Keduse Worku

Applied Scientist | Data Scientist | Probabilistic Modeling & Bayesian Inference
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EDUCATION

Johns Hopkins University — **Baltimore, MD**
Ph.D. in Astrophysics (Summer 2026) — *2026*
Master of Arts (M.A.) in Physics — *2024*

Yale University — **New Haven, CT**
Bachelor of Science (B.S.) in Astrophysics — *2022*

TECHNICAL SKILLS

Programming: Python, JAX, NumPy, SciPy, PyMC, PyTorch (basic), SQL
Machine Learning (ML): Decision trees, PCA, autoencoders, anomaly detection
Statistical & Computational Modeling:

- **Probabilistic modeling & inference:** Monte Carlo simulation, Hamiltonian Monte Carlo (HMC), Gaussian Processes, Hidden Markov Models, probabilistic classification
- **Dynamical & stochastic systems:** time-series modeling, stochastic differential equations, numerical interpolation
- **Optimization & scalable computation:** gradient-based optimization, GPU acceleration, vectorized computation

RELEVANT EXPERIENCE

Graduate Research Assistant — **August 2022 - Present**
Johns Hopkins University — Baltimore, MD

- Developed GPU-accelerated JAX simulations for neutrino–dark matter models, reducing runtime from 1 hour to 10 seconds **(600× speedup).**
- Designed probabilistic classification pipelines for **10,000+ noisy candidates** using **Bayesian inference**, boosting selection accuracy **by 20%** via uncertainty-aware modeling and statistical validation.
- Led cross-institutional collaborations **across U.S. and Europe**, presenting results and streamlining data workflows to enhance computational efficiency and model accuracy.

Quantitative Research Summer Intern - Asset & Risk Modeling — **May 2025 - August 2025**
New York Life Insurance Company (Fortune 100) — New York, NY

- Implemented callable bond pricing models under the Hull–White short-rate framework, using stochastic differential equations and trinomial trees.
- Developed and validated numerical interpolation strategies and unit tests for fixed-income pricing workflows.

LSSTC Data Science Fellow — **September 2023 - August 2025**
Multi-Institutional — Baltimore, MD

- Applied **ML methods for anomaly detection and classification** on large-scale observational datasets, including **tree-based models and PCA.**
- Developed scalable data pipelines for **high-volume processing and time-series analysis** of large-scale survey data.

Predoctoral Researcher — **January 2022 - August 2022**
Princeton University — Princeton, NJ

- Built an end-to-end Python pipeline for **large-scale matrix computations and cross-correlation analysis**, improving parameter estimation efficiency and uncertainty quantification within a **100+ member collaboration**.
- **Engineered novel** contamination reduction **techniques**, enhancing resolution **by over 50%** for observational datasets**.**

Computational Research Intern — **June 2021 - August 2021**
Flatiron Center for Computational Astrophysics — New York, NY

- Optimized cross-correlation pipelines using **frequency-specific window functions**, reducing systematics and improving precision by **20%**.
- Extracted statistical insights from multi-frequency data to improve parameter estimation accuracy.

SELECTED DATA SCIENCE & APPLIED ML PROJECTS — Apr 2025 - Present

- Benchmarked Hamiltonian Monte Carlo **(Bayesian)** against Hidden Markov Model **(Frequentist)** for inferring latent system states from noisy time-series data.
- Built a Bayesian inference pipeline using **PyMC** and **HMMs** to **recover latent stochastic dynamics** from bid–ask spreads and volatility, **identifying early indicators of market stress.**