IDENTIFICATION OF PLASMA SHEET FLAPPING WAVES OBSERVED BY CLUSTER

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Recently it has been reported on the low-frequency oscillations of the plasma sheet generated by some impulsive source in magnetospheric tail center and propagating toward flanks (V. A. Sergeev et al., Geophys. Res. Lett., 31, L05807, 2004). To interpret this finding a number of wave modes have been invoked to and then discarded, for either the group velocities or propagation directions were inconsistent with the observations. In the present study we examine the MHD internal gravitational-type waves, first described in (V.B. Safargaleev and Y.P. Maltsev, Geomagn. and Aeronomy, 26, 270 - 274, 1986) as a possible candidate to match the observed flapping motions. The role of gravity is played by the centrifugal force, acting on hot plasma in a curved magnetic field, near-equator magnetic curvature being treated. We present a flapping perturbation to be a standing structure along the magnetic field and a traveling wave in the dawn-dusk direction. The corresponding dispersion relation indicates propagation in the positive/negative yGSM directions with the group velocity of about fg/3ky, ky being the dawn-dusk wave number, the frequency fg determined by the background magnetic configuration. Within such a framework the following features of the flapping motions observed in experiment can be readily interpreted: group velocity vy ranging from 10 km/s to 30 km/s for quiet current sheet and from 30 km/s to 100 km/s for active sheet; a phase shift of pi/2 between BX and VZ oscillations, VZ being the vertical bulk velocity of plasma; a certain dispersion over the wavelengths, that is, longer wavelengths are coming to the flanks first. There is one discrepancy between the predictions of our theory and observations. According to the theory, both kink-like and sausage-like deformations of the current sheet are possible, while only those of the former type have been observed so far.

Abstract Submission Form

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2. B - Fields and Waves

3. (a)

4. C - Contributed Paper

5. No special instructions