STRUCTURE OF HIGH LATITUDE MAGNETOSPHERIC PLASMA DOMAINS AND THE PROBLEM OF LARGE-SCALE MAGNETOSPHERE-IONOSPHERE INTERACTIONS

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Structure of high latitude magnetospheric plasma domains and transverse magnetospheric currents is very important for the solution of the problem of large-scale magnetosphere-ionosphere interactions. Arguments showing the necessity to reanalyze the traditional approaches to such structure description are summarized taking into account the latest results of THEMIS project observations. Daytime compression of magnetic field lines and the existence of magnetic field minima far from the equatorial plane are taken into account. Dayside integral transverse currents at the geocentric distances 7-10Re are calculated in the suggestion of the validity of the condition of magnetostatic equilibrium and compared with nighttime transverse currents. It is shown that ordinary ring current has the high latitude continuation until geocentric distances ~10-12Re. Isolated substorm expansion phase onset in such a case at the equatorial boundary of the auroral oval becomes the problem of ring current instability instead of ordinary suggestion on the tail current instability. The appearance of plasma motion across the most equatorial inverted V structure is selected as the main reason of bright arc formation and the increase of such motion as the reason of auroral brightening at the beginning of substorm expansion phase onset. The problem of the formation of large and middle scale electrostatic fields, Region 1 and Region 2 field-aligned current is analyzed. It is shown that the existence of definite boundary conditions leads to the possibility of the excitation of discrete number of modes, which are eigenfunctions of the problem with scales comparable with the transverse scale of the magnetosphere. Large-scale dawn-dusk electric field can be considered as the zero mode of plasma pressure instability. Such approach gives the possibility to overcome difficulties connected with the hypothesis of solar wind electric field penetration inside the magnetosphere.

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