Numerical simulations of electron elastic collisions with neutral H_2O originated from Enceladus

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Saturn’s inner magnetosphere is dominated by water group neutrals originated from Enceladus. The water group neutrals (H_2O, OH, and O) play the dominant role in loss of energetic plasmas [e.g., *Paranicas et al.,* 2007; *Sittler et al.,* 2008]. The observations of injected plasmas in the inner magnetosphere suggest that these particles do not survive very long time due to the neutral cloud originated from Enceladus [e.g., Paranicas et al., 2007; 2008]. Thus, the previous studies suggested that the neutrals contribute to loss processes of plasma in the inner magnetosphere. However, little has been reported on a quantitative study of the electron loss process due to electron-neutral collisions.

Tadokoro et al., [2014] examined the time variations of equatorial electron pitch angle distribution and electrons within loss cone through 1keV electron pitch angle scattering due to elastic collisions around Enceladus, conducting one dimensional test particle simulation. The result showed that the electrons of 11.4 % are lost in ~380 sec. This time corresponds to the time scale of the co-rotation of the flux tube passing through the region of the dense H_2O in the vicinity of Enceladus. Assuming the uniform azimuth H_2O density structure in the Enceladus torus, they estimated the electron loss rate of 33% during one co-rotation.
We show the energy dependent electron (500 eV –50 keV) loss rates through pitch angle scattering due to elastic collisions. We show the comparison of the loss rates between the high (in the vicinity of Enceladus) and low (in the Enceladus torus) H_2O density regions. The collision is solved by a Monte-Carlo method. The cross section is based on experimental data. We show the calculation errors by making 10 times calculations. We also estimate the auroral brightness by using calculated electrons.

Keywords: elastic collision, Enceladus, Saturn

