THE UNIVERSITY of EDINBURGH

UK CENTRE FOR ASTROBIOLOGY

MSc in Astrobiology & Planetary Sciences

School of Physics and Astronomy
University of Edinburgh

Professor Charles Cockell

EDINBURGH
Extraordinary futures await

Overview

1. What are astrobiology and planetary sciences?
2. Why Edinburgh?
3. Structure of our MSc programme
4. Application requirements and process

Astrobiology and planetary sciences

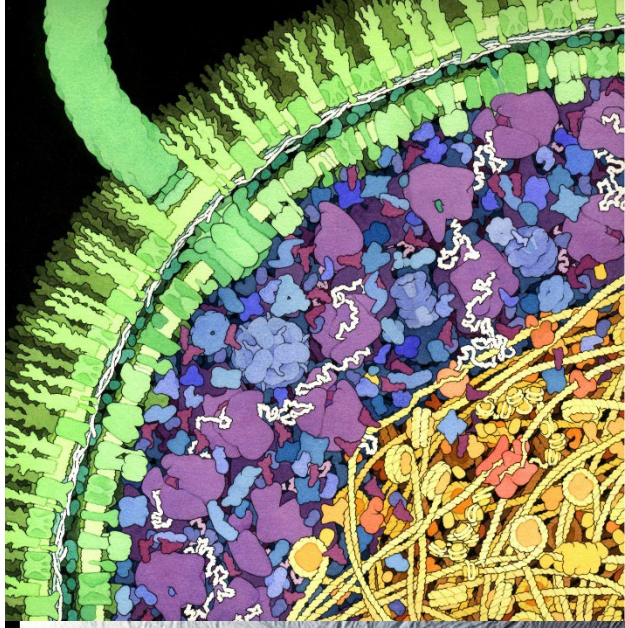
Astrobiology seeks to understand the origin, evolution, distribution, and future of life in the universe and thus to integrate biology with planetary science, astronomy, cosmology, and the other physical sciences.

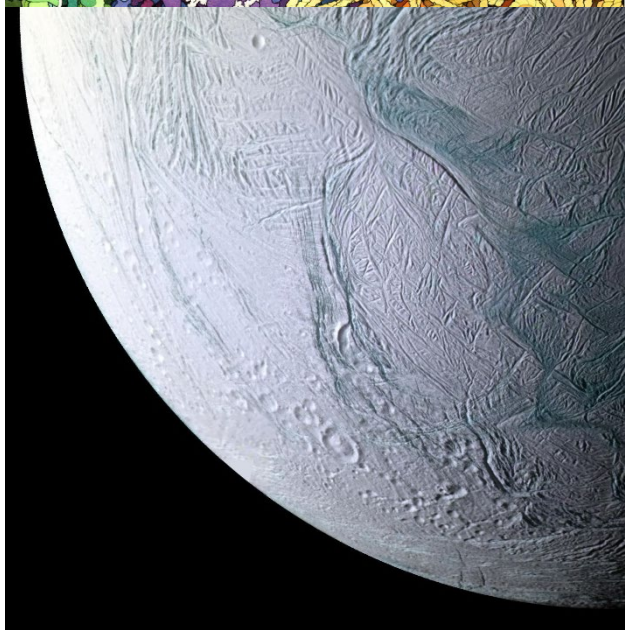
Planetary science seeks to understand the origin, evolution, composition and structure of planetary bodies.

These fields are interlinked — and draw on many other fields

Astrobiologists want to know:

