

A Model for Nonlinear Electrostatic Solitary Waves Observed by Cluster and Double Star

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Cluster has observed electrostatic solitary waves at many locations, from the solar wind to the magnetosheath, magnetotail, and auroral zone – basically in all regions where the plasma is highly turbulent. The ESW are in the form of bipolar pulses (one positive peak and one negative peak) in the electric field parallel to the background magnetic field. These waves may play an important role in the space plasma dynamics. Therefore, in this paper we propose a physical model for ESW by deriving the "Sagdeev potential" from the magnetohydrodynamic equations to interpret the observed bipolar pulses in the electric field. The analysis results show that, in some plasma conditions, we can get the bipolar pulses in the electric field from our model. The result of linear analysis of our model shows the solitary waves are developed from ion acoustic wave or ion cyclotron wave. Some features of the electric solitary waves are discussed, too.