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A Model on Nonlinear Electrostatic Solitary Waves in Space Plasmas

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The Electrostatic Solitary Waves (ESW) have been observed at many space plasmas, such as the solar wind, the magnetosheath, auroral zone, upper ionosphere, and magnetotail – basically in all regions where the plasma is highly turbulent. 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 two-fluid 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 polarity of the electric field structure can be oriented either negative to positive or the reverse polarity. To consider the condition in the upper ionosphere, we get the amplitude and duration of the ESW from our model can be varied from 35 to 330mV/m and 7 to 23ms, respectively. These are consistent with the observation. We also discussed application of our model to other space plasmas