Jessica Lok

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I am interested in applications of fluid and continuum mechanics to geophysical and astrophysical problems, e.g. (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 accretion 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. I am an independent and driven individual always looking to expand my skillset.

EDUCATION

2021–2025 **University of Cambridge, UK,** Natural Sciences Tripos MSci, Class *I*

Year 4: Astrophysics, Class *I*, ranked 3rd in cohort

Courses: Astrophysical Fluid Dynamics, Dynamics of Astrophysical Discs, Physics of the Earth, Fluid Dynamics of the Solid Earth
Project: "Vertical dust profiles as diagnostics of protoplanetary disc winds" (Grade: *A+*)

Year 3: Astrophysics, Class *II.i*, ranked 10th in cohort

Year 2: Class *I*: Mathematics (*I*), Physics (*I*), Earth Sciences (*I*); *awarded the Clough Scholarship*

Year 1: Class *II*: 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 **Dust dynamics and synthetic observations of wind-driven protoplanetary discs.**
Master's project supervised by Prof Cathie Clarke & Dr Álvaro Ribas, Institute of Astronomy

Derived equations for coupled gas and dust dynamics in wind-driven, non-turbulent discs; devised numerical integration schemes to solve for vertical dust velocity and density profiles. Generated synthetic images of edge-on discs using radiative transfer code; established systematic methods to compare synthetic and real observations of edge-on discs.

2024 Jun-2025 Jun **Research internship, Space Plasma Physics group, QMUL.** *Supervisor: Dr Heli Hietala*

GitHub
Summary

Investigated plasma waves generated by satellites in low Earth orbit; calculated satellite conjunction geometry from orbital element sets; processed spacecraft ephemeris and VLF electric/magnetic field data; extended to potential radiation leakage from Starlink satellites, though inconclusive; external bow shocks of externally-photoevaporating protoplanetary discs.

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*

Summary

Imaged and collected mineralogical and petrophysical data of candidate lithostratigraphic units for carbon storage; improved phase classification schemes for EDS data; investigated tidal bores as cause of sediment build-up in the River Great Ouse to advise on flood management in the Fens.

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 & analysed Antarctic ice cores; set up chemical standards; ran Monte Carlo simulations on spatial distribution of particulate matter collected in filters for representative transect selection.

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^2 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 (GitHub / 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

Others LaTeX, Bash command line & scripting, QGIS, Excel, Adobe Photoshop, Inkscape, Adobe Premiere Pro, Da Vinci Resolve.

TALKS AND PRESENTATIONS

"Vertical dust profiles as diagnostics of protoplanetary disc winds", Institute of Astronomy (2025/05)

"Searching for sat-generated plasma waves", QM Space Plasmas group (2024/09), Cambridge Discs group (2025/01)

IoA Undergraduate Journal Club: *"Models of Pallasite Formation"* (2024/02), *"Asteroseismology"* (2025/02)

Internship experience & applications, CU Scientific Society (2024/11), CU Women in Physics Society (2024/12)

EXTRACURRICULARS AND VOLUNTEER WORK

2024-25 **Secretary of the Cambridge University Hillwalking Club.**

Responsible for communications, website, archives. Plan and lead group hikes and trail runs.

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, Cambridge Hands-On Science, College admissions & open days.

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

CU Ceilidh Band, CU Korfball Club, Sedgwick Club, Geological Society of London.