MODELING WAVE-PARTICLE SCATTERING AND LOSS FROM THE RADIATION BELTS

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In the collisionless environment of planetary radiation belts, scattering by plasma waves provides the dominant mechanism for modifying the orbits of trapped particles, leading ultimately to their precipitation loss to the atmosphere. Various waves have been identified as important for scattering loss from the Earth's radiation belts. Such loss can be self-inflicted, causing the removal of particles responsible for the wave excitation, or it may be parasitic, due to scattering by waves excited by an entirely different population of particles. Examples of self-inflicted loss include the diffuse auroral scattering of plasma sheet electrons by Electrostatic Electron Cyclotron Harmonic waves and the scattering of medium-energy ring current electrons and ions by Electromagnetic Chorus emissions and Electromagnetic Ion Cyclotron waves respectively. Parasitic scattering of energetic electrons by Plasmaspheric Hiss is mainly responsible for loss from the slot region between the inner and outer radiation belts. EMIC waves can also cause rapid parasitic loss of relativistic electrons. Codes have been developed to quantify the rates of scattering by each type of wave, model the temporal variability during geomagnetically active conditions, and evaluate typical lifetimes of particles in the radiation belts. A review of the current status of such modeling will be presented, together with future plans to develop predictive 3D models for the radiation belts.

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