Harmonic structure of auroral kilometric radiation observed by the Akebono satellite

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Auroral Kilometric Radiation (AKR) often show banded structures with harmonic relationship that have been recognized as natural plasma wave phenomena in the ISIS 1 ionograms by Benson (1982). The detailed properties were clarified based on the analysis of DE 1 polarization measurements by Mellott et al. (1986). The results were as the followings: (1) The second harmonic waves and the fundamental waves have different propagation modes; namely, the fundamental waves are propagating in O-mode, and the second harmonic waves in X-mode; (2) The occurrence probability of the harmonic structured AKR events are quite low; (3) The ratio between the frequencies of the second harmonics and the fundamentals is 1.9; (4) The ratio between the intensities of the second harmonics and the fundamentals is of the order 0.1 to 10; (5) The fundamental waves and the second harmonic waves arrive from similar positions. On the other hand, an AKR spectrum with the harmonic structure observed by the Akebono satellite was reported by Oya (1990). The spectrum shows the same relationship of the propagation modes of the fundamentals and the harmonics as has been observed by the DE 1. Since the Akebono satellite observations have higher resolutions of both the frequency and the time than those of the DE 1, the data of the harmonic structures observed by the Akebono satellite are able to be examined in more detail. Then the purpose of this presentation is to establish new properties of the harmonic structure of AKR based on the data analysis of the plasma wave observation results obtained by the Akebono satellite.

The result of the statistical analysis carried out on the plasma wave observation data obtained by the Akebono satellite indicates that the occurrence probability of the harmonic AKR events to the total AKR events is more than 60 %. The relationship between the frequencies of the fundamentals and the second harmonics shows strictly twice for the upper and the lower cut-off of the spectra as well as the fine structures within the resolution of the Akebono PWS instrument. The intensity ratio of the second harmonics to the fundamentals shows two folding natures of both the linear and the quadratic relationship. Data analyses also revealed that the second harmonic waves of AKR in X-mode are generated in an identical source region with those of the fundamental waves which are generated in O-mode. These results suggest that the generation mechanism of the AKR harmonic structure should allow the coexistence of different processes for the AKR emission.