
ABSTRACTS (MASTER THESIS)

**Study on acceleration mechanism of radiation belt electrons
through interaction with sub-packet chorus emissions**

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We conduct test particle simulations to examine the mechanism how relativistic electrons are accelerated by sub-packet chorus waves. As the analysis of recent observations [1], amplitude of an element of chorus wave (an element with a rising tone frequency) consists of many shortwave packets, which we call a sub-packet chorus wave. In this simulation, we reproduce the rapid fluctuations in the wave amplitude model and phase discontinuities due to the sub-packet structure, in order to examine how they influence the nonlinear trapping processes for efficient acceleration of relativistic electrons such as relativistic turning acceleration RTA [2] and ultra-relativistic acceleration URA [3]. To conduct comprehensive examinations, we follow more than nine million test particles with various initial conditions covering an energy range from 100 keV to 6 MeV and equatorial pitch angles from 10° to 89° . The test particles are interacting with a single element of sub-packet chorus wave set up with the maximum amplitude of about 2 nT and the frequency increase from about 1.3 kHz to 3.8 kHz over 0.25s. Relativistic electrons are accelerated by about 150 keV under preferable conditions. The energy increase verifies the high efficiency of acceleration by wave-particle interaction. It is achieved by a short time interaction less than 1s with a single element of chorus wave with a rapidly fluctuating sub-packet structure. By analyzing the detailed behavior of the accelerated electrons, we find successive entrapping of resonance electrons resulting in efficient acceleration by consecutive multiple sub-packets.

References

- [1] Foster et al., 2017.
- [2] Omura et al., 2007.
- [3] Summers and Omura, 2007.