Formation process of outer radiation belt electron flux through interaction with lower-band chorus emissions with subpacket structures

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We perform test particle simulations of relativistic acceleration processes of energetic electrons interacting with chorus emissions with sub-packet structures. Recent analyses of whistler-mode chorus emissions observed by spacecraft show that a wave packet of a rising-tone chorus element consists of many sub-packets with gradually increasing frequencies [*Santolik et al.,* JGR, 2014; *Foster et al.,* JGR 2017]. The strong modulation of the wave amplitude affects dynamics of resonant electrons, making them detrapped from the wave potential or entrapped into it. We set up two wave models, i.e., a chorus element with and without subpacket structures. We compare the acceleration efficiencies in the two different wave models by tracing the formation processes through many interactions with the wave packets of chorus emissions based on the Green's function method proposed by *Omura et al.* [JGR 2015]. In both cases, resonant electrons undergoing the cyclotron resonance with the waves are efficiently accelerated by nonlinear wave trapping. In the case of the wave model with the subpacket structure, a larger number of electrons are entrapped into the wave potentials, while the acceleration efficiency in energy is decreased due to shorter interaction. In the case of the wave model without the subpackets, the acceleration efficiency in energy is much higher while the number of electrons undergoing the acceleration is decreased. Eventually the total acceleration efficiencies in forming the relativistic electron flux are not much different in the two different wave models. In both cases, we find formation of butterfly distributions of MeV electrons.

Keywords: radiation belt, chorus, acceleration, relativistic electron

