Abstracts

Interaction of solar wind plasma and the Earth magnetic field is particularly important, as it represents a global energy process taking plase in the natural environment. Very low density plasma flow from the Sun's photosphere, solar wind, Earth's magnetosphere and its main radiation belt, ionosphere, form the system, where continuous electromagnetic energy transmission from the solar wind to the magnetosphere takes place.

The aim of the thesis work is to study the topological features of magnetic field on the dayside of the earth's magnetosphere and to estimate the characteristic spectrum of magnetogradient waves cased by nonuniform distribution of magnetic field induction in the magnetohydrodynamic boundary layer. Magnetohydrodynamic (MHD) approximation is used for the specific problems related to the solar wind plasma dynamics. The effects of the plasma electric conductivity changes is estimated in kinetic approximation by Sagdeev's anomalous resistivity theory.

A number of original models have been proposed in the thesis, which enable theoretic interpretation of modern digital experiments. Results of the interpretation can be essential for understanding physical nature of dissipative effects developing during laboratory modeling of thermonuclear synthesis. In the first paragraph of the first chapter the system of magnetic hydrodynamic equations is discussed. In the second paragraph, simplified forms of the equations and transformation scheme of these equations to the non-dimensional form are presented. The main non-dimensional similarity parameters of the MHD flow presented as well. There of the first chapter the theory of Earth's magnetic boundary layer, i.e. magnetopause, and corresponding to it equations are given. In the third paragraph of the first chapter the Shvetz's successive approximations method is shortly reviewed and its efficiency is estimated for analytical solutions of problems on various types of boundary layers.

The first paragraph of the second chapter is related to the problem of magnetic viscosity. This substance, before its interaction with the magnetosphere has practically ideal electric conductivity. However, if for the estimation of the value of this parameter we use Spitzer's well-known formula, valid for the absolutely ionized gas then the solar wind is not an ideal conductive environment. This means that solar wind has a certain magnetic viscosity. According to Sagdeev's kinetic theory of anomalous resistivity the anomalous increase of magnetic viscosity of plasma is related to the excitation of ion-acoustic instability. In the thesis work the anomalous magnetic viscosity of the solar wind plasma derived from Sagdeev's theory is compared to the value derived from the azimuthal magnetic field model around stagnation zone. We found that the boundary condition of magnetohydrodynamic balance requires same values of magnetic viscosity as it is given by Sagdeev's theory. In the paragraph two the effect of impulse change of magnetic viscosity in the non-stationary meridional magnetic boundary layer and identified as magnetopause in meridional section of magnetosphere is reviewed.

In the first paragraph of third chapter, using the theory of algebraic curves, model of reconnection of interplanetary magnetic field force lines and the force lines of geomagnetic field due to annihilation at the critical point of magnetosphere is presented. Unlike other known models, in this topological picture of magnetic field of the effect of interconnection initiation, the erosion of magnetic boundary and respective disturbance of the intra magnetospheric structure is not required. In the second paragraph of the third chapter the screwlike topological model of the magnetic field force lines at the surface of stagnation zone is given. The basis of the model is the identification of the top of stagnation zone with the singular point. According to this model the reconection of the interplanetary magnetic field force line at the tip of stagnation zone is possible. Therefore the topological similarity takes place between the magnetic surface with the top and the stagnation zone, which is formed during the laminar flow around the surface with the critical point. In the third paragraph of this chapter, on the basis of MHD system of equations, by the method of small disturbances, in the frames of stagnation zone model of magnetosphere, the characteristics of the MHD waves generated by the disturbances of parameters of the solar wind are derived in linear

approximation. The results are obtained as for ideal conductor as well for dissipative plasma, considering the factor of compressibility when the disturbance is extended towards the axis of symmetry of stagnation zone. In the last, forth paragraph of the third chapter the problem of the generation of a Rossby type magnetogradient waves in the focal area substetuded by stagnation zone of magnetosphere is discussed. For the first time, the characteristic parameters of abovementioned waves and the frequency spectrum is derived in this area as for linear as well for nonlinear distributions of the magnetic field.

The results are presented in the following conclusions:

1. By modeling impulsive changes solar wind's electric conductivity in time, using the Jigulev's first order analytical equations, Parker's kinematical model and Shvetz's succsessive approximations metod, parameters of the meridional magnetopause are defined; The effect of inertia of the magnetic boundary layer is presented; Similarly to the effect in the temperature boundary layer, it promotes the stability of the parameters of magnetopause during the change of the electric conductivity of the plasma; The value of the velocity of the electromagnetic drift along the magnetopause which is the validity criteria of the mono-liquid magnetic hydrodynamic equations in the vicinity of magnetosphere boundary is estimated.

2. By means of algebraic curve theory, flat topology model of the change in the configuration of the boundary force line of geomagnetic field due to annihilation of magnetic filed in the critical point of magnetosphere is developed; According to this model in the critical point there is a possibility of formation of a real algebric knot. In this case the reconnection scheme of the interplanetary magnetic filed and geomagnetic field force lines and Shvetz's model of succsessive approximations becomes more simple because the erosion of magnetic boundary, usually connected to excitation of intra-magnetospheric structures, is not necessary.

3. Based on the possibilities of multiple splitting of interplanetary magnetic field force line at the singular point, the surface of magnetic boundary of stagnation zone of magnetosphere is developed; it was shown that this surface, in case of the synthesis with the model of concentrated magnetic loops around magnetosphere, will be transformed to the screwlike magnetic surface with the variable steps. The parameters of this transformation are determined by the linear parameters of stagnation zone; It has been demonstrated that the topological similarity between the force lines of frozen into the solar wind plasma interplanetary magnetic field and the lines of the plasma current, which takes place when velocity vectors and the vectors of induction of magnetic field are parallel before interaction with the magnetosphere, can be preserved in stagnation zone of magnetosphere even if plasma has finite magnetic and regular viscosity.

4. In stagnation zone of magnetosphere, as in the ideal conductive as well in the approximation of mechanical and magnetic viscous compressible plasma, the generation of magnetohydrodynamic waves with the frequency spectrum equal to the cyclotron frequency spectrum of protons in magnetopause is possible. It turned out, that besides the equatorial magnetopause, generation of very low frequency Rossby like magnetogradient waves is possible also in the focal area of magnetosheath (stagnation zone); in the approximation of stagnation zone model for the different models of linear and nonlinear distribution of magnetic field, the frequency spectrum of Rossby like waves, which completly covers the frequency range of regular geomagnetic (Pc1-Pc6) pulsations is derived.