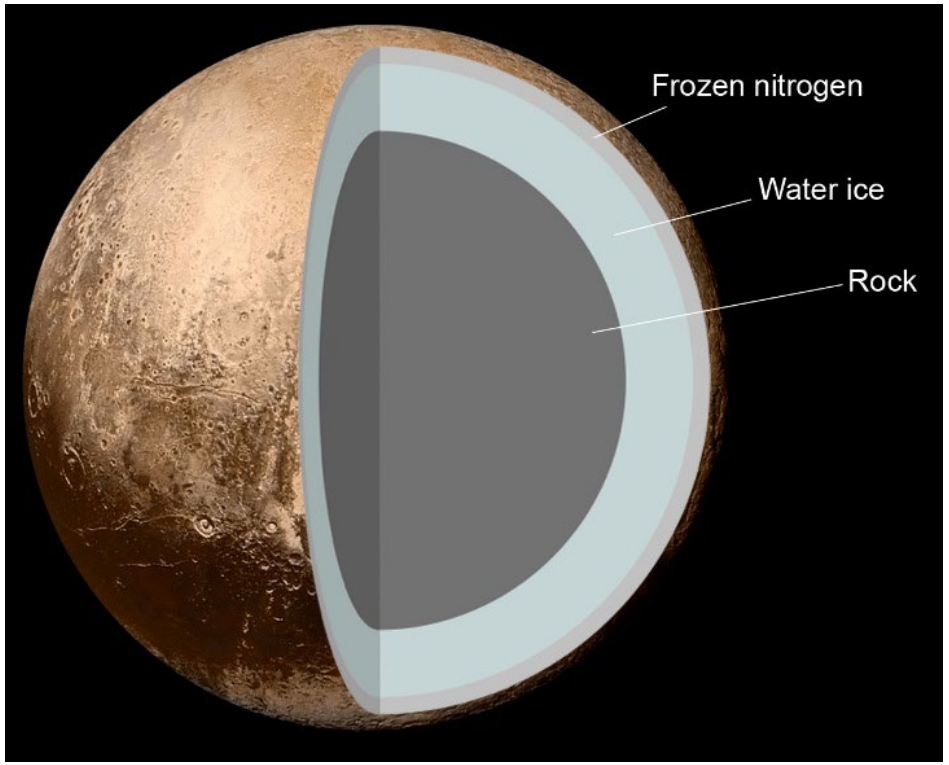
- How does life begin?
- How have extraterrestrial processes shaped life on Earth?
- What alternative forms could life take?
- Could life have arisen anywhere else?
- What makes a planet habitable?
- How should we go about searching for extraterrestrial life?
- “Are we alone?”



