Estimation of Relativistic Electron Energy in Whistler-Mode Cyclotron Resonance

Makoto Ikeda[1]

[1] Faculty of Humanities, Musashi Univ

Active experiments to probe the hot plasma in the Earth magnetosphere were conducted several times between 1973 and 1988 at Siple Station, Antarctica (e.g., Sonwalkar et al. 1997; Carpenter et al. 1997). In these active experiments, Whistler mode radio waves amplified in the magnetosphere were received in the Northern Hemispere conjugate regions, Roberval and Lake Mistissimi ,Canada. The data obtained near Roberval showed some properties of the hot plasma in the magnetosphere by analyzing the transmitted Siple signals and their broadening waves amplified in whistler-mode. An example of the hot plasmas known by some analyses represented that the energies perpendicular to the geomagnetic field Eperp were estimated to be between 0.6keV and 11.0keV, and the resonant energies parallel to the geomagnetic field Ez were estimated to be between 0.3keV and 1.0keV. Especially, the energy perpendicular to the geomagnetic field Eperp of about 12keV was estimated from the multi-stations observation of VLF Siple signalls on the ground (Ikeda et al., 1988)

So far, these electrons have been treated as non-relativistic ones in relation to the wave-particle interaction with Whistler-mode signals, but it should be considered that the relativistic treatment is necessary even for these interactions. A resonant velocity VR including arbitrary velocity of Vz and Vperp is also described, furthermore the perfect resonance means the equation of -VR(Vz,Vperp)=Vz, and it can give the relation between Vz and Vperp. Namely, this relativistic treatment can give the new information of Vperp to us in the ground observation. Conclusively the authors could get the result (16keV) similar to the estimation (12keV) of multi-stations observation.