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Relativistic electron loss by broadband kinetic Alfvén waves in the outer radiation belt

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The mechanism behind the loss of relativistic electrons from the outer radiation belt remains a mystery even after more than 50 years of radiation belt research. Two main mechanisms are believed to be responsible for the loss of energetic electrons: radial loss to the magnetopause and local loss to the atmosphere due to interactions with whistler and electromagnetic ion cyclotron (EMIC) waves. Pitch angle scattering caused by these waves can reduce the altitude of electron mirror points, while collisions with atmospheric particles lead to the precipitation loss of electrons. In a recent study, the findings of Chaston et al. (2015) indicate that regions of occurrence of KAWs overlap with the radiation belt 'band-type' losses (Blum et al., 2015) to the atmosphere. Moreover, the transverse wavelengths of these wave modes are comparable with the radiation belt electron gyro-radii, indicating that these waves can effectively scatter radiation belt electrons. To explore this connection, a statistical survey was conducted using data from the Radiation Belt Storm Probes (RBSP) spanning from 2013 to 2015. The analysis identified over 45 events of KAWs with simultaneous signatures of butterfly distributions in the pitch angle of MeV electrons. The correlation between the wave spectral density and the variation of electron distribution will be thoroughly examined to provide further insights into the physical mechanisms driving the loss of radiation belt particles.

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2. Blum, L., X. Li, and M. Denton (2015), Rapid MeV electron precipitation as observed by SAMPEX/HILT during high-speed stream-driven storms. *J. Geophys. Res. Space Physics*, 120, 3783–3794. doi: 10.1002/2014JA020633.