

CONCERNING THE GENERATION OF CONVECTION IN THE MAGNETOSPHERE

P.A. SEDYKH

1. Institute of Solar-Terrestrial Physics of the Siberian Branch of the Russian Academy of Sciences, Irkutsk, Russia, e-mail: pvlsd@iszf.irk.ru

2. Department of medical biophysics, Irkutsk State Medical University, Irkutsk, Russia, e-mail: pvlsd@mail.ru

In this paper it has been done a re-examination the consequences of the fact of electric current generation at the bow shock front that we considered at the previous researches [Ponomarev, Sedykh. J. of Atm. Solar-Terr. Phys. Vol. 68. 2006]. The magnetopause potential F_m is determined from the conditions of balance of the matter coming through the shock front and outgoing from the magnetosheath through the magnetopause and space between the bow shock front and magnetopause. This potential differs from the bow shock front potential only in a multiplier. If we assume that the flux tubes are equipotential, the motion of the plasma tube content completely depends on the motion of the tube equatorial trace. Thus, it is sufficient to determine the potential distribution in the equatorial plane within the boundaries, one of which (magnetopause) is represented by parabola with a parameter and the other, by a circle of some radius. The problem is solved in parabolic coordinates, where the Laplace operator seems to be the simplest. The solution is sought in the form of expansion into the series in terms of orthogonal functions in a standard way. The obtained result is also standard. The character of electric field distribution over the dawn-dusk meridian quite corresponds to the classical distribution obtained in [Heppner, 1977]. The significance of this result consists in that the convective electric field (taking into account corotation) was for the first time obtained from the main principles of physics. The power source for maintaining convection was specified, and the boundary conditions at the magnetopause were obtained from the solution of the general problem rather than were specified proceeding from intuitive considerations. The problem of determining the power coming in this case into the magnetosphere is solved as if automatically because vectors of the electric field intensity and density of the electric current are known. We should merely integrate the product of these quantities over the volume of the magnetosphere. Finally, one can note that the energy flux into the magnetosphere is closely related to the current through the magnetosphere by the well-known relationship. The problem of generation of convection in the magnetosphere proved to be the most advanced and independent of paradigm among all magnetospheric problems. The results obtained by us do not differ from the known results. The electric field along the bow shock front and the potential depend on the solar wind velocity normal component and on the IMF tangential component and may be defined by the certain formulas. The work was done within the framework of the grant MK-3697.2008.5.

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P.A. Sedykh, Institute of Solar-Terrestrial Physics of the Siberian Branch of the Russian Academy of Sciences, Lermontov str. 126a, Irkutsk, 664033, Russia, e-mail: pvlsd@iszf.irk.ru