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Cassini RPWS LP Measurements of Cold Plasma in the Ionosphere of Titan

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We present unique results of the cold plasma environment around Titan obtained primarily by the Cassini Radio and Plasma Waves Science (RPWS) Langmuir probe (LP) sensor during the Ta and Tb flybys, which occurred on October 26, and December 13, 2004. The data show that magnetospheric conditions play a crucial role for the structure and dynamics of the space environment around Titan all the way down to closest approach (1200 km). The general shape of the ionospheric number density during the flybys can to a first approximation be modelled by photo-ionization by UV light from the Sun. However, the plasma density was otherwise very structured and could be related to similar features in the magnetic field data. The maximum measured ionospheric electron number densities reached 3800 cm^{-3} (Ta) and 3200 cm^{-3} (Tb) respectively. The closest approach electron temperatures were 110-1400 K and increased with altitude, and the altitude profiles were consistent with electron heat conduction from the hotter Titan wake. An intriguing result was the sharp increase in averaged ion mass to 60-70 amu below the maximum number density near closest approach on the less solar illuminated outbound pass. The mass loading boundary (MLB) and ionopause were identified. No large asymmetry of the mass-loading region could be detected between the inbound and outbound during Ta, which was in stark contrast to both the Voyager-1 flyby characteristics and the Tb flyby cold plasma characteristics. An extensive mass load region on the anti-Saturn side of Titan forms

therefore only under certain magnetospheric conditions. The total escape flux was estimated to a few times 10^{25} ions/s.