



## **Radar sounding observations of the nightside Martian ionosphere**

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The Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) instrument on the Mars Express spacecraft began operations in June 2005. The spacecraft immediately began making observations of the nightside Martian ionosphere in the northern hemisphere using both the subsurface and ionospheric modes of the instrument. Nighttime operations were limited as the orbit progressed to dayside, resuming in the southern hemisphere in November 2005. Observations indicate that the Martian ionosphere is generally well described by Chapman theory up to solar zenith angles of about  $100^\circ$ . At higher solar zenith angles, ionospheric echoes are highly variable with electron densities ranging from less than  $2000/\text{cm}^3$  to a typical maximum of  $8000/\text{cm}^3$ . Ground echoes with little dispersion are frequently observed simultaneously at frequencies below the maximum plasma frequency in the ionosphere, indicating considerable fine structure in the ionosphere. Analysis of ground reflections indicates a typical nighttime total electron column density of about  $10^{15}/\text{m}^2$ . The highest nighttime electron densities tend to occur over regions with strong remnant crustal magnetic fields.