磁気赤道域における上側周波数帯コーラス放射の発生機構

大村 善治 [1]; 疋島 充 [2]; 加藤 雄人 [3]; Summers Danny[4]; 八木谷 聡 [5]
[1] 京大・生存圏; [2] 京大・生存圏; [3] 東北大・理・地球物理; [4] 京大・生存圏; [5] 金沢大・理工

Generation mechanism of upper-band chorus emissions in the equatorial magnetosphere

Yoshiharu Omura[1]; Mitsuru Hikishima[2]; Yuto Katoh[3]; Danny Summers[4]; Satoshi Yagitani[5]
[1] RISH, Kyoto Univ; [2] RISH, Kyoto Univ.; [3] Grad. Sch. Sci, Tohoku Univ.; [4] RISH, Kyoto University; [5] Kanazawa Univ.

We assume that nonlinear growth of a whistler-mode wave is initiated at the magnetic equator where the linear growth rate maximizes. Self-sustaining emissions become possible when the wave propagates away from the equator during which the increasing gradients of the static magnetic field and electron density provide the conditions for nonlinear growth. The self-sustaining mechanism can result in a rising tone emission covering the frequency range of 0.1 - 0.7 of the equatorial electron gyrofrequency. During propagation higher frequencies are subject to stronger dispersion effects that can destroy the self-sustaining mechanism. We obtain a pair of coupled differential equations for the wave amplitude and frequency. Solving the equations numerically, we reproduce a rising tone of VLF whistler-mode emissions that is continuous in frequency. Chorus emissions, however, characteristically occur in two distinct frequency ranges, a lower band and an upper band, separated at half the electron gyrofrequency. We explain the gap by means of the nonlinear damping of the longitudinal component of a slightly oblique whistler-mode wave packet propagating along the inhomogeneous static magnetic field.

磁気赤道域付近では、ホイッスラーモード・コーラス放射はサイクロトロン周波数の半分を境として上側周波数と下側周波数に分かれたように観測される。この上側周波数のコーラス放射の生成機構について、磁気赤道でのコーラス放射の非線形成長と斜め伝搬ホイッスラー波の非線形波動粒子相互作用の両方の理論に基づいて論じる。