The ionosphere of Jupiter in the Juno era

- **Work with state of the art spacecraft data to characterise the physical conditions of the ionosphere, and how it changes over time**
- **Investigate the interplay between heating of the ionosphere by auroral heating and heating by gravity waves**
- **The opportunity to lead ground-based observing programmes using world-class telescopes**

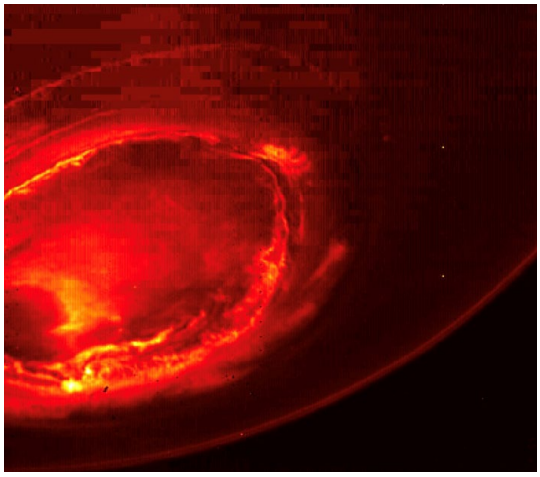
Level	PhD
First Supervisor	Henrik Melin
Second Supervisor	Tom Stallard
Application Closing Date	19 January 2022
PhD Start date:	26 September 2022

Project Details:

The NASA Juno spacecraft has been in orbit at Jupiter since 2016 in 53 day long polar orbit. This provides completely new and dramatic views of the planet, very different from the ones we get from here at Earth. The near-infrared instrument on the orbiter (JIRAM – the Jovian Infrared Auroral Mapper) provides stunning data of ionosphere, the charged particle component of the upper atmosphere. The ionosphere is a very important region since it can 'feel' the magnetic field, and is there for a region where momentum and energy is exchanged between the atmosphere and the magnetosphere. The stunningly bright and variable auroral displays at Jupiter provides a mechanism to heat the upper atmosphere at the poles, but how is this energy re-distributed towards lower latitudes? Our understanding of the ionosphere away from the auroral region is very limited, and Juno JIRAM provides a window through which we can begin to understand this region.

Jupiter, Juno and the JIRAM instrument

A dominant ion in the ionosphere is the molecular ion H3+, and by fitting its observed spectrum using the model developed at Leicester we can determine the temperature and ion density of any particular point on the planet, with each successive orbit providing a view of how this changes over time. This project will investigate how energy is re-distributed in the upper atmosphere of Jupiter, and how important the heating by gravity waves, generated by the turbulent lower atmosphere, are on a global scale.



Juno JIRAM observations of Jupiter's aurora

Researchers at the University of Leicester are world leaders in the study of the ionospheres of the giant planets, and the PhD candidate will be joining an active research team with collaborators in Japan and the US.

The PhD candidate will also have the opportunity to lead Juno support observations using the NASA Infrared Telescope Facility in Hawaii, from which we can determine the amount of forcing that the magnetosphere exerts on the ionosphere and atmosphere, a highly complementary data product to the high spatial resolution data taken by Juno JIRAM.

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

Successful PhD candidate will have some prior experience in coding and the project will predominantly use Python, as well as the High Performance Computer system at the University. With Leicester's involvement in the James Webb Space Telescopes, and the ESA Juice mission to Jupiter, the Planetary Science Group is a vibrant and dynamic setting for studying the giant planets. .

References:

1 Thirty years of H3+ astronomy, Miller S. and Tennyson, J., Rev Mod Phys, 2020, https://journals.aps.org/rmp/abstract/10.1103/RevModPhys.92.035003

2 Identification of Jupiter's magnetic equator through H_3^+ ionospheric emission, Stallard et al., Nature Astronomy, 2018, https://www.nature.com/articles/s41550-018-0523-z

3 Mapping H_3^+ Temperatures in Jupiter's Northern Auroral Ionosphere Using VLT-CRIRES, Johnson et al., JGR, 2018, https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018JA025511

4 Juno/JIRAM's view of Jupiter's H_3^+ emissions, Dinelli et al., Phil. Trans. Roy. Soc, 2020, https://royalsocietypublishing.org/doi/10.1098/rsta.2018.0406

5 H3ppy - H3+ fitting routine - https://github.com/henrikmelin/h3ppy