Dr Alex Goater

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Professional Profile

Computational physicist with a PhD in Astrophysics and over four years' experience building high-performance numerical models, statistical frameworks, and automated analysis pipelines to solve complex physics problems. Proficient in Bayesian inference, MCMC techniques, and uncertainty quantification, with a proven record of optimising algorithms for multi-dimensional parameter spaces and processing large-scale datasets efficiently. Skilled in Python, Unix environments, and advanced data analysis, with expertise in constructing robust likelihood models and accelerating computational workflows for maximum performance and accuracy.

I deliver reliable, scalable modelling solutions in both research and commercial settings by combining deep theoretical knowledge with practical software engineering skills. My experience includes cross-disciplinary collaboration, technical presentations to diverse audiences, and producing tangible results under shifting priorities. Whether refining complex models for greater accuracy or streamlining computation to meet demanding performance targets, I excel at turning challenging physical questions into elegant, high-impact computational solutions that drive informed decision-making.

Core Competencies

- High-performance numerical modelling & simulation (Bayesian inference, MCMC, multi-dimensional parameter spaces)
- Statistical uncertainty quantification & likelihood model construction
- Python programming, Bash scripting & scientific computing
- Unix/Linux HPC environments, job scheduling & workflow optimisation
- Large-scale data processing & automated analysis pipeline development
- Algorithm design, optimisation & convergence assessment
- Software engineering (Git/GitHub, version control, documentation)
- Stakeholder management & cross-disciplinary collaboration
- Technical presentation & scientific communication
- Research funding acquisition & event organisation
- Commercial software development for operational workflows
- Project management in evolving priority environments
- Adaptability, self-direction & multi-tasking under shifting constraints
- Software development (HTML, CSS & Javascript)

Career History

Professional Experience

Digital Acceleration Internship – McAndrew Martin Ltd, Portsmouth | Jan 2024 – Jun 2024

- Improved technological infrastructure using Python and Microsoft Power for data-driven insights.
- Cut software costs by designing and delivering an in-house 'building survey' app on a strict timeline.
- Led development from concept to deployment, collaborating across departments to ensure seamless integration.

Education

PhD in Astrophysics, University of Surrey | Sep 2020 – Dec 2024

- Designed and developed a modular Python-based toolkit for galaxy morphology analysis, implementing Bayesian parameter estimation via `emcee` to fit elliptical exponential surface brightness profiles.
- Integrated multiple random orientation sampling to assess morphological robustness, generating statistical summaries, corner plots, and contour maps.
- Built scalable pipelines for cosmological simulation datasets containing 10^5–10^6 stellar particles, with parallel processing, memory optimisation, and automated batch handling.
- Developed a full command-line interface with Bash scripts for automated environment setup, validation, and execution, ensuring reproducibility and ease of deployment.
- Created robust likelihood models for multi-dimensional parameter spaces with strong model convergence and uncertainty quantification.
- Delivered publication-quality visualisations and statistical outputs to support research analysis, resulting in a first-author publication in a leading astrophysics journal.
- Optimised workflows for Unix/Linux HPC environments (DiRAC), including job scheduling, resource management, and data pipeline automation.
- Collaborated with international research teams on methodology alignment and data integration, contributing technical expertise to shape methodology and analysis direction.
- Delivered technical presentations to audiences with varying levels of domain expertise, adapting communication style for clarity and impact.
- Managed shifting project priorities, balancing code development, literature review, and manuscript preparation in parallel.
- Organised a multi-institution astrophysics conference funded through competitive grants, coordinating logistics, speakers, and cross-institution collaboration.
- Provided critical peer feedback and incorporated review comments constructively to refine research outputs.

- Demonstrated self-motivation and resilience in solving complex, open-ended problems with limited precedent or guidance.

Master of Physics, Astrophysics & Cosmology, University of Portsmouth | Sep 2016 – Jun 2020
First Class With Honours

- Conducted independent research on kilonova detection using statistical analysis of observational datasets.
- Developed foundational skills in scientific computing and statistical analysis.

Continued Professional Development

Professional Portfolio Website | Personal Project | 2025

- Built a responsive portfolio website from scratch using vanilla HTML, CSS, and JavaScript, demonstrating proficiency in core web technologies.
- Optimised site performance achieving fast load times through efficient code structure and minimal resource overhead, prioritising user experience across all device types.
- Integrated contact form functionality and interactive UI elements, demonstrating full-stack web development capabilities from frontend implementation to user interaction handling.
- Implemented real-time scroll progress calculation and viewport detection algorithms, demonstrating mathematical problem-solving applied to user interface challenges.
- Applied modern software engineering practices including version control, modular code structure, and comprehensive documentation.

Awards & Recognition

Laura Bassi Scholarship

- Received the international Laura Bassi Scholarship, a prestigious grant awarded to those with groundbreaking research in underexplored fields of study.

SEPnet Conference Funding

- Secured competitive funding to organise and host an astrophysics conference, connecting researchers from multiple disciplines.

PhD Scholarship

- Awarded the highly competitive Doctoral College Studentship to fund a PhD at University of Surrey.