MAGNETOTAIL PLASMA VERSUS THE LARGE-SCALE ELECTRIC FIELD

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Convection of closed magnetic tubes in the central part of the Earth's magnetospheric tail reduces their length and compresses the plasma contained in them. This is accompanied by the formation in the tail of two shock waves which have separated from the neutral plane in the north- and southward directions, between which lies a hotter and denser plasma as compared with the tail 1obes. The distinctive plasma characteristics in the region between the shock waves, and also the spatial position of this region suggest that in the real magnetosphere a plasma sheet corresponds to this region.

A numerical simulation of the motion of shock waves in convecting magnetic f1ux tubes has been carried out. By introducing the postulate about the character of the relationship between the shock wave velocity and plasma parameters, we have calculated the form of the shock surface which we interpret as the plasma sheet boundary. The line of intersection of the shock surface with the ionosphere is taken here as the polar boundary of the auroral oval, because the plasma sheet particles are able to precipitate equatorward of this boundary only. According to our model the plasma sheet hot plasma lies on closed magnetic lines but not always comes to there feet. Hence the magnetic lines of the polar cap may be closed, and this does not hinders quite a realistic auroral oval formation.

Magnetospheric electric field global strengthening causes plasma sheet thinning (with a characteristic time of a few tens of seconds) and auroral oval equatorward displacement (with a time of a few tens of minutes). Electric field reduction leads to plasma sheet expansion and auroral oval polar boundary contraction. As a result, substantial part of the former polar cap becomes a part of the region of particle precipitation, i.e. of the auroral zone. This prediction of the model is in agreement with observations as well as other predictions.