Whistler mode waves for subtracted distribution in Saturn's magnetosphere at different radial distances

Kumari Neeta Shukla[1], Devi Singh[1] and R.S. Pandey[2]*

[1]Department of Physics, Manav Rachna International Institute of Research and Studies, National Capital Region, Aravali Hills, Sector-43, Faridabad – 121001, Haryana, India
[2]Department of Physics, Amity Institute of Applied Sciences, Amity University, Sector – 125 Noida, Uttar Pradesh, India
*Corresponding Author E-mail: rspandey@amity.edu

Abstract:

In this paper, Whistler mode waves in Saturn's magnetosphere have been studied. The linearity of the subtracted distribution function is used to derive the dispersion relationship of Whistler mode waves in the Saturn's ambient magnetic field in the Saturn's magnetosphere extended plasma sheet. The derivation of perturbation distribution function, dispersion relation and growth rate was determined by using characteristics and dynamic methods. An analytical expression for the growth of a whistler propagating perpendicular to the direction of the magnetic field is obtained. The analysis shows that the temperature anisotropy, the increase of the number density, the increase of the amplitude and the loss cone distribution function make the growth rate of the whistler wave increase with the significant change of the wave number. The calculations were performed at two radial distances from Saturn's magnetosphere. This result is of great significance for analyzing the very low frequency radiation observed in Saturn's magnetosphere over a wide frequency range. The developed analytical model can also be used to study various types of instabilities in the planetary magnetosphere.

Keywords: Whistler mode waves, Saturn's magnetosphere, Subtracted distribution function.