Jessica Lok

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I am interested in applications of fluid and continuum mechanics to geophysical and astrophysical problems. My primary interest is in the dynamics of planetary interiors covering both short-term processes (e.g. melt migration) and long-term evolution (e.g. core solidification). My secondary interest is in the (magnetohydro)dynamics of protoplanetary discs. With a background in solid Earth Science and Astrophysics, 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 10th 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 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

GitHub
Summary

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 proplyd bow shocks to deduce proplyd inclinations.
- Currently investigating VLF signals of radiation leakage from Starlink satellites.

2023 Jul-Aug

Summary

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.

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^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 (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.

Others QGIS, 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 Korfball Club, Sedgwick Club (Cambridge Earth Sciences society).

Member of the Geological Society of London.

References available upon request.