Electrostatic electron cyclotron harmonic waves observed in the equatorial region of the Plasmasphere

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Within dynamic spectra of 12 years observation of the plasma waves and sounder experiment (PWS) on board Akebono satellite, electrostatic electron cyclotron harmonic (ESCH) waves are frequently observed in the equatorial region (M-LAT less than 30 deg.) of the plasmasphere within an altitude range from 5000km to the apogee of the satellite (about 10,000km). The equatorial-plasmasphere ESCH waves (named as EP-ESCH waves) which appear above the UHR frequency at lowest harmonic number branch of the maximum frequency of the electrostatic electron cyclotron waves (Warren and Hagg, 1968), are commonly observable even in the quiet state of the plasmasphere. The EP-ESCH waves are observable in all the local time sectors, however, the occurrence probability showed clear enhancement in the early morning sector of 01-03 MLT. Sometimes the EP-ESCH waves are associated with other branch of the ESCH waves below the UHR frequency revealing a property of nonlinear wave particle interaction with the odd half harmonics branch of ESCH waves coupled by the cyclotron wave-particle interaction of the order of n = 1. Based on the analysis of the dispersion relation of ESCH waves, supra-thermal plasma with the energy of several tens eV with high temperature anisotropy is likely to generate the EP-ESCH waves in the plasmasphere. The similar type wave-particle interaction has been already identified in the topside sounder ionograms (Oya, 1971) and many plasma wave observations in the magnetosphere (Oya, 1972, Shawhan, 1979, Kurth et al., 1979). It is interesting that intense wave-particle interactions are stimulated in the plasmasphere which has been recognized as a moderate region of clod plasma only associated with radiation belt particles of very high energy. The occurrence character of the ESCH waves showed that there is a constant activation or a constant flow-in of free energy to generate the strong plasma instability of ESCH waves near the midnight sector of the plasmasphere. Existence of ESCH waves as well as the nonlinear wave particle interaction revealed more active and turbulent nature of the plasmaspheric plasma than it has been believed.