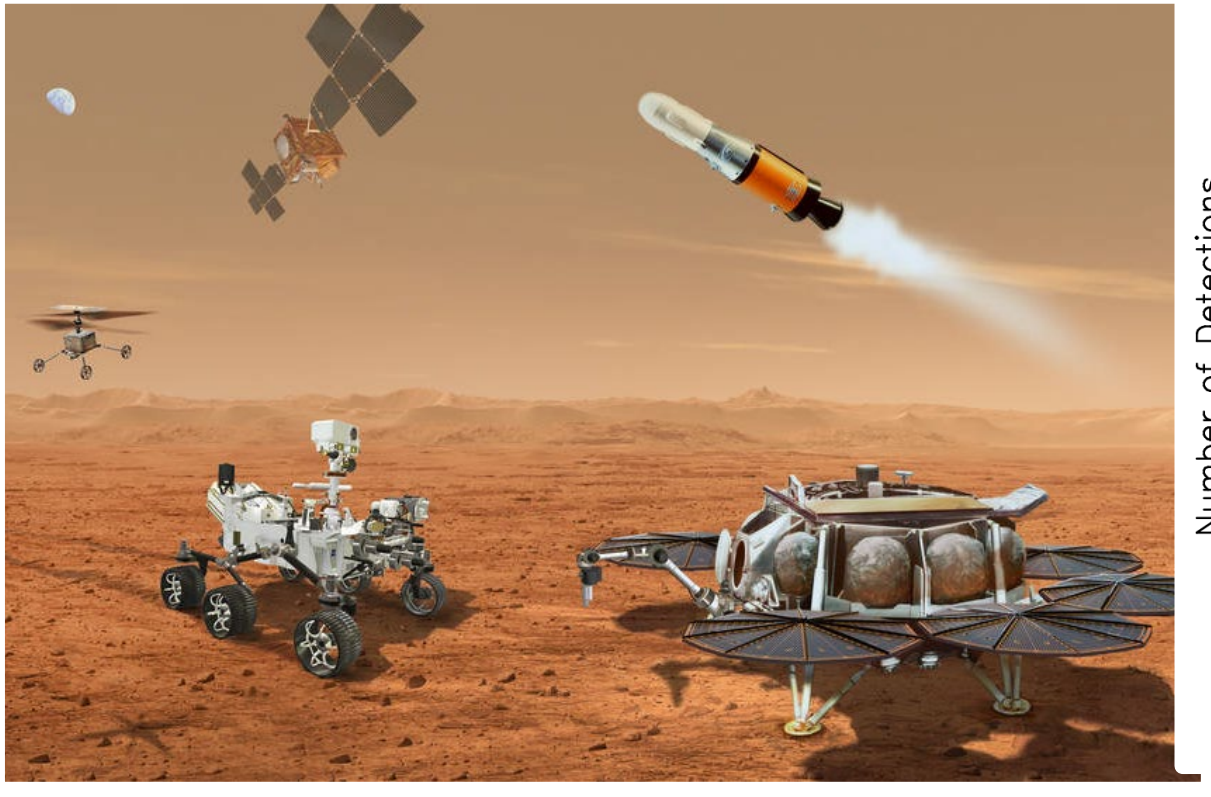


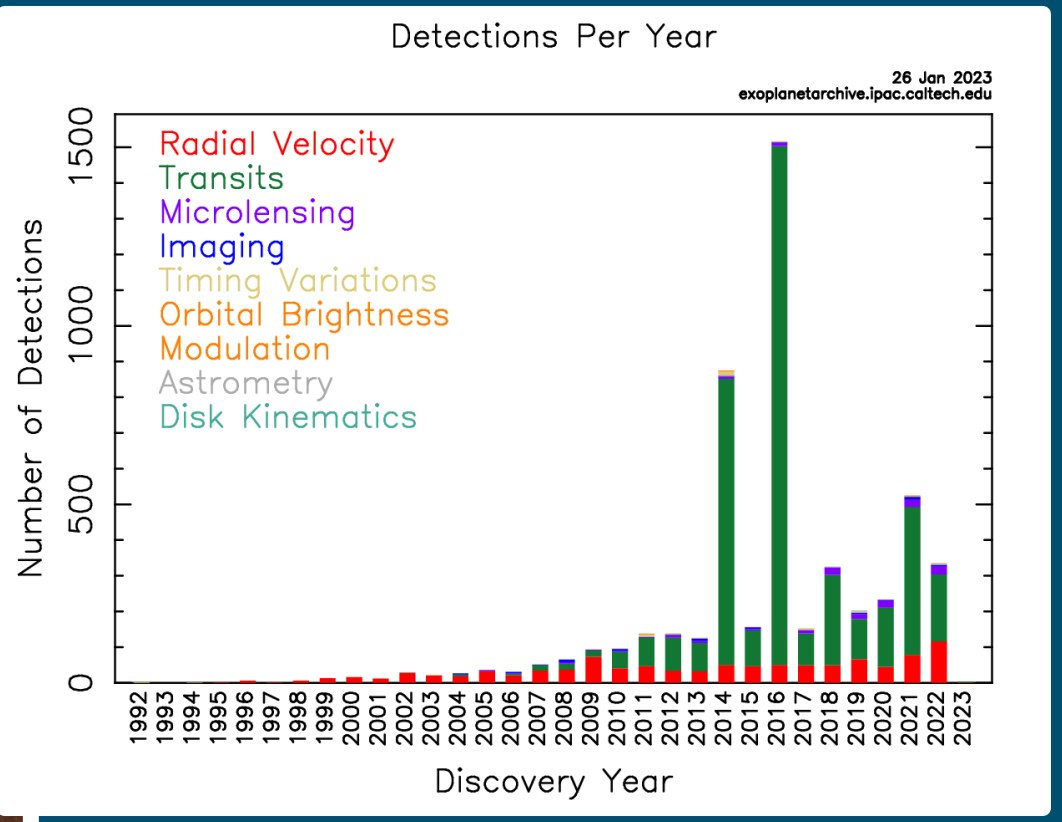
Planetary scientists want to know:

- How do planetary bodies form and change?
- What controls planetary structure and composition?
- How do planetary bodies acquire volatiles and organic molecules?
- How are other planetary bodies different from ours? Why?
- Are there other Earth-like planets?



An exciting time to join these fields





+ missions to Venus, Titan, Psyche, outer solar system…

Why Edinburgh?

