

SIMULTANEOUS OBSERVATION OF PLASMASPHERIC REFILLING USING ULF AND HE⁺ IMAGING DATA

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The plasmasphere is a region in the inner magnetosphere filled with cold dense plasma of ionospheric origin. This presentation will show a dynamic behavior of the plasmaspheric plasma using two different techniques.

One of the techniques involves measurements of magnetospheric field line resonances. Cross-phase analysis from closely spaced ground magnetometers yields the eigenfrequency of magnetic field lines, providing information on the plasma mass density near the equatorial plane. Data from an extended meridional array of ground magnetometers therefore allows the radial density distribution to be remotely monitored.

The other technique involves the extreme ultraviolet (EUV) camera onboard the IMAGE satellite. This instrument detects solar 30.4 nm radiation that is resonantly scattered by He⁺ ions and produces images every 10 min. The images from near apogee (~8 Re) can provide global perspectives of the plasmasphere and column density along the line of sight with 0.1 Re spatial resolution.

We determined the equatorial mass and He⁺ number density during a moderate geomagnetic storm in June 2001. The eigenfrequency for field lines increased markedly, corresponding to reductions in mass density and indicating that the plasmopause moved Earthward and these flux tubes were depleted. Plasmaspheric refilling progressed with a clear diurnal variation associated with supply of plasma from the ionosphere on the dayside and downward loss of plasma on the night side. Corresponding erosion and refilling were found in the EUV images. We then measured the rate at which these flux tubes were refilled to pre-storm levels. It took 2-3 days for L=2.3 flux tubes to refill to prestorm values, 3 days for L=2.6, and over 4 days for L>3.3. Linear increasing of densities in the dayside allow us to estimate ion refilling rate and resultant upward ion flux at the 1000 km level for both of mass and He⁺ density. By comparison with cross-phase and IMAGE-EUV measurements, we also estimated ion composition, and found the O⁺ proportion was of order 5-10%.

We will discuss these results in the context of supply of the plasma from the ionosphere and trapping in flux tubes.

Plasmasphere, ULF wave, Extreme-Ultraviolet image

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