

The ionosphere of Saturn from Cassini Radio Science

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Abstract

Since 2005, the NASA Cassini orbiter has produced 59 profiles of the electron density in the Saturn ionosphere. In 2005, when the ring opening angle was near maximum, they obscured most of the limb of Saturn, and the near equatorial regions were available for radio occultations, and 12 near-equatorial profiles were obtained (Nagy, A.F., *et al*, *J. Geophys. Res.-Space Phys.*, (2006), **111**, Issue A6). During the rest of the Cassini Prime mission, 20 additional profiles were obtained at mid- and high latitudes (Kliore, A. J., *et al.*, *J. Geophys. Res.-space Phys.*, (2009), **114**, A04215, DOI:10.1029/2008JA013900). In the Cassini Extended mission, 24 more profiles were obtained, mostly at low and near-equatorial latitudes during the Equinox mission in 2009-2011, and a final set of 15 observations were obtained in 2012 and 2013 during the Solstice mission, including several at high Northern and Southern latitudes. These are the last possible observations, because the increasing ring opening angle will again obscure the limb of Saturn until the end of the Cassini mission in 2017.

The most prominent feature of the latitudinal variability of the Saturn ionosphere is the consistent diminution in the main peak density, the total vertical electron content, the ionopause height, and even the main peak altitude as the altitude decreases toward the equator, beginning at about 50 deg. North and South. This roughly coincides with the maximum L-shell latitude that connects magnetically with the outer edge of the A- ring. However, the diminution is observed to be greatest at low latitudes, corresponding to L-shell radii inside the D-ring, having no connecting magnetic field lines to the rings. This is consistent with water products from the rings reaching the upper atmosphere, but not entirely by way of magnetic field lines.