- One of the world's great cities and universities
- Leading major advances in biology, geology, physics, chemistry, and space sciences for centuries
- Home of the Royal Observatory of Edinburgh, the UK Astronomy Technology Centre (STFC), the Centre for Science in Extreme Conditions, and the UK Centre for Astrobiology.
- Home to a thriving community of cosmologists, astronomers, astrobiologists, microbiologists, geologists, planetary scientists…

The UK Centre for Astrobiology (UKCA)

- An internationally known focus for research in astrobiology
- A community of 15-20 individuals
- Regular group meetings, journal clubs, and seminars from visitors
- Extensive, dedicated laboratory facilities in Edinburgh
- Original UK partner of NASA Astrobiology Institute
- Highly productive (150+ papers in the past 10 years)
- >150,000 learners have completed our online courses
- UKCA doctoral graduates have gone on to very successful careers

The UK Centre for Astrobiology (UKCA)

1 *Habitability*

How do physics and chemistry set life's fundamental limits?

What is a habitable planet?

Are Mars and the icy moons habitable?

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2 *Search for life*

What are the distinctive observable features of life?

Is there life on Mars?

How can we avoid false positive "detections"?

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3 *Space exploration*

Can biotech make space exploration sustainable?

What science can we do in space?

Should human society expand off-world?

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1 *Habitability*	2 *Search for life*	3 *Space exploration*
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What is a habitable planet?	**Is there life on Mars?**	**What science can we do in space?**
Are Mars and the icy moons habitable?	**How can we avoid false positive "detections"?**	**Should human society expand off-world?**

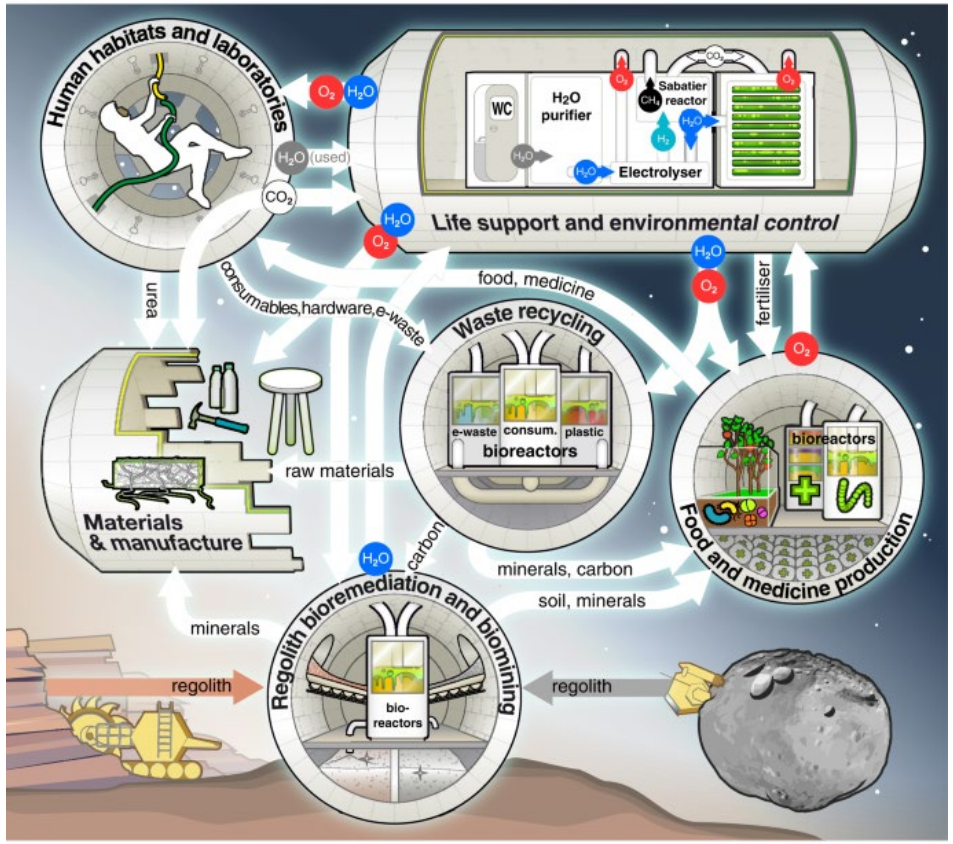
visit:
www.astrobiology.ac.uk

Edinburgh research — this year alone

UKCA scientists C. Loron, S. McMahon and E. Rodriguez demonstrated exceptional preservation of biomolecules in 400-million-year-old fossils —validating new techniques for probing the oldest fossils on Earth

