Analysis of Variations in the Io Plasma Torus Using Galileo PLS Data

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The Galileo mission was the first to actually maintain an orbit around Jupiter as opposed to doing a flyby like Ulysses, Voyager 1 & 2, and Pioneer 10 & 11, and so it was the first data set that allowed us to investigate large scale spatial and temporal variability in the plasma conditions within Jupiter's magnetosphere. By assuming the plasma between 5 and 30 Jupiter radii is in thermodynamic equilibrium, we were able to fit convective Maxwellian distributions to the counts detected by the Plasma Science (PLS) instrument aboard the Galileo satellite, allowing us to determine properties such as number density, isotropic temperature, and bulk flow velocity vector. The observations made by Cassini's Ultraviolet Imaging Spectrograph (UVIS) of emissions from the Io plasma torus allow us to get an estimate of the relative abundances of ion species present there. However, malfunctions during the mission made the data especially choppy and difficult to analyze, and we have to settle for an average charge-to-mass ratio of 14.8; this has made this project both a study in plasma physics as well as refined data analysis. After developing rigorous filters for the proper data points to fit to, we were able to construct two-dimensional meridional profiles of Jupiter's inner magnetosphere, and we determined no significant variation in these properties with respect to local time.