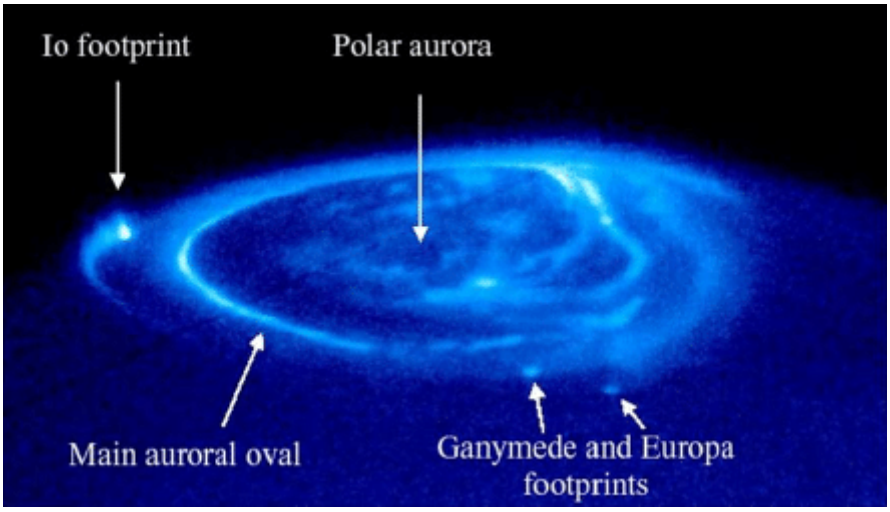
Magnetospheres of the Gas Giants:- Analysing Juno (Jupiter) and Cassini (Saturn) magnetic field data to determine magnetospheric current systems and their internal and external drivers

- **Join a world leading research group as they study the magnetospheres of the giant planets.**
- **Analyse data from the Juno mission as it orbits Jupiter, and the highly successful Cassini mission to Saturn.**
- **Your research will help prepare for future missions to the outer planets, such as JUICE.**

Level	PhD
First Supervisor	Emma Bunce
Co Supervisor	Gabrielle Provan
Application Closing Date	19 January 2022
PhD Start date:	26 September 2022

Project Details:

In this PhD project you will examine magnetospheric current systems at Saturn and Jupiter using data from the NASA/ESA Cassini and NASA Juno spacecraft, respectively. Both Saturn and Jupiter are fast rotators with internal plasma sources and strong magnetic fields supported by extensive current systems. Azimuthal ring currents flow within these planetary magnetospheres, shaping their magnetospheric cavities. Planetary magnetospheres are not steady structures, but constantly varying magnetic systems which are influenced by drivers both internal to the magnetosphere and by the external solar wind. Large auroral current systems are formed within both magnetospheres which create luminous and ever changing auroral light displays in the planet's upper atmospheres. Studying both the auroral currents and the ring currents at Saturn and Jupiter can tell us how energy and momentum is transferred from the Sun and throughout the solar system.



Jupiter's auroras

The Cassini mission orbited Saturn from 2004 until 2017, and the Juno mission continues to orbit Jupiter since insertion to polar orbit in 2016. Each spacecraft makes unique measurements of the electric currents which flow both along magnetic field lines (driving the aurora) and azimuthally around the planet as a ring current extending into the magnetosphere. Using the signatures detected by the Juno and Cassini magnetic field instrument, the student will measure the current systems surrounding Jupiter and Saturn, allowing a direct comparison with models, and thus revealing the driving forces behind these currents.

The project will involve data analysis, data presentation, interpretation and comparison of results with theoretical model and possibly the updating of these models (depending on results!). Full training will be

Further information on how to apply and funding can be found HERE

given, the project will involve a significant amount of computer programming in both IDL and Python. Report writing and presenting results at international conferences is important.

The PhD will be supervised by Professor Emma Bunce, the current President of the Royal Astronomical Society. Emma has performed ground-breaking research at the outer planets. She is the Principal Investigator of the MIXS instrument onboard the ESA BepiColombo mission to Mercury, and CoI on two instruments on the ESA JUICE mission.

The project will be co-supervised by Dr Gabby Provan, a highly experienced planetary research scientist, with expertise of the Earth, Jupiter and Saturn's magnetospheres.

References:

1 Connerney, J. E. P., Timmins, S.,Herceg, M., & Joergensen, J. L. (2020).A Jovian magnetodisc model for theJuno era. Journal of GeophysicalResearch: Space Physics, 125,e2020JA028138. https://doi.org/10.1029/2020JA028138

2 Hunt, G. J., Bunce, E. J., Cao, H., Cowley, S. W. H., Dougherty, M. K., Provan, G., & Southwood, D. J. (2020). Saturn's auroral field-aligned currents: Observations from the northern hemisphere dawn sector during Cassini's Proximal orbits. Journal of Geophysical Research: Space Physics, 125, e2019JA027683. https://doi.org/10.1029/2019JA027683

3 Hunt, G. J., Provan, G., Bunce, E. J., Cowley, S. W. H., Dougherty, M. K., & Southwood, D. J. (2018). Field-Aligned Currents in Saturn's Magnetosphere: Observations From the F-Ring Orbits. Journal of Geophysical Research: Space Physics, 123(5), 3806–3821. https://doi.org/10.1029/2017JA025067