



Juno observation of Io Plasma Torus

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Juno is currently orbiting Jupiter in a highly eccentric, 53.5-day orbit, with a perijove altitude of about 4000 km. Radio science measurements are acquired during selected perijove passes for about eight hours across closest approach to determine the gravity field and the interior structure of Jupiter. The gravity determination is obtained by fitting precise range rate measurements ($3 \mu\text{m/s}$ over a time scale of 1000 s) through predictions obtained from a dynamical model of the spacecraft.

The Juno, X band uplink, X band downlink, radio system at 7.2-8.4 GHz is complemented by a Ka band system devised for the radio science investigation. During dedicated perijove passes, the onboard Ka band frequency translator (KaT) locks into a Ka band uplink signal at 34 GHz and retransmit it coherently to ground at 32 GHz. This radio system configuration, used on Dec. 11, 2016 during the third perijove pass (PJ3) and planned for all gravity orbits, allows a 75% calibration of dispersive contributions in the Ka signal, such as the Io plasma torus. During PJ1 (Aug 27, 2016), a direct measurement of plasma contribution in the downlink leg can was possible by transmitting two downlink signals at X and Ka band coherent with a common uplink X band signal.

The data collected during PJ01 and PJ03 show a clear signature associated to the Io plasma torus. Doppler data points can be integrated and related to a plasma path delay, or a TEC profile, along the Earth-Juno line-of-sight. Due to the geometry of the orbit (polar, close to face on as seen from the Earth), the radio link crosses the Io plasma torus during all gravity science measurements. The associated delay, although small at Ka band, should be calibrated in order to obtain a more accurate gravity estimation. In turn, the calibration data available in all gravity passes can be profitably used to obtain a good sampling of the plasma environment in the torus. This work will present the methods adopted in the data analysis and the characterization of the Io torus from the first Juno perijove passes.