Anthony Burrow, Ph.D.

anthony.r.burrow@gmail.com
linkedin.com/in/anthony-burrow
anthonyburrow.github.io

Objective

Data scientist with a Ph.D. in Physics and experience leveraging machine learning to model complex data sets in astrophysics. Seeking to apply my advanced skill set in model production, data visualization, and software development in Python and C++ to deliver insightful data-driven solutions to business goals.

Education

- **Ph.D. in Physics** (GPA: 3.92; Verification)
  July 2024, *University of Oklahoma*
  View Dissertation
- **B.S. in Astrophysics** (GPA: 3.91)
  May 2017, *University of Oklahoma*

Certifications

- **IBM Professional Certificate**
  - Data Science, Aug. 2024 (View)

    Enhancing skills in the data science lifecycle — ETL, data analysis, data visualization, SQL, machine learning, etc. — to derive insights from data.

Relevant Experience

- **Generative AI Trainer** Dec. 2024 – Present
  Independent Contractor
  - Serve as an expert in physics, mathematics, and programming to train and evaluate responses from large language models (LLMs) to STEM-based prompts.
  - Assess the validity of evaluations from other AI trainers to maintain quality assurance in model training data.
- **Research Assistant (Data Science)** July 2019 – July 2024
  University of Oklahoma *Norman, OK*
  - Employed machine learning algorithms to establish a new, optimized standard of classifying astronomical objects.
  - Designed an innovative method of extrapolating and predicting astronomical data by leveraging dimensionality reduction techniques, with extrapolated results matching observed data within 2–5%.
  - Led collaborative statistical analyses with leading researchers from around the world, resulting in two published reports to a peer-reviewed journal that interpret findings using data visualizations and highly technical writing.
  - Developed and maintained open-source software to enhance accessibility of models for the scientific community.
  - Utilize hybrid cloud computing infrastructure to synthesize physics models for comparative data analysis.

  Products:
  - White Dwarf Classifier: Developed several ML models (e.g., random forest, gradient boosting, SVM) to classify several groups of objects within over 90% accuracy, achieving results that improve upon previously published work.
  - SNEx (Python): Spectrum extrapolation into near-infrared wavelengths using principal component analysis.
  - Spextractor (Python): Fast spectrum-smoothing by implementing interpolation via Gaussian process regression.
  - See Publications section (next page).
- **Undergraduate Research Assistant (Data Analysis)** June 2015 – May 2017
  University of Oklahoma *Norman, OK*
  - Created Python scripts needed for data analysis, discovering several stars with time-variable properties.
  - Calibrated and processed raw image data by removing multiple sources of noise and bias.
  - Conducted multiple remote observations at the Apache Point Observatory to obtain more raw data for analysis.

Technical Skills

Programming & Scripting: Python, C/C++, SQL, R, C#, Slurm, Make, CMake, Fortran, LaTeX
Python Libraries: NumPy, pandas, scikit-learn, Tensorflow, matplotlib, SciPy, Astropy, pytest
Development Tools: Docker, Power BI, JupyterLab, Visual Studio, RStudio
Platforms: Linux/UNIX (Ubuntu, Arch), Windows
Version Control: Git, GitHub, GitHub Actions workflows, Continuous Integration & Deployment (CI/CD)

Additional Software Projects

- SpecFit (Python, C++): Efficient spectrum-fitting of various integrated models using non-linear optimization, utilizing `pybind11` to allow fast C++ functionality within Python.
- Rad1D: Radiative transfer code that utilizes iterative matrix operations to solve complex equations that explain light passing through a medium. Written in C++ with a Python wrapper, implementing unit testing for seamless integration.
- Hydro1D: Hydrocode that simulates the time-dependent shock dynamics of stellar material (C++, Python).

Publications

- **Burrow, Anthony**, Baron, E., Burns, Christopher R., et al. (2024). *Extrapolation of Type Ia Supernova Spectra into the Near-Infrared Using PCA*. ApJ , doi: 10.3847/1538-4357/ad3c45
- **Burrow, Anthony**, Baron, E., Ashall, C., et al. (2020). *Carnegie Supernova Project: Classification of Type Ia Supernovae*. ApJ , doi: 10.3847/1538-4357/abafa2
- Eight co-authored publications (view NASA ADS query) of scientific and data analyses with collaborators.

Presentations

- **POISE Collaboration Meeting, August 2023**: *Extrapolation of Type Ia Spectra into the Near-Infrared Using PCA*; a final discussion leading to Burrow et al. (2024).
- **POISE Collaboration Meeting, July 2022**: *Extrapolation of Type Ia Spectra into the Near-Infrared Using PCA*; the beginning of the project leading to Burrow et al. (2024).
- **CSP Collaboration Workshop, September 2020**: *Carnegie Supernova Project: Classification of Type Ia Supernovae*; a presentation of the publication by Burrow et al. (2020).
- **American Astronomical Society Winter Conference, January 2017**: Poster presentation highlighting my undergraduate research.

Awards

- **Avenir Foundation Graduate Student Fellowship**:
  Spring 2022, Summer 2022; *University of Oklahoma*
- **Provost's Certificate of Distinction in Teaching**:
  Fall 2019; *University of Oklahoma*
- **Award for Outstanding Scholarship by a Graduating Senior**:
  May 2017; *University of Oklahoma Homer L. Dodge Department of Physics and Astronomy*
- **William Schriever Award for Outstanding Scholarship in Physics & Astronomy**:
  2014-2015; *University of Oklahoma*

Additional Work Experience

- **Graduate Teaching Assistant** Aug. 2019 – Dec. 2021
  University of Oklahoma *Norman, OK*
  - Delivered lectures and facilitated in-class group discussions in undergraduate astronomy and physics courses, focusing on foundational concepts and problem-solving strategies.
  - Led hands-on astronomy lab sessions, instructing students in the operation of telescopes.
  - Heavily supported an undergraduate Introduction to Research course, emphasizing hands-on research practices including data analysis, coding in Python, and literature review.
  - Graded assignments and provided individualized feedback for advanced undergraduate astronomy students.