A Brief Overview of Results from the RPI on IMAGE

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The Radio Plasma Imager (RPI) on the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) spacecraft was designed as a long-range magnetospheric radio sounder, relaxation sounder, and a passive plasma wave instrument. The long-range sounder echoes from RPI allows for the remote sensing of a variety of plasmas structures and boundaries in the magnetosphere. A profile inversion technique for RPI echoes has been developed and provides a method for determining the density distribution of the plasma from either direct or field-aligned echoes. This technique has enabled the determination of the evolving density structure of the polar cap and the plasmasphere under a variety of geomagnetic conditions. New results from RPI show that the plasmasphere refills significantly faster (by a factor of ~2) than theories have predicted. In addition plasma resonance observations from RPI at large radial distances over the polar cap have been made allowing for the determination of the plasma density to within an accuracy of less than a few percent.

RPI's passive receive-only mode measures natural emissions such as the continuum radiation and auroral kilometric radiation (AKR). Plasmaspheric measurements from RPI have been compared extensively with the Extreme Ultraviolet (EUV) Imager on IMAGE. These combined observations show that kilometric continuum is generated at the plasmapause, from sources in or very near the magnetic equator, within a bite-out region of the plasmasphere.

Finally, the RPI has been used to successfully test the feasibility of magnetospheric tomography. During perigee passage of the Wind and Cluster spacecraft, RPI radio transmissions at two frequencies have been observed and Faraday rotation was measured and occurs when the received electric field is observed to rotate with time due to the changing density of plasma. Many future multi-spacecraft missions propose to use Faraday rotation to obtain global density pictures of the magnetosphere.