A study of the characteristics of whistler-mode emissions in the terrestrial and the Jovian magnetospheres

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Whistler-mode chorus emissions are commonly observed in the magnetospheres of magnetized planets. The typical frequency range of chorus emissions is suitable for the cyclotron resonant interaction with a wide energy range of energetic electrons. Recently it has been widely recognized that the role of whistler-mode chorus emissions is significant in the energization process of relativistic electrons in the Earth’s inner magnetosphere.

Recent simulation studies suggest that chorus emissions are generated through the nonlinear resonant interaction with energetic electrons having an anisotropic velocity distribution in the region close to the magnetic equator. Besides, the possibility of an efficient energization process of relativistic electrons has also been pointed out by theories and simulations.

In the present study, we discuss the energy source and generation process of chorus emissions in the Jovian magnetosphere and compare with the characteristics of chorus emissions observed in the terrestrial magnetosphere. Using observation results of the PWS (Plasma Wave Science investigation) on the Galileo spacecraft, we study the properties of whistler-mode chorus and hiss emissions in the Jovian magnetosphere. The analyses reveal that the whistler-mode chorus emissions are observed within 13 RJ in the Jovian inner magnetosphere. We also analysed observation from the EPD (Energetic Paritcle Detector) on the Galileo spacecraft so as to discuss the generation process of the whistler-mode emissions, and we found a certain relationship between whistler-mode wave enhancement and injection events of energetic electrons.

Based on these results, we discuss the characteristics of whistler-mode emissions in the Jovian magnetosphere and their contribution to the dynamics of energetic electrons from the point of view of wave-particle resonant interaction.