Robb Calder

Cambridge, United Kingdom rdc49@cam.ac.uk +44 7712 206571 https://rdc49.github.io.

Education

PhD in Astrophysics **Cambridge, UK**
Institute of Astronomy, University of Cambridge *Sep 2023 – Present*

- Funded studentship from the Science and Technology Facilities Council, UKRI
- Project title: "Atmospheric Processes on Hot Rocky Planets"
- Supervisors: Prof. Oliver Shorttle and Dr. Paul Rimmer

Integrated MPhys in Astrophysics **St Andrews, UK**
School of Physics and Astronomy, University of St Andrews *Sep 2018 – Jun 2023*

- Graduated First Class Honors with Distinction; 83/100
- Carried out a research project under the supervision of Professor Moira Jardine titled *Smothering Exoplanet Winds*. In this project, I used a Parker Wind Model to study the interaction between stellar winds and evaporating planetary atmospheres
- Studied a wide range of courses including *Advanced Data Analysis*, *Magnetofluid Dynamics*, *Observational Astrophysics*, *Monte-Carlo Radiative Transfer Techniques* and *Observational Astrophysics*
- Awarded class medal in final year for being among the highest ranking astrophysics students
- Deans Scholar for each consecutive year of undergraduate degree

Research Experience

PhD - Atmospheric Processes on Hot Rocky Planets **Cambridge, UK**
Institute of Astronomy, University of Cambridge *Sep 2023 – Present*

- Ran retrievals on transmission spectra of K2-18b and WASP-17b using petitRADTRANS
- Used 1D photochemical model (ARGO) to model the atmospheres of Venus and Venus-like exoplanets
- Modified ARGO to include pseudo-chemical reactions that produce arbitrary amounts of gaseous species to simulate unknown chemical pathways
- Used 1D photochemical models as input for synthetic spectra generation using petitRADTRANS

Masters' Project - Smothering Exoplanet Winds **St Andrews, UK**
School of Physics and Astronomy, University of St Andrews *Jan 2023 – May 2023*

- Used a 1D Parker Wind model to determine if a stellar wind acts to reduce the evaporation rate of a planetary atmosphere
- Ran simulations to determine the region of the parameter space (stellar mass, planet mass, orbital separation) in which the stellar wind reduces the atmospheric evaporation rate
- Used results of simulations to explore the effect of stellar flares or stellar evolution on the ability of stellar winds to reduce atmospheric evaporation rates
- Identified that the planet HD 97658b is expected to have a reduced atmospheric evaporation rate owing to the stellar wind, which may explain the lack of an observed evaporating atmosphere

Summer Research Project - Cloud Formation on Hot Jupiter Exoplanets **St Andrews, UK**
School of Physics and Astronomy, University of St Andrews *Jun 2021 – Oct 2021*

- Received funding from the Laidlaw Leadership and Research Scholarship to undertake a research project under the supervision of Professor Christiane Helling.
- Used a parameter grid of Global Circulation Models as input for a 1D kinetic cloud formation code, in order to study cloud formation on Hot-Jupiter atmospheres

- Visualised the GCM data using Python to inform the cloud formation simulations
- Wrote bash script to automate the distribution of cloud formation simulations across a high performance computing cluster
- Used Python to visualise the vast quantity of output data (60GB) in a concise and informative format

Technical Skills

Programming

- Python (including numpy, matplotlib, astropy and scipy), Mathematica, Fortran, Bash
- LaTeX, HTML, CSS

Coding Packages

- Use and modification of 1D photochemical-kinetics code (ARGO)
- Use of petitRADTRANS for atmospheric retrievals and synthetic spectra generation

Conferences

IoA 50 - Frontiers Conference **Cambridge, UK**
Attended in Person *July 2024*

Origins Federation Conference **Cambridge, UK**
Attended in Person *Sep 2024*

Selected Publications

- Helling, C., Samra, D., Lewis, D., Calder, R., Hirst, G., Woitke, P., ... & Chubb, K. L. (2023). Exoplanet weather and climate regimes with clouds and thermal ionospheres-A model grid study in support of large-scale observational campaigns. Astronomy & Astrophysics, 671, A122.

Teaching Experience

Undergraduate Supervisor **Cambridge, UK**
University of Cambridge *Feb 2023 - May 2023*

Directed sessions involving 2-3 students to help them consolidate material covered in lectures. Marked submitted worksheets and past paper questions.

- Topics in Astrophysics (3rd Year): 9 students, 12 sessions