The dynamics of Earth's magnetopause and their space weather impacts

PhD project
Space, Plasma & Climate Physics
October 2026 start, full-time

Supervisor Dr Martin Archer
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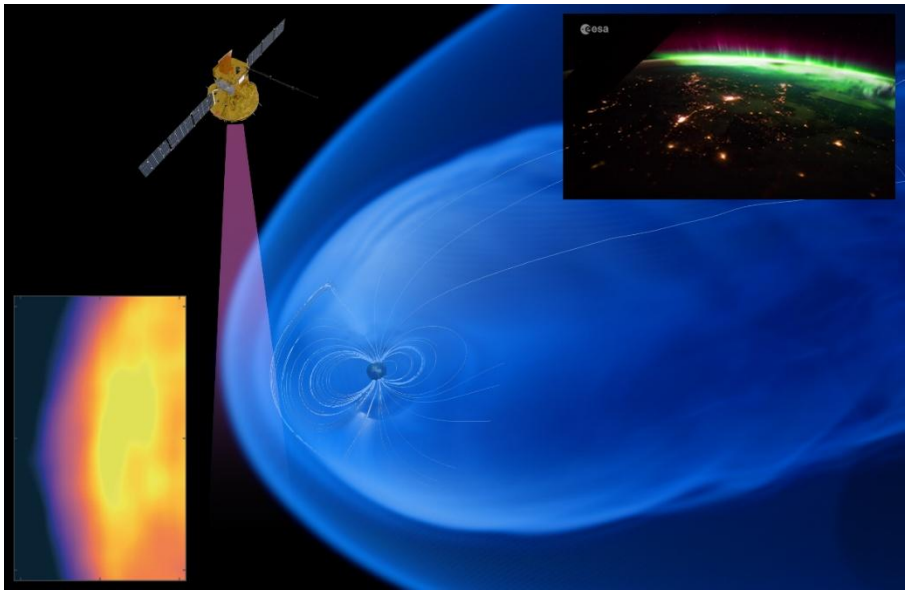

This PhD project will probe the coupling and interplay between the solar wind and magnetosphere at its interface, the magnetopause, in new ways to understand not only the fundamental space plasma interactions but also elucidate how these impact upon our global space environment leading to space weather effects that can affect our everyday lives and society.

The **ESA-CAS SMILE mission,** due to launch imminently, will image the dayside magnetosphere for the first time in soft X-rays from solar wind charge exchange. Since X-ray emissions are expected to peak at the magnetopause, SMILE offers the possibility of remote sensing magnetopause dynamics for the first time. Through leveraging other spacecraft and ground-based instruments, these can then be linked to the effects felt within geospace and on the ground. This exciting new capability offers many possible opportunities in determining the large-scale response of the first link in the geospace processing chain that ultimately leads to space weather.

You will work in the context of international collaborations and the wider multi-national mission and instrument teams. Depending on your interests and skills, there will be opportunities to be involved with:

- Processing and analysing cutting-edge **SMILE remote sensing** soft X-ray data to track the magnetopause's motion for the first time
- Undertaking **global simulations** of the solar wind – magnetosphere interaction using the Gorgon magnetohydrodynamic code developed at Imperial (shown above) for interpreting of SMILE observations
- Leveraging **constellations of *in situ* spacecraft** observing conditions within the solar wind and magnetosphere, linking these to one another and SMILE observations
- Analysing **globally distributed ground-based measurements** of auroral, ionospheric, and geomagnetic processes to determine how space weather effects arise from the dynamics in space
- Developing **magnetohydrodynamic theory** and numerical models underpinning these observations

This project is highly centred on data analysis, computer programming, and data visualisation. Experience with these will be vital. It will also leverage advanced interdisciplinary signal processing and machine learning methods, which it would be an advantage for you to have some familiarity with. Knowledge of basic plasma or space physics would also help, but is not necessarily required upon application.

For more information, please contact Dr Martin Archer (m.archer10@imperial.ac.uk)

Funding Notes

This project is fully funded by the Department of Physics at Imperial College London for students with 'home' fee status. The studentship is available via a competitive process. The successful candidate will receive full funding for tuition and stipend. Due to the nature of the funding available, 'overseas' and self-funded students are not eligible.

Apply here via My Imperial

Deadline 30 June 2026