Nature Communications **14**, Article number: 1387

Edinburgh research — this year alone



R. Santomartino, with collaboration from C. S. Cockell and S. McMahon, led an international review showing how microbes can make human space exploration more sustainable

Nature Communications **14**, Article number: 1391

Edinburgh research — this year alone

ROE Professor B. Biller helped to discover water, methane and carbon monoxide as well as silicate particles in the hot atmosphere of exoplanet VHS1256-b using the James Webb Space Telescope

Astrophysical Journal Letters **946** L6

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Introducing our MSc Programme

- New programme now teaching our first students!
- The (joint) first MSc Astrobiology degree to be offered in the UK
- A full-time, 12-month taught MSc (lectures, seminars, practicals, workshops) with a research dissertation
- Designed to shape highly trained, critically minded, interdisciplinary scientists well qualified for doctoral study and for a range of scientific, technical, and other careers

Some suggested destinations

Our experience suggests that MSc graduates will go on to:

- PhD-level study in relevant fields
- Technical careers
- Science communication
- Scientific publishing
- Science journalism
- Scientific civil service
- Science teaching
- Data science and quantitative research

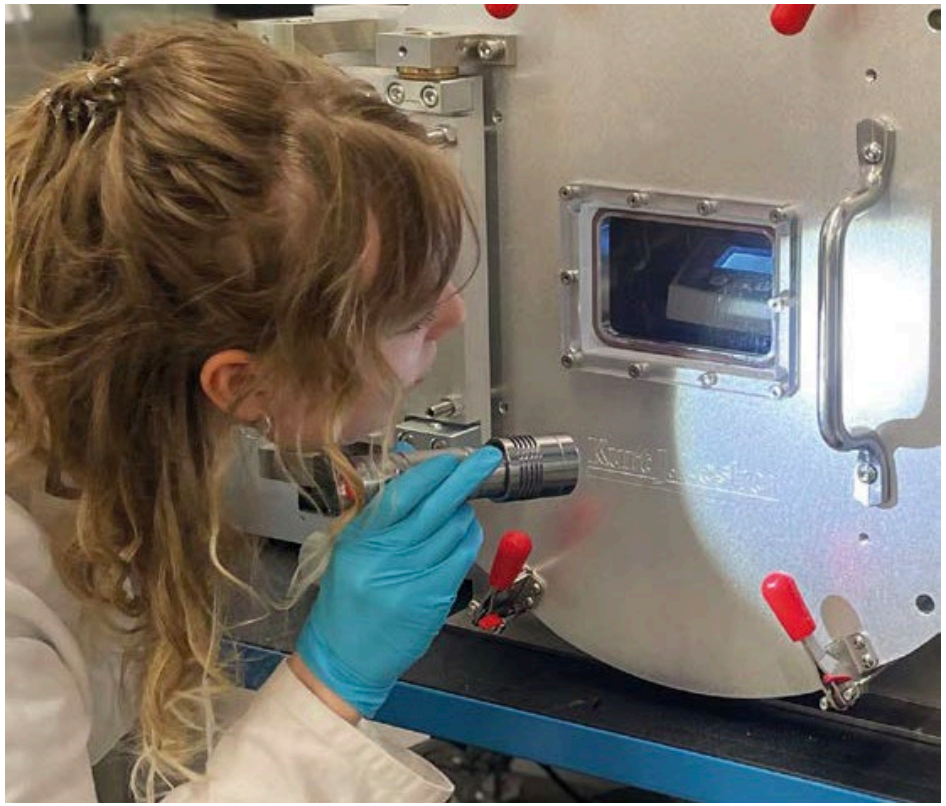
Core (mandatory) courses

Semester 1	Lead School
Astrobiology: Theory	Physics and Astronomy
Project Design and Literature Analysis	GeoSciences
Semester 2	**Lead School**
Astrobiology: Methods	Physics and Astronomy
Social Dimensions of Astrobiology and Space Exploration	Science, Technology and Innovation Studies
Dissertation (Semester 2+)	Physics and Astronomy

