6th Asia-Pacific Conference on Plasma Physics, 9-14 Oct, 2022, Remote e-conference

Simulation of Chorus Wave Excitation in the Compressed/stretched Dipole Magnetic Field

Zhenyu Kong[1,2,3], Xinliang Gao[1,2,3], Yangguang Ke[1,2,3], Quanming Lu[1,2,3], and Xueyi Wang4[1]
[1]CAS Key Laboratory of Geoscience Environment, School of Earth and Space Sciences, University of Science and Technology of China, Hefei, 230026, China;
[2]CAS Center for Excellence in Comparative Planetology, Hefei 230026, China;
[3]Collaborative Innovation Center of Astronautical Science and Technology, Harbin, China;
[4]Physics Department, Auburn University, Auburn, AL, USA
e-mail (speaker):zykong@mail.ustc.edu.cn

The properties of chorus waves have been extensively studied, which are important to understand chorus generation and wave-particle interactions between chorus and energetic electrons. Observations reveal that there exists a distinct day-night asymmetry for the properties of chorus waves, such as the sweep rate and duration, which is predicted to be relevant to the asymmetric configuration of Earth's background magnetic field. In this paper, using the one-dimensional (1-D) particle-in-cell (PIC) simulation model with a compressed/stretched dipole magnetic field, we study the dependences of the properties of rising tone chorus waves on the background magnetic field. It is demonstrated that the saturated amplitude and the chorus sweep rate increase while the chorus duration decreases the increase of the compression factor ξ, which represents the compression/stretch degree of the field line. Moreover, the threshold of exciting chorus waves in the compressed dipole field is generally lower than that in the stretched dipole field. These results are useful to understand the chorus excitation and the day-night asymmetry of chorus properties.

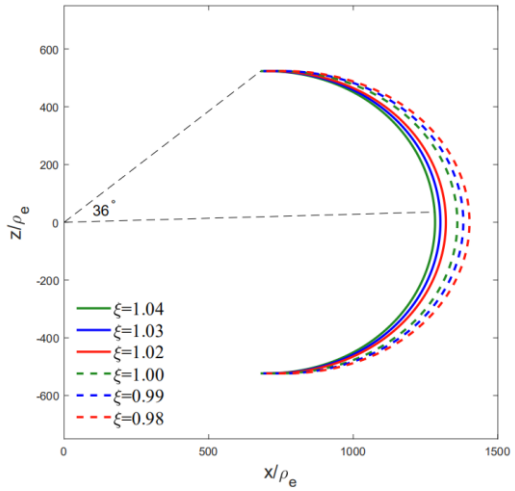

Figure 1. Six different magnetic field line configurations in the Cartesian coordinates (x,z). ξ is the compression factor controlling the magnetic field configuration such as normal (ξ = 1), stretched (ξ < 1), or compressed (ξ > 1) dipole magnetic field.

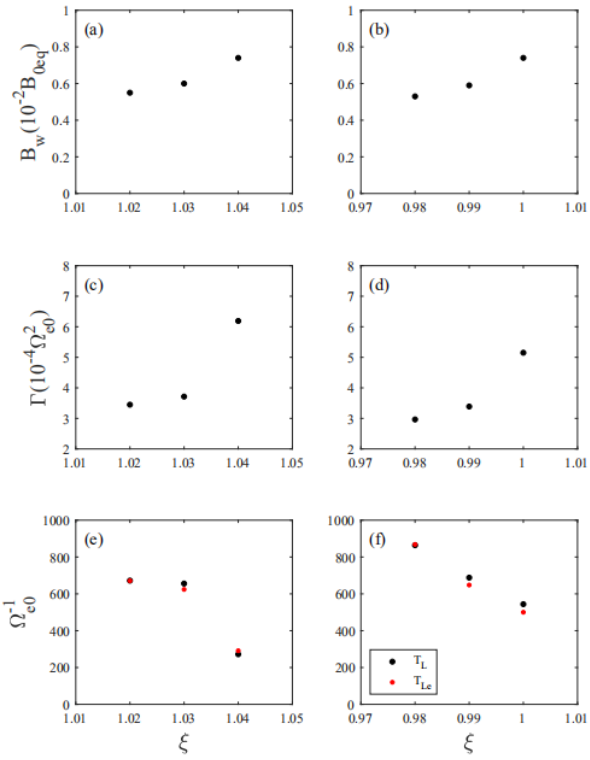

Figure 2. The saturated amplitude B_w (a)(b), the frequency sweep rate Γ (c)(d), and the duration T_L (e)(f) of the rising tone chorus as functions of the compression factor ξ. The results in the compressed dipole magnetic fields in Runs 1-3 are displayed in the left panels, while the results in the stretched (and normal) dipole magnetic fields in Runs 4-6 are shown in the right panels.