

Overview of the Ionospheres of Unmagnetized Solar System Bodies

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Abstract

The physical and chemical processes operating in all ionospheres are very similar. Ionospheres are formed when solar radiation or precipitating particles from the external environment (e.g., magnetosphere or solar wind) ionize the upper atmospheres of planets, satellites, or other neutral environments. However, very different density structures, chemical compositions, temperatures, and dynamics result due to differences in the heliocentric distance, strength of the intrinsic magnetic field, size of the planet/object, and the underlying atmospheric composition. An important aspect of ionospheric behavior is magnetosphere-ionosphere coupling and/or the interaction with the solar wind or other external plasma. For planets and bodies with weak intrinsic magnetic fields (e.g., Venus, Mars, Titan, and comets), external magnetospheric or solar wind plasma interacts more directly with the ionosphere and upper atmosphere. The composition, dynamics, and energetics are all affected by this interaction. Data on the ionospheres of non-magnetic bodies is available from many missions including Pioneer Venus, Venus Express, MAVEN, Mars Express, Cassini, and Rosetta. A broad review of this topic will be given.