Core course: Astrobiology Theory

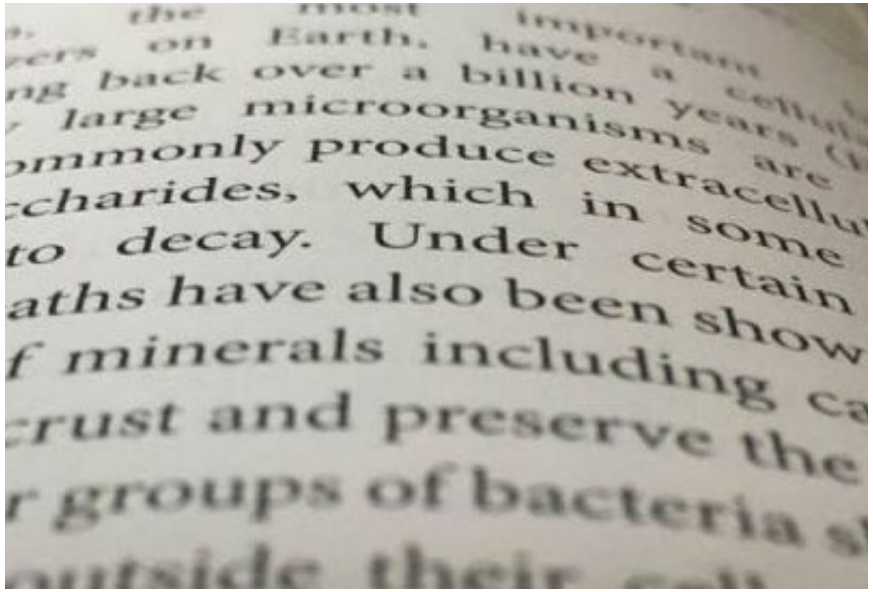
- Properties and relationships of life
- Structure of the physical universe
- The origin and evolution of life
- Habitability and extreme conditions
- Biosignatures and life detection
- Evolution of life over multi-billion-year timescales.
- Latest developments and debates

Core course: Astrobiology Methods



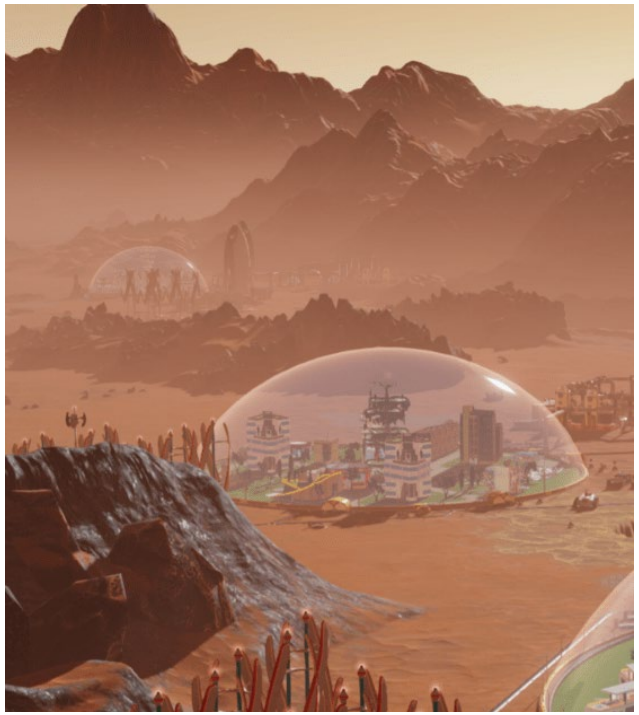
- Professional training in scientific skills and acumen
- Established and emerging research methods
- Funding and institutions
- Space mission development
- Career pathways

Core course: Project Design & Literature Analysis



- Key preparation for the dissertation
- Master the literature on your chosen topic
- Design your own research project
- Write your own proposal
- Present your proposal together with students on other MSc programmes

