Cavity Formation by Nonlinear Interaction of Dispersive Alfvén Wave and Ion Acoustic Wave in Space Plasmas

R. P. SHARMA^{*}, H. D. SINGH and SACHIN KUMAR

Space Plasma Group, Centre for Energy Studies, Indian Institute of Technology Delhi-110016

*rpsharma@ces.iitd.ernet.in; Contact: +91-11-26591259

Small-scale length cavities have been observed in the auroral zone by Viking, Freja and FAST spacecrafts. These density cavities appear to be the favorite sites of the particle acceleration and also the generation of auroral kilometric radiation (AKR) [1,2]. We have studied the nonlinear coupling of Dispersive Alfven Waves (DAWs) with ion acoustic wave to demonstrate that this may be responsible for these density cavities/ humps in space plasmas. Nonlinear distribution of energy among higher wave numbers is also given. Sundkvist et al. [3] reported the detection of coherent structures in the "dayside cusp" of Earth's magnetosphere by the four spacecraft cluster. With the help of numerical simulations, we have shown that such type of coherent structures (filamentation) of DAWs is present in the space plasmas. Secondly, the turbulent spectra in the high-altitude cusp region on the basis of cluster spacecraft observations have been studied by Nykry et al. [4]. They observed that spectral break point may be caused partly by damping of obliquely propagating kinetic AWs and partly by cyclotron damping of ion cyclotron waves. They found examples of double sloped, broadband spectra with shallower "inertial" and steeper "dissipation" range: The inertial range slopes vary between -2.7 to -1. The dissipation range slopes vary between -5 to -3. We have presented the magnetic spectra from our simulation results which are consistent with these observations.

Keywords: Dispersive Alfvén waves; Density cavities; Filamentation; Turbulent Spectra

References

- [1] Louarn et al., J. Geophys. Res., 95(A5), 5983-5995 (1990).
- [2] Ergun, R. E., et al., Geophys. Res. Lett., 25(12), 2025–2028 (1998).
- [3] Sundkvist et al., Nature, 436, 825 (2005).
- [4] Nykyri et al., Ann. Geophys. 24, 1057 (2006).