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A coordinate analysis of dayside diffuse aurora: GEOTAIL, FAST, and South Pole auroral observations

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It has been thought that the source of diffuse auroral emissions is scattered plasma sheet electrons into the loss cone by some wave-particle interactions. Both ECH waves and whistler-mode chorus have been thought to be the contributors to the production of diffuse auroral electrons since they can resonate with plasma sheet electrons. A question which wave mode dominantly contributes to the production of diffuse auroral electrons has been discussed for more than four decades and there is still controversy. A recent study done by Thorne et al. [2010] reveals that whistler-mode chorus is dominantly responsible for the production of diffuse auroral electrons. While, there are some observational suggestions that ECH waves cause diffuse auroral electron precipitations. [e.g., Nishimura et al., 2010; Liang et al., 2010]. Multi-point observations along a field line using low altitude satellites and spacecraft around the magnetic equator are important to investigate the contributor to the generation of diffuse aurora since the properties of diffuse auroral electrons depend on the wave mode that causes electron pitch angle scattering.

This study shows a coordinate analysis of dayside diffuse auroras using the data obtained from a reliable ground-spacecraft conjunction event. During the event, diffuse auroras were observed by the South Pole all sky imager. At that time, GEOTAIL located in the dayside magnetosphere at a radial distance of ~ 10Re, at 1000 MLT and its ionospheric footprint was inside the diffuse aurora. Furthermore, the FAST spacecraft passed over the footprint of GEOTAIL. The FAST observations showed the precipitating electrons in the energy range of 0.1 to 10 keV and the pitch angle distributions revealed that electron scattering rates reached strong diffusion limit in the energy range of 0.1 to 5 keV. PWI/SFA onboard GEOTAIL observed both whistler-mode waves and ECH waves around the conjunction event. More likely wave mode contributing to the electron precipitations was investigated by estimating resonant energies for whistler-mode waves and ECH waves, respectively. Based on the observed frequency distributions, minimum resonant energy for whistler-mode waves were too high to scatter the electrons in the energy range below 10 keV, while ECH waves can resonate with the electrons in the energy range of 0.1 to 10 keV. This result suggests that generation mechanism of diffuse aurora in this event was pitch angle scattering driven by ECH waves rather than whistler-mode waves.

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