

Characteristics of Chorus Emissions Related to Enhancement of Relativistic Electrons during Magnetic Storm

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It is well known that drastic change of the relativistic electron population in the outer radiation belt occurs during magnetic storm, that is, population of the relativistic electron flux decreases during a main phase of magnetic storm, and in some cases increases to above the prestorm level during the recovery phase. Several mechanisms for the enhancement of relativistic electrons have been proposed, and one of the plausible mechanisms is the wave-particle resonant diffusion by whistler mode chorus. In the present paper, we introduce chorus emissions in the outer radiation belt during magnetic storms observed by the Akebono satellite and discuss the role of the VLF wave in the acceleration process of relativistic electrons.

We made event study in order to examine the relationship among keV electrons, VLF wave chorus and relativistic electrons [1]. We could find several cases in which the chorus emissions were enhanced related to injected ring current electrons and the inner edge of injected electrons and chorus emissions were clearly correlated. The population of relativistic electrons decreased just after the onset of magnetic storm and it gradually increased in the heart of outer radiation belt.

It is generally accepted that the chorus emissions are generated around the equatorial region with their wave normal parallel to the magnetic field lines and propagate toward the higher latitude region. In order to discuss the interaction between waves and particles, we need to know the spatial distribution of the wave normal direction. Using the data from Akebono, we examined the wave normal and Poynting direction of chorus emissions during magnetic storms. It should be noted that Akebono usually observes chorus in the off-equatorial region and the wave normal directions were usually large against the magnetic field lines [2]. On the other hand, our ray tracing result was consistent with the result of direction finding that chorus propagates along the same magnetic field line with quite large wave normal angle in the off-equatorial region. The result suggests that the VLF chorus would play an important role in the acceleration process of relativistic electrons, and interaction condition between waves and relativistic electrons might become better in the off-equatorial region.

References

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