BOSTON UNIVERSITY

Boston University College of Arts & Sciences
Center for Space Physics

2025 SPACE PHYSICS SEMINAR SERIES

Jupiter's Local-Time Dependent Alfvén Radius

Jovian magnetospheric plasma is coupled to the ionosphere through Alfvén waves. Alfvén waves enable the transport of angular momentum and energy between the planet and magnetospheric plasma, a process that ultimately generates Jupiter's bright auroral emissions. However, past the Alfvén radius, the location where the radial velocity is greater than the Alfvén velocity, magnetospheric plasma is effectively decoupled from the planet, with fluctuations in the local magnetosphere no longer communicated back to the planet. Determining Jupiter's Alfvén surface is critical for interpreting drivers of auroral emissions, in situ data, and applications of numerical models. Previous studies that calculated the location of the Alfvén radius assumed an azimuthally symmetric magnetosphere and local-time independent magnetic field. Here, we employ a statistical description of the magnetic field that includes local time effects. We find a minimum Alfvén radius of 30 RJ (Jupiter radii) at 6 LT, with plasma decoupled from the planet in the post-dusk through dawn sector. Furthermore, no Alfvén radius exists within 60 RJ between 8 and 20 LT. At distances greater than 50 RJ, the Alfvén travel time is such that magnetospheric plasma moves substantially in the magnetosphere before angular momentum can be efficiently transferred from the atmosphere. Therefore, the angular momentum supplied may no longer be sufficient for the local conditions. Our results highlight the importance of local time considerations in MI coupling studies and offer new interpretations for local time dependent auroral features, such as the polar collar.

Thursday, April 3rd

3:30 - 4:30 p.m.

725 Commonwealth Ave | Room 502

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