

# Jessica Lok

Fitzwilliam College, Cambridge CB3 0DG | [jhyl3@cam.ac.uk](mailto:jhyl3@cam.ac.uk) | [frozensglobe.github.io](https://frozensglobe.github.io) | Updated December 2024

I am interested in applications of fluid and continuum mechanics to geophysical and astrophysical problems. Brought together by the common theme of planetary formation: (i) the dynamics of planetary interiors covering both short-term processes (e.g. melt migration) and long-term evolution (e.g. core solidification); (ii) the (magnetohydro)dynamics of protoplanetary discs. With a background in Astrophysics and solid Earth Science, I enjoy taking an interdisciplinary approach, as well as a mixture of pen-and-paper, numerical modelling, and data-driven approaches to my work.

## EDUCATION

- 2021–present      **University of Cambridge, UK**, Natural Sciences Tripos MSci (expected to graduate July 2025)
- Year 4: Astrophysics, Institute of Astronomy (IoA)**
- Courses: Astrophysical Fluid Dynamics, Astrophysical Disc Dynamics, Planetary System Dynamics, Solid Earth Geophysics, Solid Earth Fluid Dynamics
- Year 3: Astrophysics, Class *II.i*, ranked 10<sup>th</sup> in cohort
- Year 2: Class *I* overall: Mathematics (*I*), Physics (*I*), Solid Earth Sciences (*I*)  
*Awarded the Clough Scholarship*
- Year 1: Class *II* overall: Mathematics (*I*), Physics (*I*), Earth Sciences (*II.i*), Chemistry (*II.i*)
- 2014–21      **South Island School, Hong Kong**. IB Diploma, 44/45, *ESF Chairman's Awards for Excellence*

## RESEARCH AND INDUSTRY EXPERIENCE

- 2024 Oct-present      **Master's project: Modelling dust advection by protoplanetary disc winds.**  
Supervisors: Prof Cathie Clarke, Dr Álvaro Ribas
- Derived equations for coupled gas and dust dynamics. Devised numerical integration schemes to solve for vertical velocity structures of dust of a given size and invert for density profiles.
  - Will use MCFOST (radiative transfer code) to generate spectral energy distributions and scattered light images for an assumed grain size distribution.
- 2024 Jun-present      **Research internship, Space Plasma Physics group, QMUL.** Supervisor: Dr Heli Hietala
- Investigated plasma waves generated by satellites in low Earth orbit. Calculated satellite conjunctions and deduced conjunction geometry from orbital element sets; processed spacecraft ephemeris and field data from the Cluster, MMS and CASSIOPE missions.
  - Investigated JWST observations of protoplanetary disc bow shocks to deduce protoplanetary disc inclinations.
  - Currently investigating VLF signals of radiation leakage from Starlink satellites.
- [GitHub Summary](#)
- 2024 Jul-Aug      **Seismic imaging (geophysics) internship at CGG/Viridien.**
- Project processing multi-azimuth towed-streamer seismic data. Pre-migration denoising of shot gathers using deconvolution in various domains with sparseness constraints.
  - Presented PowerPoints of results to clients and acted on client feedback.
- 2023 Jul-Aug      **Research internship specialising in SEM methods, CASP.** Supervisor: Dr Michael Flowerdew
- Imaged and collected mineralogical and petrophysical data of candidate lithostratigraphic units for carbon storage; improved phase classification schemes for EDS data.
  - Investigated fluvial sediment build-up to advise on flood management in the Fens: source inference from mineralogy; deduced tidal bores as the mechanism of upstream transport.
- [Summary](#)
- 2022 August      **Assistant in the Tosca Lab, Dept. Earth Sciences, Cambridge.** Supervisor: Peter Methley
- Investigated amorphous Ca-Mg carbonate as precursor of dolomite formation. Designed system for synthesis; composition & structure verification via Raman spectroscopy & X-ray diffraction.

2022 July

**Placement in Palaeoclimate group, British Antarctic Survey.** *Supervisor: Dr Dieter Tetzner*

- Processed Antarctic ice cores; analysed ice core meltwater and set up chemical standards.
- Ran Monte Carlo simulations on spatial distribution of collected particulate matter in meltwater filters to inform transect selection for future analysis.

## FIELD EXPERIENCE

2023 Aug-Sep

**Geological mapping project in the Barrême Basin, Alpes-de-Haute-Provence, France.**

6-week independent mapping project funded by The Lord Mayor's Trust, Worts Travelling Scholars Fund, CASP, and Fitzwilliam College Cambridge. 10 km<sup>2</sup> area covering the eastern margin of a Tertiary thrust-sheet-top basin bounded by Cretaceous carbonate units.

**Field courses**

Isle of Skye (mapping), Cornwall & Dorset, Shropshire & Cumbria (mapping), Isle of Arran

## COMPUTING EXPERIENCE ([portfolio](#))

**Python**

[github.com/frozenglobe](#)

- Data acquisition via HTTP requests from web services
- Parsing & processing JSON, CDF, HDF5, netCDF and FITS files
- Manipulation of Python lists, NumPy arrays, pandas dataframes and Xarrays
- Data visualisation with Matplotlib, Plotly and APLpy
- Datetime manipulation & conversion; coordinate conversions with SpacePy and AstroPy
- Numerical methods: root-finding, IVP solving, PDE solving, curve fitting & interpolation
- Orbit propagation with simplified perturbations models; FFTs; Monte Carlo simulations

*Projects not already listed*

Modelled axisymmetric accretion disc for surface density profile, angular momentum transfer, and evolution of particle orbits.  $\langle V/V_{\max} \rangle$  test for quasars.

**QGIS**

Mapping project basemaps; river bathymetry analysis.

*Others*

LaTeX, Bash, Excel, Adobe Photoshop, Inkscape, Adobe Premiere Pro, Da Vinci Resolve.

## TALKS AND PRESENTATIONS

2024 Sep

[“Searching for s/c-generated plasma waves with Cluster”](#), QMUL Space Plasmas group

2024 Feb

[“Models of Pallasite Formation”](#), Institute of Astronomy Undergraduate Journal Club

2024 Nov/Dec

Internship experience & applications, CU Scientific Society & CU Women in Physics Society

## EXTRACURRICULARS AND VOLUNTEER WORK

2024-25

**Secretary of the Cambridge University Hillwalking Club.**

Responsible for communications and day-to-day running of the Club. Plan and lead group hikes.

2022-24

**Secretary and Acting Chair (2023) of the Cambridge University Astronomical Society.**

Organised weekly academic talks; taught members to operate telescopes; hosted observation nights in local communities. Facilitated relations between members, the Committee & the IoA.

2023 Jan-May

**STEM SMART mentor with Dept. Physics, Cambridge.**

Organised and led fortnightly mentor sessions with a group of ~20 Y12 students from underprivileged backgrounds, covering study & exam skills and university applications.

**Other**

Telescope operation at IoA public open evenings. Volunteered with Cambridge Hands-On Science, demonstrating experiments to primary schools. Assisted with College admissions & open days.

Solo-hiked the West Highland Way, funded by Fitzwilliam College Cambridge.

CU Ceilidh Band, CU Korfbal Club, Sedgwick Club (Cambridge Earth Sciences society).

Member of the Geological Society of London.