

Earthward and Tailward Flowing Plasmoid: Structure and Its Related Ionospheric Signature

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Earthward-moving plasmoid on Oct. 28, 2002 has been observed by the Cluster spacecraft with simultaneous auroral viewing by the IMAGE satellite. This offers the opportunity to ascertain the optical signature and the evolution in the ionosphere of the earthward moving plasmoid for the first time. The intensity of the current in the center of the plasmoid is found to be weaker than that in the adjacent region. Also, the directions of the current in the central part of the plasmoid are different from the background cross-tail current: it is more field-aligned. The calculation of $J \times B$ demonstrates that the plasmoid is not a highly force-free structure. The unusually large bipolar electric field found in the plasmoid (peak to peak values 6 and 8 mV/m) may be explained as a dawn-dusk polarization electric field which is generated to enhance the flows. Broadband electrostatic noise (BEN) and bursty electrostatic electron cyclotron waves are found inside the plasmoid which are closely associated with the acceleration of the plasma. Furthermore, IMAGE data show the auroral signatures moving to lower latitudes, when the earthward moving plasmoid is observed by the Cluster spacecraft. Such an equatorward auroral motion is consistent with the observed earthward moving plasmoid. Furthermore, the ionospheric ground based equivalent current pattern is in agreement with the magnetospheric observations. The time scale of the disturbance in the ionosphere is also consistent with the time scale of the plasmoid observed in the magnetosphere.