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Study of Hydromagnetic solitary waves in the earth inner magnetosphere via the Adlam-Allen model

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The study of large amplitude solitary waves is important in many near earth space plasma observations. In particular these are important in the region of DF at inner magnetosphere. We have employed the Adlam/Allen physical model, but have found the solution by a different method that that employed by the original authors. The derived results were then compared with the observations of DFs in the inner earth magnetosphere.

Under the wave geometrical conditions in the Maxwell's field equations in the wave frame and the quasineutrality condition, an exact solution for isolated solitary pulse is obtained in terms of dimensionless parameter a parameter defined in terms of Alfven Mach number M. Consequently, all the variables namely velocity fields, a electric field and the corresponding static electric potential, a charge density field and Sagdeev pseudopotential are expressed as a function of a parameter Lambda. The existence of real wave solutions in the Mach number range $1< M < 2$. Spatial dependence of all the solitary wave amplitudes is shown through Lagrangian parameter in all the figures. A higher critical Mach value of 2 describes a faster and stronger wave, which illustrates a slowing down of the particle when it passes through the stationary wave. As a result, parallel velocity of the particles approaches zero due to the larger value of the density in the middle of the wave. The dimensional thickness of the waves in the present case is of the order of the characteristic Adlam-Allen length and move much more slowly than the wave propagating along the magnetic field. Before we close, it is appropriate to mention applications of our results. The derived results are suggested to be helpful to understand the analytical evolution of nonlinear electric field and electric potential signatures in the transition region at the Di-polarization fronts in the earth inner magnetosphere. For this purpose, we consider THEMIS satellite data for approximating our result of the bipolar amplitude of the electric field obtained of the order of 4.1 mV/m in the cold plasma case: (an ideal case where the particle thermal effects are ignored). Study of hydromagnetic waves in space plasmas with dust particles in space and magnetosonic shocks would be an interesting dimension of current research work which will be helpful in understanding the behavior of waves in upper atmosphere and solar wind interactions in upper space and with earth's magnetosphere. This will be the subject of a future investigation.

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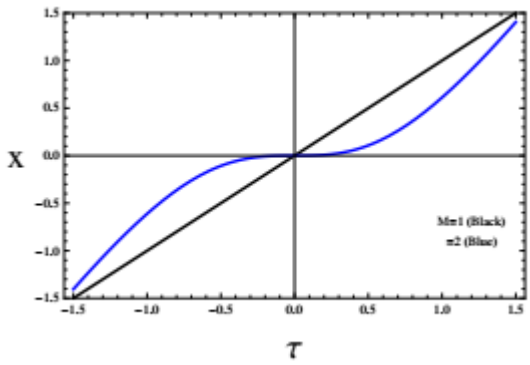

Fig.1 of the manuscript (submitted for publication)

Note: Abstract should be in (full) double-columned one page.