

Flash aurora as manifestation of the nonlinear resonant interactions between single chorus element and electrons

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Chorus waves have attracted considerable attention because they are a major candidate for rapid local acceleration and/or loss processes of Earth's radiation belts via wave-particle interactions. Rapid (less than 1 s) electron precipitation correlating to chorus element structures is the most important for understanding the elementary physical steps behind the rapid loss of energetic electrons in a wide energy range in the inner magnetosphere. However, the spatiotemporal characteristics of resonant interactions between a single chorus element packet and electrons have not been understood because of the very short duration (a few hundreds of milliseconds) of single chorus element. In order to visualize the resonant interactions between chorus elements and electrons, we have carried out coordinated observations between the Arase satellite and PWING (study of dynamical variation of Particles and Waves in the INner magnetosphere using Ground-based network observations) installing high-speed (100 Hz) EMCCD cameras. In-situ chorus elements at the Arase satellite and transient auroral flashes referred to as 'flash aurora' at the conjugate ground site (Gakona in Alaska) were observed on March 30, 2017. The flash aurora shows not only a temporal evolution correlating with the chorus element structures, but also a spatial variation strongly correlating with the chorus wave amplitude. The ideal conjugate observations suggest that the chorus waves regulate not only time variations of precipitating electron flux in a wide energy range, but also transverse (across the magnetic field line) scales of source size for energetic electron precipitation. Moreover, such rapid spatiotemporal characteristics of flash aurora can be an important signature of nonlinear resonant interactions between a single chorus element packet and energetic electrons.

In this presentation, we will present the spatiotemporal characteristics of flash aurora taken by the high speed EMCCD camera and related chorus element structures by the Arase satellite in detail.