

Diffusion-Advection Modeling of Wave-Particle Interactions in the Radiation Belts

Jay M. Albert¹

¹Air Force Research Lab, 29 Randolph Road, Hanscom AFB, Massachusetts USA (jay.albert@us.af.mil)

Abstract

Properly treating wave-particle interactions is crucial to modeling and predicting the behavior of radiation belt electrons. The usual quasi-linear theory alone cannot capture the effects likely to be caused by nonlinear interactions with coherent waves, particularly chorus. Detailed analytical estimates of nonlinear particle motion in a specified wave have been developed, and combined with detailed wave models can be used to formulate a combined diffusion-advection equation for the electron phase space density. Quasi-linear diffusion is recovered for small amplitude waves, but phase bunching and phase trapping, caused by larger amplitude waves, can also be included.