ADVANCES IN MAGNETOSPHERIC RADIO WAVE ANALYSIS AND TOMOGRAPHY

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A number of experiments have been accomplished in which the Radio Plasma Imager (RPI) on the IMAGE spacecraft was used as a low frequency radio wave transmitter and the WAVES instrument on WIND and the Wide-band instruments on all four CLUSTER spacecraft as receivers. These transmissions/receptions provide a unique opportunity to test a number of important magnetospheric measurement techniques. For instance, the RPI transmissions to the four Cluster spacecraft are being used to precisely calibrate differential delays for the Cluster AKR source location and motion studies using VLBI. This technique is extremely useful since it is the only direct method of determining the instrumental delays and other errors in the analysis leading to uncertainties in source location. The RPI/Wave experiments are being used to verify and test the feasibility of magnetospheric radio tomography by measuring inter-spacecraft electromagnetic wave propagation parameters such as intensity, phase, and Faraday rotation measurements. The path-integrated electron density/magnetic field products can be unambiguously measured from these, low signal to noise ratio, single and dual frequency measurements. In light of these successful results, the potential scientific value of multi-spacecraft radio tomographic imaging of the magnetosphere for future missions will also be discussed.