

SOUNDING MARS BY SCHUMANN RESONANCES AND ELECTROMAGNETIC TRANSPARENCE

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Abstract: The study of the propagation of ELF waves is essential for the electromagnetic sounding investigations planned for some of the future Martian missions. Future surface stations will have the possibility of continuous recording of the low frequency magnetic and electric field fluctuations and also sound the upper ionosphere by transmitters/receivers on ground. Natural electromagnetic waves produced near the surface by electrostatic discharge in dust storms (dust devils) or geological activity can be trapped in the resonant cavity formed by the surface and upper ionosphere, as it occurs on Earth. The measurements of resonant frequencies, also called Schumann frequencies, by ground stations can be used for remote sensing of the ionospheric structure and ground/subsurface conductivity. We present here a numerical model of the Martian atmosphere with the aim of calculating the resonance frequencies and its dependence with solar season, daytime and weather conditions. As it happens with the Schumann resonances on Earth, losses associated with the electric conductivity will make these frequencies to be lower than the theoretically predicted for a ideal two conductivity layers. We also investigate the frequency range of waves able to cross the ionospheric layers, by comparing theoretical and experimental measurements taken by previous orbiters. It is possible to estimate the ionospheric electron density, which has a strong dependence with local time and season.

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