Robb Calder

lacktriangle Cambridge, United Kingdom lacktriangle rdc49@cam.ac.uk lacktriangle +44 7712 206571 lacktriangle 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
- o Project title: 'Atmospheric Processes on Hot Rocky Planets'
- o 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

- o 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.
- o Deans Scholar for each consecutive year of undergraduate degree.

Research Experience

PhD - Atmospheric Processes on Hot Rocky Planets

Cambridge, UK

Sep 2023 - Present

Institute of Astronomy, University of Cambridge

- $\circ\,$ 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.
- \circ 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.
- Used coupled climate-geohysical evoltion model (PROTEUS) to simulate the thermal evolution of planets in the sub-Neptune regime.

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 and 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.

${\bf Summer\ Research\ Project\ -\ Cloud\ Formation\ on\ Hot\ Jupiter\ Exoplanets}$

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 Prof. Christiane Helling.

- Used a grid of Global Circulation Models as input for a 1D kinetic cloud formation code, in order to study cloud formation on Hot-Jupiter exoplanet 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 insightful format.

Technical Skills

Programming

- o 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.
- Use of PROTEUS to simulate the thermal evoltion of planets in the sub-Neptune regime.

Conferences

Comercines	
IoA 50 - Frontiers Conference Attended in Person	Cambridge, UK July 2024
Origins Federation Conference Attended in Person	Cambridge, UK Sep 2024
Leverhume Centre for Life in the Universe Science Day, 2025 Attended in Person, presented poster titled: 'Abiotic Ozone in the Observable Atmospheres of Venus and Venus-like Exoplanets'	Cambridge, UK February 2025
UK Exoplanet Meeting 2025 Attended in Person, presented poster titled: 'Abiotic Ozone in the Observable Atmospheres of Venus and Venus-like Exoplanets'	Leeds, UK March 2025

Selected Publications

- Calder, R., Shorttle, O., Jordan, S., Rimmer, P., Constantinou, T. (2025). Abiotic ozone in the observable atmospheres of Venus and Venus-like exoplanets. Monthly Notices of the Royal Astronomical Society, 540(3), 2432-2450.
- 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 largescale observational campaigns. Astronomy & Astrophysics, 671, A122.

Teaching Experience

Undergraduate Supervisor University of Cambridge

Cambridge, UK

Feb 2024 - May 2026

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

- o 1st Year: Topics in Astrophysics (3rd Year Undergraduate Course): 9 students, 12 sessions
- o 2nd Year: Topics in Astrophysics (3rd Year Undergraduate Course): 4 students, 8 sessions

Outreach

Public Lectures and Stargazing

Cambridge, UK

University of Cambridge

Sep 2024 - May 2026

Gave lectures to members of the public explaining current science and led supervised star-gazing sessions for

members of the public.

 $\circ~21/10/2024 \colon$ Barrington Scout Group

 \circ 22/11/2024: 6th/17th Cambridge Scouts

 $\circ~17/02/2025{:}~50{th}$ Cambridge Cub Scouts

 \circ 18/02/2025: Team Consulting

International Women's Day Committee

University of Cambridge

Cambridge, UK

Jan 2025 - Mar 2025

Participated in the International Women's Day committee. This committee organised various department activities with the aim of celebrating female astronomers and promoting gender diversity in the field of astronomy.

- Lead and organised a workshop for local secondary school children to teach them about exoplanet transits and famous female astrophysicists in the field of exoplanets.
- o Helped run the International Women's Day stall at the Institute of Astronomy Open Day.
- Gave a lecture at the Institute of Astronomy Open Day about famous female astrophysicists in the field of exoplanets.