Modeling Ionospheric Densities and Flows in Crustal and Draped Magnetic Fields at Mars

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NASA's Mars Atmosphere and Volatile Evolution (MAVEN) explorer has been in orbit around Mars for over 5 years now, collecting valuable data about the planet. Specifically, the Langmuir Probe and Waves (LPW), the Neutral Gas and Ion Mass Spectrometer (NGIMS), and the Suprathermal and Thermal Ion Composition (STATIC) instruments measure important ionospheric properties. The instruments measure electron densities and temperature (LPW), neutral gas and ion composition (NGIMS), and the properties of escaping ions (STATIC). Electron and ion density and flux measurements are presented. The data indicates significant differences in ion properties between open crustal, closed crustal, and draped magnetic fields. Similar differences are noted for electrons as well. An ionospheric model has been developed that produces a profile of the ionosphere. The model then explores the evolution of the ionosphere, via chemistry and transport. At low altitudes (z<300 km), chemistry dominates, while transport dominates at higher altitudes. Results show significant differences in the ionosphere between the types of fields. The model utilizes data from the Magnetometer (MAG) instrument to provide properties of magnetic fields at Mars. The model may also help explain some of the atmospheric loss occurring at Mars. This is compared to data from STATIC. Analytic arguments for subsonic vs supersonic flow speeds (in the open field case) are also presented.