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Gas Giant Ionospheric Structure and Conductance

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Abstract

We provide an overview of the observed ionospheric structures at Jupiter and Saturn, and examine their effects on electrical conductances. The Saturn Thermosphere Ionosphere Model (STIM), a global circulation model of Saturn's upper atmosphere, is used to highlight contemporary unexplained ionospheric phenomena; a similar approach is applied to Jupiter using a 1-D ionospheric model derived from STIM. In particular, we focus on low-altitude ionospheric layers, as their presence, ubiquitous in the observations, significantly alters any derived or predicted ionospheric conductances.

At Saturn, Pedersen conductances estimated from electron density profiles derived from radio occultation observations at non-auroral latitudes range between ~1-8 mho. Energetic electron precipitation in the auroral region can enhance modeled Pedersen conductances from ~0.5 mho (solar-driven) to 12 mho, whereas similar electron source distributions at Jupiter lead to Pedersen conductance estimates of <2 mho, mostly owing to Jupiter's stronger magnetic field.