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Magnus force effects in the rotating ionospheres of Venus and Mars

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Abstract

Measurements conducted with the ORPA instrument of the Pioneer Venus Orbiter in the Venus ionosphere and with the ASPERA-3 instrument of the Mars Express spacecraft in the Mars ionosphere have been examined to identify effects related to the Magnus force that is produced by the combined presence of the directed motion of each planet's eroded upper ionospheric plasma and the rotating lower altitude region of their ionosphere [1]. The overall response of the ionosphere to that force is a dawn-dusk asymmetry in the distribution of the upper nightside ionosphere as well as in the plasma wake that extends downstream from it. At Venus the high altitude ionospheric trans-terminator flow is displaced towards the dawn side consistent with the fast retrograde rotation of that planet's atmosphere. At Mars the velocity vectors derived from the ASPERA-3 measurements in that planet's ionosphere are examined to determine if there is a dawnward deflection in the distribution of the eroded ionospheric plasma consistent with the prograde rotational motion of the planet and its atmosphere. Calculations are carried out to estimate the angular deflection of the upper layers of the ionospheric plasma that is eroded by the solar wind in each planet.

References

[1] Pérez-de-Tejada, (2006), J. Geophys. Res., 111, JA011554

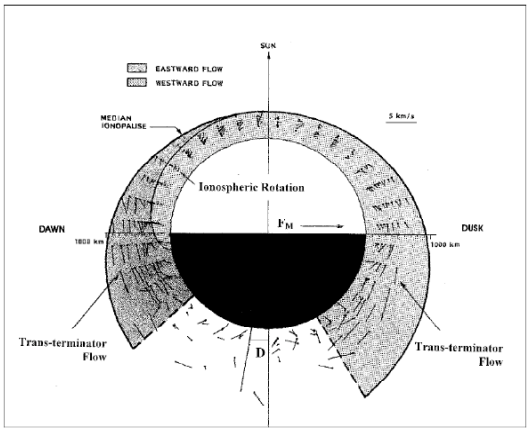

Figure 1: Anti -Sunward O^+ velocity averages in the trans-terminator flow measured in the Venus ionosphere with the ORPA instrument of the PVO. As a result of the super-rotation motion of the Venus atmosphere/ionosphere ¨dawn¨ occurs in the +Y solar ecliptic direction.

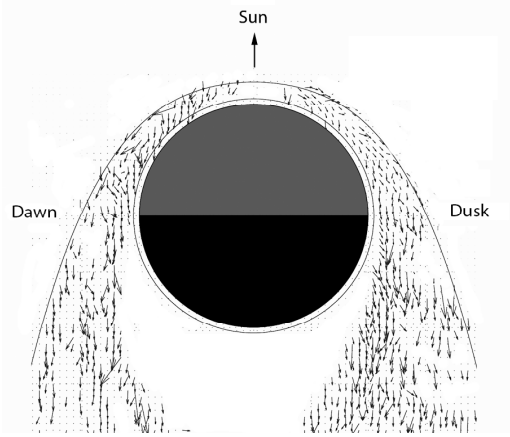

Figure 2: <200 eV O^+ flow near Mars measured by the ASPERA-3 experiment on MEX.