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# *Nonlinear electrostatic solitary Structures associated with Electron and Ion Beams in the Aauroral M sphere*

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The theoretical models of the formation and interaction of three-dimensional electrostatic solitary s
in the magnetospheric plasma with the electron and ion beams are constructed. Basing on the MHD
of equations two connected equations similar to the modified Korteweg-de Vries-Zakharov-Kuznetzo
ZK) equations for plasma with electron and ion beams is derived. The main problem of the solutio
three-dimensional equations KDV-ZK consists of obtaining the exact asymptotic solution on infinity
continuation in the limited region of space. After one integrating and assuming, that the solitary s
move with the certain velocity along a magnetic field, the system of two connected equations with
law nonlinearity is received. This system allows an exact analytical solution, which is the asymptoti
spherically symmetric solitons. This asymptotic solution can be continued in the limited region of the
radial variable. The mathematical substantiation of a used method is given and uniqueness of solution is
By the method of the numerical modeling of the nonlinear interaction of two solitons with the positiv
tudes it is shown that for the determined plasma parameters the formation of two asymmetrical solit
the positive and negative amplitudes is possible. Also, it is shown, that in the presence of the ion and
beams moving respectively to each other, both structures can be formed as slow structures, moving
velocity close to plasma sound velocity (ion-acoustic mode) and fast structures with the velocity close
mal electron velocity ( electron-acoustic mode). The basic results of the numerical models are compa
experimental data received by satellites *FAST, POLAR, GEOTAIL*.