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Comparison of two possible mechanisms for the transport of plasma in Saturn's inner magnetosphere.

A.M.Rymer(1,3), B.H.Mauk(1), T.W.Hill(2), N.Andre(3), A.J.Coates(3), S.J.Bolton(4), Michelle Thomsen(5), E.C.Sittler(6), D.T. Young(4), M.K.Dougherty(8)

1. Johns Hopkins University, Applied Physics Laboratory, USA.
2. Department of Space Physics and Astronomy, Rice University, USA.
3. Mullard Space Science Laboratory, University College London, UK.
4. Southwest Research Institute, USA.
5. Los Alamos National Laboratory, Space and Atmospheric Science Group, USA
6. NASA/Goddard Space Flight Centre, USA.
7. Department of Space and Atmospheric Physics, Imperial College, UK.

There is considerable interest in plasma transport mechanisms into and out of the corotation dominated inner magnetosphere of Saturn. Analysis of CAssini Plasma Spectrometer (CAPS) data shows that there commonly exist two approximately Maxwellian super-posed electron populations in the roughly equatorial region between $L \sim$ 5-12 R_s. This region is also where electron injection events and resultant dispersion signatures are often observed. Notable other examples of bimodal electron populations are those found in the solar wind, the Io torus, and (on typically small temporal and spatial scales) in boundary layers such at planetary magnetopauses and lobes. In the Io torus it is likely the colder electron population is a component of pick-up gases from Io, and, given its field-aligned character, the hotter component may be produced by field aligned currents. The electron injection events observed in Saturn's inner magnetosphere are attributed to the centrifugal interchange instability. Such interchanges are thought to be regulated by interaction with the planetary ionosphere through the intermediary of field-aligned currents. So, is the source of the higher energy component of the bimodal electrons at Saturn the same as it is thought to be in the

Io torus? If the source is associated with localized magnetic field-aligned currents, then one expects the phase space density (PSD) at given adiabatic invariant values to have a local maximum as a function of the radial L parameter where the source strength maximizes. Alternatively the energetic component could be the consequence of drift and radial diffusion of electrons energized in the middle to outer magnetosphere. Under ideal conditions this process conserves the first and second adiabatic invariants of gyration and bounce (although, in reality we expect the picture to be more complicated as electrons scatter and isotropise) and by choosing appropriate fixed invariant values we should observe PSD to be either flat or decrease monotonically toward the planet. We test both hypotheses with in-situ measurements from Cassini fields and particles instruments.