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Field-aligned property of density perturbations driven by diamagnetic disturbances

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Geosynchronous altitudes, located near the inner edge of plasma sheet, are right position to monitor the delivery of plasma sheet material to inner magnetosphere. The plasma sheet material has been suggested to be transported by the earthward fast flow accompanied by dipolarization front (tangential discontinuity) ahead of it. Hence, interaction of dipolarization front with the inner magnetosphere could be interpreted as an intrusion of diamagnetic material into the inner magnetosphere.

Using simple MHD model, we study properties of density and field magnitude perturbations caused by intrusion of diamagnetic material.

First, steady state analyses were attempted by assuming first order perturbations. The results showed that there appear two wave modes corresponding to a slow phase velocity and a fast phase velocity as resemble those in isotropic plasmas. For the fast phase velocity mode, pressure perturbations and field perturbations exhibited paramagnetic relations, similarly to isotropic plasmas. For the slow phase velocity mode, diamagnetic properties appear only at high plasma beta (ratio of kinetic/magnetic pressures) part of low pressure anisotropy (ratio of perpendicular/parallel pressures) region. The term [paramagnetic] or [diamagnetic] were classified according to whether the sense of the field disturbances was either parallel or opposite to the density

Second, it is found from the examination of the time evolution that slow phase velocity mode can be excited when diamagnetic source disturbances were imposed. In addition, the compressed density pulses are propagated along the field lines from the source region if the plasma-beta was not too high. Contrarily, compressed density pulses did not propagated out of the source region but was confined in it if the plasma-beta was very high.

We suggest that a different behavior of plasmas in different energy ranges that was often observed in the magnetotail can be attributed to diamagnetic nature inherent in the plasmas therein.