Analysis of Voyager Observations of Ion and Electron Phase Space Densities in the Magnetospheres of Jupiter and Saturn

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Data from the Low Energy Charged Particle experiment aboard the Voyager spacecraft were used to calculate ion and electron phase space densities in the magnetospheres of Jupiter and Saturn. Theses were calculated at constant first and non-zero second adiabatic invariants using real pitch angle and energy spectrum information. These calculations are used to infer the nature of charged particle sources, losses, and transport in the inner magnetospheric regions. Traditional dipolar as well as current, non-dipolar models were used to represent the planetary magnetic fields of Jupiter and Saturn. At jupiter the general nature of the transport is consistent with inward diffusion from the outer magnetosphere, combined with losses near the orbit of Io. These apparent losses are not consistent with simple satellite sweeping by Io alone. It has been suggested that another loss mechanism is at work, possibly pitch angle scattering in the strong limit. At Saturn the data are also consistent with a picture of inward diffusion from the magnetospheric boundary, though there is evidence for a source of low energy ions in the inner magnetosphere. The 04 and Z3 magnetic field models proposed for Jupiter and Saturn do not change the nature of these conclusions significantly.