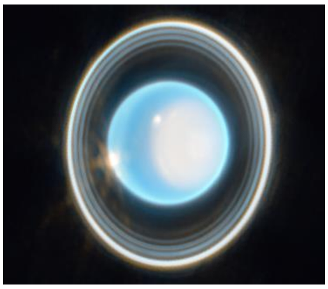
Development of a Uranus Upper Atmosphere Model



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Planet Uranus orbits at a distance of around 20 AU from the Sun (Earth being at 1 AU) and hosts an atmosphere composed primarily of hydrogen and helium. Having been visited only once by a spacecraft (Voyager 2 in 1986), comparatively little is known about its atmosphere. Recent remote measurements with the James Webb Telescope have revealed information about its deeper atmosphere and clouds, and regular ground-based observations with the NASA Infrared Telescope Facility (IRTF) measure thermal emissions from H_3^+ in its upper atmosphere, giving us information about the temperatures. Uniquely, Uranus is tilted on its side with its pole lying close to the equatorial plane on its orbit around the Sun. Uranus also has an intrinsic magnetic field and thereby hosts a magnetic 'bubble' around it, a magnetosphere, which has a strong heating effect on its upper atmosphere (thermosphere) and guides high speed electrons impacting upon the thermosphere which cause local ionisation. Electric fields from the magnetosphere accelerate plasma in the upper atmosphere (ionosphere). The magnetic axis is strongly titled relative to its rotation axis, making Uranus a unique and fascinating object to study. Driven by curiosity about this under-explored planet, concepts for space missions to Uranus are currently being studied by space agencies.

Aim of the project to develop a first-principles physics-based global 3-D model of Uranus' upper atmosphere (thermosphere and ionosphere), allowing us to examine theoretically the winds, temperature- and gas composition structures of its upper atmosphere and how these vary over time (changing solar cycle and magnetosphere conditions). The project offers the scope to investigate a plethora of physical phenomena, including thermosphere and ionosphere structure and variability, relevant chemistry, seasonal changes, and atmospheric waves which are thought to play a crucial role. The model will be based on existing codes for Saturn and Jupiter, your task will be to adopt the existing models to Uranus conditions. This offers the scope of direct comparisons between the planets, deepening the physical understanding. Alongside strong enthusiasm and motivation for the science, you should bring experience in coding.

You will join a group of space physics experts involved in observations and theoretical modelling of Saturn, Jupiter, Mars and Venus. The project offers opportunities to work with scientists within the Space, Plasma and Climate Community as well as other space scientists across the UK and abroad.