On the Fluctuation of the Critical Frequency of Martian Dayside Ionosphere Observed by MARSIS

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The Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS) on MEX works as a topside ionosonde in the Active Ionospheric Sounding (AIS) mode. It measures the ionospheric plasma frequency as a function of altitude. The critical frequency corresponds to the peak electron density of Martian ionosphere, which generally behaves as a Chapman-alpha layer with respect to solar zenith angle. However, besides this first-order approximation, apparent fluctuations of ~200kHz in the critical frequency are often observed. These fluctuations are more wavelike than being random like measurement errors. The time scale is in the order of 1 minute. If this ~6% fluctuation in critical frequency honestly presents the fluctuation in peak electron density, the electron density fluctuation is larger than 10% of its value, which would be significant. Factors that may contribute to the apparent fluctuations include local plasma resonance, ionospheric waves, crustal magnetic fields, etc.. We will explore possible causes of this phenomenon.