

Brett Addison (PhD)

Data Scientist | Astrophysicist

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Full working rights in Australia under visa New Zealand Citizen Family Relationship subclass 461

SUMMARY

I am a seasoned astrophysicist and data scientist, with 15 years of experience in data analysis and Python programming to explore exoplanets and study fundamental constants. My expertise includes extracting insights from complex datasets using world-class telescopes, authoring over 50 scientific papers, and presenting research findings globally. I'm enthusiastic about applying this expertise to solve real-world data science challenges, driving innovation, and effectively communicating complex insights to both teams and clients.

SKILLS

Below I have outlined my technical and data analysis expertise, developed through working as an astrophysicist and skilling up in the area of data science.

Programming Languages

- Python (proficient) — Numpy, Pandas, SciPy, scikit-learn, Matplotlib, Bokeh, Seaborn, Jupyter notebook
- R (familiar)
- Modern Fortran (proficient)
- SQL (familiar)
- HTML (familiar)
- CSS (familiar)

Software/Platforms

- Git
- Linux/Mac OS/Windows
- Microsoft Office 365 suite
- LaTeX

Data Analysis

- Statistical analysis
- Time series analysis
- Machine Learning (ML)
- Data wrangling
- Bayesian Statistics/MCMC
- Monte Carlo simulations
- Data Visualisation
- Random Forest

PROFESSIONAL EXPERIENCE

Aug 2022 — Nov 2022, Aug 2024 (Present) Astronomy Lecturer, University of Southern Queensland Toowoomba, AU

- Teach a variety of undergraduate and masters' level courses in physics, astronomy, and data science with duties that include delivering weekly tutorials, developing course content, and writing/marking assessments/exams.
- Supervise students undertaking research projects in the BSc and Masters' programs at UniSQ.
- Collaborate with the Physics/Astronomy team to plan and execute changes to the undergraduate and postgraduate course offerings and provide advice on the new 8-unit Astronomy major.
- Consistently earned high marks for my teaching, with ratings from student surveys exceeding 4 out of 5, reflecting my commitment to delivering engaging instruction in astronomy, physics, and data science courses.

Nov 2022 — Dec 2023 (Present) Postdoc Researcher (Adjunct), Swinburne University of Technology Remote

- Played an integral role in a research initiative measuring the fine structure constant to advance our knowledge of fundamental constants and cosmological models.
- Implemented a Python analysis pipeline to measure the fine structure constant using a novel technique of comparing the spectra of similar stars (star-to-star comparison).
- This resulted in reducing errors by 3 orders of magnitude compared to other approaches used for measuring the fine structure constant.
- Developed an analysis pipeline in Python to classify the evolutionary state of giant stars using a novel differential equivalent width technique.
- This resulted in improving the accuracy of classification by 90% compared to other techniques.

Aug 2018 — Jul 2022 (Present) Research Fellow (Adjunct), University of Southern Queensland Toowoomba, AU

- Led ground-based observations of key exoplanet candidates using the MINERVA-Australis Telescope array.
- Collaborated with over 40 international researchers at MIT, Harvard, George Mason University, NASA, Sydney Uni, and UNSW to schedule and organise ground-based telescope observing.
- Designed and implemented data ingestion and analysis pipelines in python to transform raw data into science ready data products and then synthesized results into 23 scientific publications.
- This resulted in the discovery of nearly 50 exoplanets, including the ultra-hot Jupiter TOI-1431b, one of the hottest planets ever discovered.

Dec 2015 — Jun 2018 Postdoc Researcher, Mississippi State University Starkville, MS

- Built the Starchive database of over 30,000 objects using PostgreSQL, Python, and SQLAlchemy for data handling; collaborated on schema design to accommodate diverse data sources.
- Employed Matplotlib and Pandas in Python to visualise and analyse patterns in the stellar and planetary property data, informing selection of interesting candidates to pursue.
- Created automated pipelines to handle ongoing ingestion of data, with embedded validation checks to ensure data quality.
- This resulted in reducing manual data entry by 99% and enabling faster data retrieval times, allowing the team to focus on higher-level analysis and boosting productivity.

RECENT DATA SCIENCE PROJECTS

Predicting the Orbital Tilts of Exoplanets Using Machine Learning

I developed random forest regression and classification models using the Python library Scikit-learn to predict exoplanetary orbital obliquities (tilts). I worked with datasets containing exoplanet and host star properties, addressing challenges such as small sample size, data imbalance, and weak predictive features. This project provided me with skills in applying machine learning to real-world datasets. I documented the process through a series of blog posts, available on my [website](#), and shared the Jupyter notebooks with the models on [GitHub](#).

COMMUNICATION SKILLS

- Throughout my career as an astrophysicist, I have led nine peer-reviewed scientific publications with over 250 total citations. I have also been a contributing author to 46 additional papers with 900+ total citations. Full list of my publications is available on [NASA ADS](#).
- Presented research findings at 14 major Australian and international conferences.
- Delivered more than 10 public science presentations and media interviews on exoplanet discoveries (e.g., see <https://tinyurl.com/rx7nkyg> and <https://www.youtube.com/watch?v=z9-6zltEouw>).

EDUCATION

2015 PhD in Astrophysics, University of New South Wales, Sydney, Australia

2009 BSc in Astrophysics & Mathematics, Florida Institute of Technology, Melbourne, Florida

CERTIFICATIONS

Kaggle Data Science with Python course certificates:

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|-----------------------------|---------------------------------|-----------------------|
| • Intro to Machine Learning | • Intermediate Machine Learning | • Feature Engineering |
| • Intro to Deep Learning | • Intro to SQL | • Advanced SQL |

Coursera Data Science Specialization using R course certificates:

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|--------------------------------|------------------------------|-----------------------------|
| • The Data Scientist's Toolbox | • R Programming | • Getting and Cleaning Data |
| • Exploratory Data Analysis | • Reproducible Research | • Statistical Inference |
| • Regression Models | • Practical Machine Learning | |