*URSI GASS 2023, Sapporo, Japan, 19 – 26 August 2023*

# Lifetime of Energetic Electrons due to Their Interactions with Chorus Waves

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Chorus waves can cause the loss of energetic electrons in this area via pitch-angle scattering. To quantify the effect of chorus waves on energetic electrons, we calculate the bounce-averaged quasi-linear diffusion coefficients based on the chorus wave models developed using the Van Allen Probe data [1]. In this study, using these diffusion coefficients, we calculated the lifetime of the electrons with an energy range from 1 keV to 2 MeV using two different methods. Method 1 is following [2], who showed that when the pitch-angle diffusion coefficient ($D_{\alpha\alpha}$, as a function of the equatorial pitch-angle, $\alpha$) has no pronounced local minima below 1/10th of the pitch-angle diffusion coefficient near the edge of the loss cone ($\alpha_{\mathrm{LC}}$)), the pitch-angle distribution of phase space density decays exponentially with the same rate at all equatorial pitch-angles, preserving the shape of the distribution function. In this situation, the approximate lifetimes $\tau$ of the electrons can be evaluated as:

$$\tau = \frac{1}{D_{\alpha\alpha}(\alpha_{\mathrm{LC}})}, \tag{1}$$

Method 2 is following [3], who investigated the situation where pitch-angle diffusion coefficients have a deep minimum at some equatorial pitch-angle. They show that in this situation the electron lifetime ($\tau_*$) can be estimated as

$$\tau_* \equiv \int_{\alpha_{\mathrm{LC}}}^{\pi/2} d\alpha \frac{\cos\alpha}{2D_{\alpha\alpha}\sin\alpha}. \tag{2}$$

After we calculated the electron lifetime using these two methods, we parameterize the electron lifetime as a function of $L$-shell and electron kinetic energy in each MLT and geomagnetic activity (Kp). The parameterized electron lifetimes show a strong functional dependence on $L$-shell and electron energy. This new model of electron lifetime is more advanced than previous models [4, 5]. In particular, the current model fills the gap that previous models have on the dusk side of the Earth's magnetosphere. This improvement is due to the better spacial coverage of the satellite measurements in the new chorus wave model [1] and it is critical for radiation belt and ring current modelling studies.

## References

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