Solitary structures associated with parallel whistler field at magnetopause

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Abstract

In this study, we report the observations of solitary structures associated with whistler parallel field in magnetopause. The beam-driven whistler-mode dynamical equation has been put up with the expectation that it will expand from noise level due to beam energy to large amplitude and then localize due to nonlinear effects due to ponderomotive force. Thus, whistler waves will ultimately occur in a turbulent state. For this, the model contouring the dynamics of nonlinear interaction between the high-frequency whistler wave and low-frequency ion acoustic wave (IAW) dynamics in a magnetized plasma. The presence of IAW in the background is thought to be the source of whistler wave dynamics density perturbation. When the ponderomotive nonlinearities are included in the whistler dynamics, the model equations of whistler and IAW turn out to be a modified Zakharov system of equations. Numerical simulation has been carried out with the help of pseudospectral method and finite difference method to study the effect of nonlinear interaction between these waves which results in the formation of localized structures. The results of the numerical simulation show that the intense localized structure and power spectra are considered to be responsible for the heating and acceleration of plasma particles. The electric field power spectra exhibit the scaling $k^{-3/2}$ in the inertial range and $k^{-0.8}$ the dispersive range. The transverse scale size of the localized structure is of the order of electron inertial length.

References

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