Growth or Decay – II: sub-Alfvénic plasmoidal decay into driven turbulence.
3. Beattie, J. R., Federrath, C., Hew, J., **Kriel, N.** (Expected September submission). Taking control of compressible modes: bulk viscosity and the compressible turbulent dynamo.
4. Hew, J., Hosking, D. N., Federrath, C., Beattie, J. R., Seta, A., & **Kriel, N.** (Expected August submission). Exact von-Kármán-Howarth scaling relations for the Hosking integral in non-helical magnetohydrodynamic turbulence.
5. **Kriel, N.**, Krumholz, M. R., Wibking, B., & Li, P. S. (Expected 2024 submission). Implementing ideal magnetohydrodynamics in `QUOKKA`.

Non-Peer Reviewed

1. Beattie, J. R., **Kriel, N.** (2019). Is The Starry Night Turbulent?. *arXiv preprints*. arXiv: 1902.03381.