

Physics & Astronomy PhD Project Proposal

Project Title: Earth's magnetospheric dynamics

Project reference: STFC – Imber

Groups: Planetary

Supervision Team:

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Three Key Points

- Solar wind-magnetosphere coupling
- Reconnection at the Earth
- Space weather

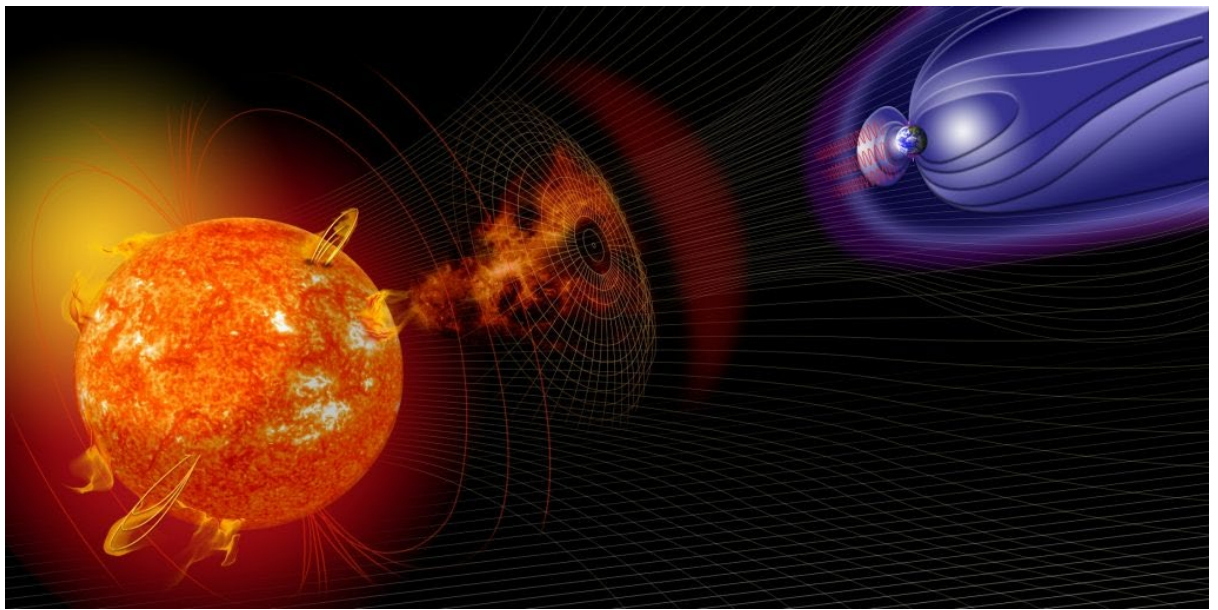
Project Description

Space weather events pose a major threat to modern day technology, from power grid stability and GPS systems, to satellite instrumentation and astronaut health. These impacts are both directly caused by energetic particles, and indirectly due to the passage of coronal mass ejections (bundles of magnetic field and plasma) from the Sun interacting with the Earth's environment. This interaction generates both global-scale circulation of the Earth's magnetic field, and the enhancement of global ionospheric current systems, which can result in damaging induced currents at the Earth's surface (GICs). We observe these currents and their associated auroral signatures using a combination of ground-based magnetometers, constellations of Earth-orbiting satellites, and auroral imagers. Recent observations have reported two localised groups of GICs, one group at auroral latitudes near midnight associated with auroral features, and the other near magnetic dawn. The goal of this project would be to investigate the drivers of these dawn GICs, linking their occurrence to the dynamics of the wider magnetosphere. This would be achieved by analysing data from a variety of missions, such as SuperMAG – a global network of ground magnetometers; SMILE FUV – an auroral camera onboard the new ESA SMILE spacecraft mission; SuperDARN – a global network of ionospheric radars; and MMS – a constellation of four magnetospheric spacecraft with high resolution instrumentation. The work will involve a combination of case studies and statistical studies, and some machine learning techniques may be applied where appropriate.

Further Reading:

- <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2024JA032811>
- <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2024JA032483>
- <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020JA028437>

Images/Graphics:



Credit: NASA. Caption: Space Weather at the Earth is driven by the dynamic solar wind.

Application advice: Please see web page

<https://le.ac.uk/study/research-degrees/funded-opportunities/stfc>