Geophysical Research Abstracts, Vol. 9, 05430, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05430

Detection of an upper layer in the topside ionosphere of Mars using the Mars Express ionospheric sounder

A.J. Kopf, D.A. Gurnett, D.L. Kirchner, D.D. Morgan, and T.F. Averkamp

Dept. of Physics and Astronomy, University of Iowa, Iowa City, Iowa , USA
(andrew-kopf@uiowa.edu)

The Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS) aboard ESA's Mars Express spacecraft has now provided nearly two years of radar measurements of the Martian ionosphere. Data are most commonly analyzed as an ionogram, which plots the time delay of the received reflections as a function of frequency, color coded for amplitude. An ionospheric radar echo appears as a trace exhibiting a smooth increase in time delay with frequency that has an intensity typically at least two orders of magnitude higher than the background noise. As frequency increases, this trace typically exhibits an abrupt increase in time delay at some frequency, forming a discontinuity in the trace that we call a "cusp." These cusps indicate locations of maximums in the electron density as a function of altitude. Previous analysis has shown that the main Martian ionospheric layer has a peak electron density of roughly 10^5 cm^{-3} at an altitude of near 130 km, consistent with the results from the Viking landers in the 1970s. However, MARSIS ionograms have also commonly shown a cusp at higher altitude, indicating the presence of another distinct layer higher in the ionosphere. Early analysis indicates that the peak density of this layer is typically around 5 x 10^4 cm^{-3} at an altitude of above 200 km. We believe the most probable cause for this feature is a peak in the concentration of O^+ ions, which were previously detected to peak at around 225 km by the Viking landers. In addition, we consider the possibility that this second cusp could be due to magnetization in the Martian ionosphere. This feature has been detected at many locations in the planet's ionosphere at various spacecraft altitudes, and shows no indication of time dependence. Therefore, regardless of its source, this feature is believed to be a normal part of the Martian ionosphere and not due to variations in the solar UV flux.