

Dr. Brett Addison

Astrophysicist · Data Scientist

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SUMMARY

I am a seasoned astrophysicist transitioning into data science, with over 10 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 (expert) — Numpy, Pandas, SciPy, scikit-learn, emcee, Matplotlib, Bokeh, Jupiter notebook
- R (moderate) — dplyr, tidy, ggplot2, Lubridate, knitr, Plotly, caret
- Modern Fortran (expert) • SQL (moderate) • HTML (moderate) • CSS (moderate)

Software/Platforms

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

Data Analysis

- Statistical analysis • Data wrangling • Machine Learning
- Bayesian Statistics • MCMC • Monte Carlo simulations
- Data Visualization • Time series analysis • Random Forest Regression/Classification

PROFESSIONAL EXPERIENCE

Nov 2022 — Dec 2023	Postdoctoral Researcher, Swinburne University of Technology	Remote
Dec 2023 — Present	Adjunct, Swinburne University of Technology	Remote

- Developed Python tools for high-resolution spectral analysis to classify the evolutionary state of giant stars using a differential equivalent width technique.
- Played an integral role in a research initiative measuring the fine structure constant from absorption line pair separation on over 200 stars, advancing our knowledge of fundamental constants and cosmological models.
- Secured time on the extremely competitive telescopes Very Large Telescope array and Keck Observatory, typical proposal success rate is less than 10%, for spectral data collection on 50 stars.

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

- Led an observational follow-up program of over 100 potential exoplanetary systems using the MINERVA-Australis Telescope array.
- Utilised Python libraries (NumPy, Pandas, emcee, and Matplotlib) and constructed Python tools to clean, analyse, and fit models to data from over 100 exoplanetary systems.
- Discovered two exoplanets and contributed to an additional 46 discoveries, co-authoring 23 discovery papers.
- Measured the physical properties of the ultra-hot Jupiter TOI-1431b, revealing that the planet has the second hottest nightside temperature.

- Created an astronomical database of over 30,000 objects using Python, SQLAlchemy, and PostgreSQL.
- Managed data for over 30,000 stellar and planetary objects and used the Matplotlib visualization tool in Python to detect patterns and correlations in their physical properties.
- Developed the ExOSAM analysis tool in Python and Fortran, fitting physical models to radial velocity data on 10 exoplanetary systems to measure their orbital obliquities.

RECENT DATA SCIENCE PROJECTS

Predicting the Orbital Obliquities of Exoplanets Using Machine Learning

I developed random forest regression and classification models using the Python library Scikit-learn to predict exoplanetary orbital obliquities. 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 (the first two posts are 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>).
- Instructed six undergraduate and master's courses in astronomy as well as an introductory data science course in Python.
- Supervised five graduate students on astronomy projects, leading to two scientific publications.

EDUCATION

Jul 2010 — Apr 2015

Doctor of Philosophy (Ph.D.) Astronomy/Astrophysics
University of New South Wales, Sydney, Australia

Aug 2005 — Dec 2009

Bachelor of Science (B.S.) Astronomy/Astrophysics and Mathematical Sciences
Florida Institute of Technology, Melbourne, Florida

CERTIFICATIONS

Below I list several data science courses I have taken through Kaggle and Coursera over the past year:

Kaggle Data Science with Python course certificates:

- 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:

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