Core course: Social Dimensions of Astrobiology and Space Exploration



- History and status of astrobiology
- Epistemology of extraordinary claims
- Sci-fi and pop culture depictions of astrobiology
- Planetary law and politics
- EDI in astrobiology and work in space
- Environmental ethics and planetary protection
- Ethics of space exploration

A choice of planetary science courses

Planetary Science

- More geoscience-focused
- Evolution and diversity of planetary bodies
- Emphasis on planetary processes (e.g., core formation, volcanism)
- Semester 2 Course

or

Astrophysics: Stars and Planets

- More astrophysics-focused
- Structure and evolution of stars and planets
- Observational astronomy
- Semester 1 Course

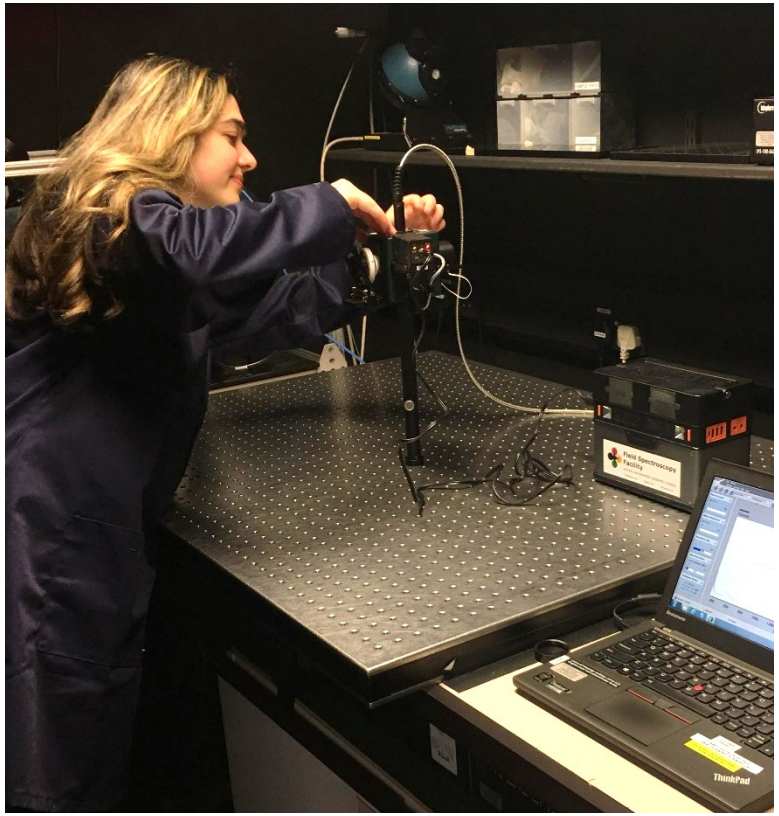
Further options

Semester 1	**Credits**
Principles and Practice of Remote Sensing	20
Biophysical Chemistry	10
Probability and Statistics	10
Environmental Geochemistry	10
Semester 2	**Credits**
Advanced Analytical & Characterisation Methods	20
Python for Life Science	10
Space Law (not available 2023-2024)	10

choose 30 or 40 credits

+ up to 10 credits of additional science courses, for 120 taught credits overall

Completing the 60-credit dissertation



- Design and conduct your own research project supervised by an expert
- Discuss and solve technical problems
- Critically evaluate the investigation
- Produce a substantial, coherent, well expressed research report of about 15,000 words
- Summarise your findings clearly in an oral presentation.

Application process

- Your application will include degree transcripts, a CV, reference letters, and proof of English language competency
- Your personal statement should discuss why you are interested in the programme and outline any previous experience with science subjects **outside the main focus of your undergraduate programme**.
- Apply separately for the **Higgs Scholarship (£10,000 deduction from tuition fee)**, awarded for academic merit + financial need

What we are looking for

- A UK 2:1 honours degree, or its international equivalent, in a natural science or related discipline.
- Good academic performance in quantitative subjects
- **Familiarity** with university-level concepts in at least **two** of the following subjects: **physics** (including geophysics, astrophysics, or biophysics), **biology** (including astrobiology, microbiology, molecular biology, palaeontology or evolution), **chemistry** (including geochemistry or biochemistry), **planetary/geoscience**, and **astronomy**.

Any questions?

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